Working Mothers' Dilemma During the COVID-19 Pandemic: Evidence from China

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Abstract

There is increasing evidence from developed countries showing that the COVID-19 recession disproportionately impacted the female labor force, causing a "She-cession". This paper investigates the magnitude of the "She-cession" in China. Using a unique three-wave employee tracking survey of China in 2020, we portrayed the temporal impact of the COVID-19 outbreak on working women during and after the COVID-19 pandemic. Our results show a widening gender gap in unemployment, hours worked, and monthly salary throughout 2020. Marital status and children exacerbated the gender gaps; as expected, working mothers with a child aged 0-6 experienced the most adverse labor market outcomes. Moreover, working mothers with a child aged 0-6 displayed the worst mental health status compared to other groups throughout 2020.

Keywords: Gender Disparities; COVID-19; Labor Market; Mental Health; China
JEL Classification Code: J13; J20; I18

Introduction

There is increasing evidence from North American and European countries showing that the pandemic recession disproportionately impacted the female labor force (Adams-Prassl et al., 2020; Etheridge & Spantig, 2020; Albanesi & Kim, 2021; Czymara et al., 2021). Although the COVID-19 infection rates were similar across genders, anti-contagion policies, like "lockdowns", affected working women more, due to an increased demand for domestic labor and their dominant employment share in the "frontline" industries (Dietz, 2021) - leisure and hospitality, retail, and education. Women are significant contributors to the total labor force in China, with 63 percent of women employed in 2019.[1] China faced the most extended zero-COVID policy, featuring frequent lockdowns, travel restrictions, and work-from-home orders. In early December 2022, China abandoned its three-year-long zero-COVID policy and abruptly lifted all COVID-related restrictions. However, economic recession, unemployment, and psychological traumas could not be undone overnight. Documenting and understanding the magnitude of the "She-cession" in China is not just a reflection of the past.

The COVID-19 outbreak in China started in November 2019, ahead of all other countries. From Jan. 23 to Apr. 7 2020, China adopted the most stringent epidemic prevention and control policies in the epicenter, Hubei (Qiu et al., 2020; Fang et al., 2020; Tian et al., 2020; Chinazzi et al., 2020; Lai et al., 2020; Hsiang et al., 2020). By February, most other Chinese cities followed Hubei, prioritizing containing the pandemic by implementing similar anti-contagion policies, such as lockdowns (Qi et al.,

[1] According to the World Bank, 63% of Chinese women aged above 15 were employed in 2019, compared to 54% of women in the U.S. and 56% in the U.K.

2021). Those stringent zero-COVID policies effectively contained the spread of the virus in China; out of 87,071 infectious cases, 78.3% were detected inside Hubei,[2] and no other major outbreaks occurred after April 2020. Yet, the zero-COVID policies caused widespread economic fallout in 2020 (Cai et al., 2021). Cai et al. (2021) show that the Chinese labor market experienced a "V"-shaped pattern, with the bottom occurring in June 2020. Toward the end of 2020, China was ahead of most other countries in its economic recovery.

This paper investigates the impact of the COVID-19 pandemic on economic outcomes and the mental health status of working women in China during 2020. First, we describe and quantify the causal effect of the COVID-19 pandemic outbreak on a comprehensive set of employment outcomes. In particular, we analyze gender differences in the unemployment rate, weekly hours worked, and monthly salary throughout 2020. Second, we study how these effects differed among occupations and industries. We also explore whether marital status and children exacerbated the gender gap. Finally, we present suggestive evidence on the mechanism behind the gendered COVID-19 effects by inspecting men's and women's heterogeneous living arrangements under COVID-19 restrictions.

We conducted three waves of surveys throughout 2020 (in March, June, and November), and tracked 5,866 employed workers across 325 cities in China.[3] We collected the pre-pandemic earnings and hours of work via retrospective questions as the comparison benchmark. The pre-pandemic labor market outcomes are comparable to the counterfactual results in the absence of the outbreak. Our survey period covers the pre-,

[2]Source: National Health Commission.

[3]After eliminating the invalid sample as discussed in section *Data*, we had 5,674 individual observations for further analysis.

during-, and post-pandemic periods in 2020 China. In addition to employment status, hours worked, and monthly salary in each wave, we collected detailed demographic information, including education, family characteristics, and migration status. Moreover, we extended the survey questions to spouses of sampled respondents (if any) in the two follow-up surveys, allowing us to construct a household-level dataset of married couples. The household-level dataset identifies the gendered COVID-19 impact on a married couple and sheds light on the role of bargaining power. For example, using the information on the respondents' and their spouses' pre-pandemic salaries, we assessed how relative earning ability factored into differentiated work resumption decisions for a husband and wife.

Our findings on labor market outcomes show that the COVID-19 pandemic and its associated anti-contagion policies led to a widening gender gap during 2020. By November 2020, although the total unemployment rate gradually declined after the outbreak had subsided, the gender gap remained substantial in the unemployment rate (5.1 percentage points), hours worked per week (1.4 h/week), and monthly salary (2,234 CNY/month). In addition, married women fared much worse than unmarried women in each of these outcomes, and working mothers with children under 7 were 43.8% more likely to be unemployed than women without children under 7. Moreover, compared with working fathers with children under 7, working mothers with children under 7 bore a 181% higher unemployment risk, spent 18.6% less time on work, and earned 36.8% less per month in November 2020.

Our findings add to the existing evidence on the "She-cession" (Möhring et al.,

2021; Albanesi & Kim, 2021).[4] Our estimated quantitative effect on unemployment seems to be smaller relative to the U.S. and the U.K. (Adams-Prassl et al., 2020). Unlike other countries, we did not find that women were more likely to be unemployed due to working in the service sector. Specifically, controlling for occupation, industry, firm ownership types, and prefecture fixed effects does not explain the gender gap in falling unemployment during 2020. In our sample, women's employment was concentrated in the healthcare and education industries, which had the lowest unemployment risks compared toto

unemployed, all of which contributed negatively to mental health status. As expected, having a child under 7 reduced mental health status. In particular, working mothers with a child under 7 consistently endured the highest stress level. Working fathers with a child under 7 were also severely affected, although not immediately.

To the best of our knowledge, this is the first paper to portray the "She-cession" in the Chinese context. Our employee tracking surveys resemble elements of the Current Population Survey of the U.S. and compensate for the lack of administrative data in China. The treatment effects that we found were large in economic terms. Aggregating to the national level, approximately 17.5 million more working women than men became unemployed in the COVID-19 recession.[5] The gender gap did not close as the labor market recovered at the end of 2020. Whether or not the gender gap will close eventually is not clear.

Our results underscore that the COVID-19 shock exacerbated the gendered income gap. The social distancing measures during the COVID-19 outbreak had particularly adverse employment and psychological outcomes for working mothers with a young child. Our analysis reveals that time demand for childcare can largely explain the gendered labor market consequences imposed by the COVID-19 pandemic. If policymakers hope to prevent COVID-19 from widening existing gendered gaps in the labor market, they must provide more safe options for childcare.

The remainder of the paper is organized as follows. Section 2 conducts a liter-

[5]The female labor force accounted for about 44.5% of the total labor force in 2020 (https://data.worldbank.org.cn/indicator/SL.TLF.TOTL.FE.ZS?locations=CN), and the total labor force population was 894.38 million. The unemployment rates for females and males were 7.41% and 2.41 %, according to our estimation based on the national survey. The gap in the unemployed population between working women and working men = 894.38*44.5%*7.41% - 894.38*(1-44.5%)*2.41%=17.5 million).

ature review and discusses our relative contributions. Section 3 explains our survey instrument and presents sample summary statistics. Section 4 describes our empirical specifications and reports the results. Section 5 concludes the paper.

Literature Review

This paper contributes to the growing literature on the gendered labor market impact caused by the COVID-19 outbreak. Numerous studies have provided evidence that the pandemic increased the unemployment probability of women more than men, but the magnitudes varied across countries and during pandemic stages. In April 2020, Adams-Prassl et al. (2020) conducted employee surveys in the same vein and found the gender gap in employment to be 7 percentage points in the U.K., 5 percentage points in the U.S., and none in Germany. Bick et al. (2020) added evidence in the US, showing that women's employment rate (employed and at work) dropped by 17.8 percentage points from February to June 2020, compared to only 15.8 percentage points for men. In spring 2020, Farré et al. (2020) collected survey data in Spain and found insignificant gender differences in changes in unemployment. Lemieux et al. (2020) presented the case of Canada and found that the employment rate dropped by 30.1 percent for women compared to 27.7 percent for men from February to April 2020.

Gromico (2021) found that the Americas experienced the greatest reduction in women's employment (9.4 percentage points), followed by a reduction of 4.1 percentage points in the Arab States (male: 1.8 percentage points). In Asia and the Pacific, the pandemic led women's employment to drop by 3.8 percentage points, compared to a

decline of 2.9 percentage points for men. Based on two surveys administered in May 2020 and May 2021 to university-based biologists, biochemists, and civil and environmental engineers in the U.S., Caldarulo et al. (2022) found that COVID-related policies (e.g., stay-at-home-orders, online learning, and work-from-home policies) showed significantly greater negative impacts on women's research activities and work-life balance, compared to men. Flor et al. (2022) quantified the effects of the COVID-19 pandemic on gender equality on health, social, and economic indicators based on a comprehensive review of data from March 2020 to September 2021, concluding that women were more likely to report employment loss (26.0%) than men (20.4%) by September 2021, as well as forgoing work to care for others (ratio of women to men: 1.8 by March 2020, and 2.4 by September 2021).

Our estimates lie in the range of the literature. We found that women were more likely to become unemployed by 1.2 percentage points in March 2020, 0.7 percentage points in June 2020, and 4.7 percentage points in November 2020.

While some women dropped out of the labor force to care for family members, more women stayed employed while taking on an increased workload in household chores (Adams-Prassl et al., 2020; Farré et al., 2020; Goldin, 2022). Having a child had always been a significant contributory factor to the gender gap in the labor market (Angelov et al., 2016; Kleven et al., 2019; Cortés & Pan, 2020), and it amplified the gender gap during the COVID-19 recession. Myers et al. (2020) found that, during the forced lockdowns created by the COVID-19 pandemic, female scientists with a young child living at home experienced a decline in time spent on research. Giurge et al. (2021) conducted surveys in the United States, Canada, Denmark, Brazil, and Spain

between mid-March and mid-June 2020 and found that mothers spent more time on childcare and household chores. Our survey on time use revealed the same pattern in China: working mothers with a young child spent significantly more time on childcare and less time on leisure activities than their husbands. The pattern held even when the mother earned more than her husband.

The changes in lifestyle brought by the COVID-19 recession may have worsened women's mental well-being relative to men's. For one, time poverty[6] is linked to lower mental well-being, physical health, and productivity (Mogilner, 2019; Whillans, n.d.; Giurge et al., 2020). Moreover, the effect of time poverty on mental stress was especially pronounced for working mothers (Whillans & West, 2022). In addition, a reduction in socialization frequency and an increasing level of loneliness may add to the more significant decline in women's mental well-being (Etheridge & Spantig, 2020). The added impact of COVID-19 on women's stress levels is concerning. Studies showed that women reported lower mental health scores than men in general (WHO, 2002; McGinty et al., 2020; Astbury, 2001) and, despite their progress in social-economic spheres, their subjective well-being has been deteriorating over the recent decade (Stevenson & Wolfers, 2009; Etheridge & Spantig, 2020).

Indeed, the strand of literature that investigates the mental health consequences of the COVID-19 outbreak has reached a consensus: mental distress rose significantly (Adams-Prassl et al., 2022; Davillas & Jones, 2020; Pierce et al., 2020), and more so for women (Thapa et al., 2020; Giurge et al., 2021; Davillas & Jones, 2020; Etheridge

[6] Time poverty is known as the phenomenon in which inequitable gender-based allocation of unpaid domestic work, representing \double-duty" for women who are in the workforce, often leaves women with little or no discretionary time (Hyde et al., 2020).

& Spantig, 2020; Liu et al., 2020; Zhou et al., 2020).[7] In China, Wang et al. (2020) and Liu et al. (2020) documented the psychological illness immediately after the COVID-19 outbreak and confirmed that women fared worse. Their studies provided cross-sectional evidence focused on areas with high infection rates and extreme symptoms such as depression, anxiety, and PTSS (posttraumatic stress symptoms). Our work complemented the literature by providing a longitudinal and nationally representative sample in China. We measured mental health status by the General Health Questionnaire (GHQ-12), as in Pieh et al. (2020), Netuveli et al. (2008) and Van Bussel et al. (2006), allowing us to observe subtle, continuous differences in mental well-being.

Data

Employee Tracking Survey

Our data come from an original employee tracking survey conducted online through Penguin Intelligence (http://piu.qq.com) in 2020. The Penguin Intelligence platform randomly drew more than 10,000 subjects from WeChat, the largest social media platform, with more than 1.2 billion users (86% of the population in China).[8] The study respondents were limited to those who were full-time employees at the end of 2019 and aged 16-65. To minimize observation bias, the questionnaire was posted to respondents as many times as possible until they finished it. The first wave of the survey was carried out in March 2020. We conducted two follow-up surveys tracking the same respondents in June and November 2020. The survey collected data on the subjects' demographics

[7] Those below 35 years old (Huang & Zhao, 2021) and immigrants (Mia & Gri ths, 2020) also su ered more mental stress than the population average.

[8] The number of WeChat users is from the o cial website of Wechat in 2020.

and family characteristics. Importantly for this study, the survey collected data on occupation, employment status, monthly salary, hours worked, time use, and mental health status. To compare with labor market outcomes in the pre-pandemic period, the first wave of the survey collected monthly earnings and hours worked at the end of 2019 using retrospective questions. The validity and reliability of this dataset have been discussed in our previous paper (see Cai et al., 2021).

Sample Restriction

A total of 5,866 respondents completed the survey in the first wave. The response rate was 56.8%.[9] In our dataset, 192 responses were dropped from the sample due to insufficient answering duration (less than 3 seconds per question on average) or missing answers on the labor market questions, reducing the sample size to 5,674. The second wave revisited all 5,674 respondents and successfully followed up with 5,027 of them (7.5% attrition rate). The third wave of the survey experienced a further 5% attrition rate, leading to a final sample size of 4,539. The respondents came from 325 prefectures in 31 provinces.[10] The average response time in waves one to three was 11.5, 12.2, and 10.7 minutes, and the average payment was 10 CNY.[11]

Our survey sample over-represented people who were young and educated, living in metropolitan areas, and employed in the IT industry. We corrected the selection bias by re-weighting our responses by sampling weight according to the 1% China

[9] According to the research on survey response rate (https://www.smartsurvey.co.uk/blog/what-is-a-good-survey-response-rate), typical survey response rates can lie between 5% and 30%. A survey response rate of 50% or higher is considered excellent in most circumstances.

[10] China has 344 prefectures.

[11] Due to the privacy policy of Tencent News Penguin Think Tank, we could not disclose the exact payment number.

Population Sampling Survey. Table A1 shows how the unweighted and weighted sample characteristics compare to the population.

To shed light on family labor divisions during the COVID-19 outbreak, we extended the survey questions to spouses in the two follow-up surveys. The respondents not only answered questions related to themselves but also about their spouses. Based on that, we constructed a household-level dataset with two observations within a household.

Descriptive Statistics

Summary statistics on employment by gender are shown in Table 1. Both men and women experienced large negative labor market shocks from the onset of the COVID-19 pandemic. Unemployment rates rose dramatically in March, hit a record high in June, and dropped by November 2020. Businesses reopened by late November as the COVID-19 outbreak was temporarily under control.[12] Compared with June 2020, the Chinese labor market gradually recovered and the unemployment rate dropped by 60% to 4.4% by November 2020. However, the pandemic hit female employees harder. By survey design, all men and women were full-time employees in 2019, but women were more likely to be unemployed throughout 2020. While men's unemployment rate dropped to 2.35% in November 2020, women's unemployment rate remained high, at 7.41%. The gender wage gap widened post-pandemic as well. The gender gap in average monthly earnings was 710 CNY in March 2020, climbed to 1,366 in June, and further rose to 2,234 CNY in November 2020. On the intensive margin, women employees spent significantly fewer hours than men. The gender gap in weekly working hours increased

[12] The number of new con rmed cases decreased to less than 10 cases per day.

by 1.13 hours from March 2020 to November 2020.

Women's higher unemployment rate during the COVID-19 outbreak had little to do with their concentration in the service sector. On the contrary, the industries that had the highest share of women – "health care and social work", "education" and "financial or insurance services" – experienced the lowest unemployment rates during 2020 (see Figure A1).

Then, we switched our focus to family-related factors. The gender gap in unemployment was especially pronounced for women with a child aged 0-6. Figure 1 shows the unemployment trends by gender for respondents with or without a child 0-6. Working mothers with a child 0-6 exhibited the highest unemployment rate in all three waves in 2020, while working fathers were the least influenced group in the labor market. This implies that the pandemic strengthened the trend of men working outside the home and women working inside the home. With a child 0-6, working fathers took on more responsibility as income earners (i.e., paid work), while working mothers contributed more to household production (i.e., unpaid work). For those employees without childcare responsibility, the gender gap in unemployment was actually mitigated.

To elicit mechanisms behind the gender gap in unemployment, we asked about the reasons for unemployment in the third survey. The results are summarized in Table A2. Narrative evidence suggests that women were more likely to become unemployed voluntarily *due to personal reasons and family responsibilities*. However, there was no gender difference in unemployment *caused by employers*. Next, we asked a series of questions to derive the gendered division of labor within a household. In both follow-up surveys, respondents recalled time used at home and social activities outside the

home. On average, women spent more time caring for their children and less on social activities outside the home than their husbands (See Panel B of Table A3).

Finally, we were interested in the mental health consequences of experiencing the pandemic. In particular, we were interested in whether or not the gendered gap in mental health status can be ascribed to changes in employment, wages, and family responsibilities. Each survey wave contained a section on mental health status in a format similar to the 12-item General Health Questionnaire.[13] The respondents rated frequency of symptoms and behaviors experienced in the past three weeks.[14] Based on frequency scores from each item, we calculated overall mental health scores. A higher score implied better mental health status. Panel A of Table A3 shows that women generally scored lower than men in mental health.

Estimation Strategy and Results

Dynamic Gender Gap in Labor Market Outcomes

First, we examined how the gender disparity in labor markets evolved from the onset of the COVID-19 pandemic to the economy's resurgence. We estimated the following equation.

$$Y_{it} = \quad + \sum_{t=1}^{} {}_t Female_i * Wave_t + \sum_{t=1}^{} {}_t Wave_t + \quad _i + u_{it}; \tag{1}$$

[13] https://eprovide.mapi-trust.org/instruments/general-health-questionnaire

[14] Frequency is placed on a four-point scale: less than usual (valued 0), no more than usual (valued 1), somewhat more than usual (valued 2), or much more than usual (valued 3).

where Y_{it} is a labor market outcome including unemployed, hours worked per week, or monthly salary; $Female_i$ is a dummy variable equal to one if individual i is female, otherwise zero; $Wave_t$ is a dummy variable for survey wave t, and the reference group is December 2019 ($t = 0$). The parameter $\ _t$ measures the average trends of labor market outcomes for men from $t = 1$ to $t = 3$ (survey waves 1 to 3) compared to t=0. Considering the unbalanced panel feature of our data, we also included individual fixed effects, $\ _i$, to control for potential difference in attrition rates for men and women. Our parameter of interest in Eq. (1) is $\ _t$ of the interaction term between each survey wave dummy $Wave_t$ and female indicator $Female_i$, $Female_i * Wave_t$, which measures the changes in the gender gap compared with the gender gap in the pre-pandemic period (t=0).

Table 2 reports the estimates of Eq. (1) when controlling for two-way fixed effects and time-varying characteristics (e.g., the number of children, marital status). Women were significantly more likely than men to be unemployed, with a gender gap of 1.2 percentage points in March and 4.7 percentage points in November 2020 (column (1)). In addition, women worked 0.62 fewer hours per week than men in November 2020 at the significance level of 1% (column (5)). As for monthly earnings, women earned 41.3% less than men in November 2020, which is statistically significant at the 1% level. The estimates in columns (2), (6), and (10) show the estimates on $\ _t$ after restricting the sample to married men and women. This restriction aggravated the gender gap for each labor market outcome.

To understand how children played a role in the variation of labor market outcomes, we further broke down our sample into those with a child aged 0-6 and those with a

child aged 7-18. Conditional on having a child, a preschool child (under 7 years old) demanded greater time and energy commitment from parents, especially from mothers. The estimates in column (3) of Table 2 show that, for working mothers with a child under 7, the gender gap in the unemployment rate gradually widened, increasing from 2.8 to 4.1 and 6.3 percentage points from March to June to November 2020. Their monthly earnings were 60% less than their male counterparts in November 2020 (column (11)). In comparison, working mothers with an older child experienced a much milder gender gap in unemployment and monthly salary (columns (4) and (12)).

Probability of Being Unemployed in 2020

Why did female employees become unemployed more often? To analyze the gender gap in the unemployment rate, we took into account individual characteristics, occupation and industry category, and prefecture fixed effects, and estimate the following Linear Probability Model:

$$Unemp-ever_{ij} = \quad + \quad Female_{ij} + \quad X_{ij} + \quad _j + \quad _{ij}; \tag{2}$$

where $Unemp-ever_{ij}$ denotes whether individual i in prefecture j was ever unemployed in 2020; $Female_{ij}$ is a dummy variable that equals 1 if individual i in prefecture j is female; X_{ij} are individual controls associated with labor productivity (education levels, age groups, marital status, *hukou*[15] categories, number of children, and a dummy variable for having a child under 7). The control variable setting is based on previous research (Goldin, 2022). Job characteristics as of 2019 are also included (industry

[15] *Hukou* is a system of household registration used in mainland China. In our analysis, there are four types of *Hukou*: urban locals, urban migrants, rural locals and rural migrants.

categories, firm ownership types, occupation categories, and monthly earnings). $_j$ denotes prefecture fixed effects, which allow us to flexibly control for time-invariant local labor market conditions and regional differences in women's social status. is the main coefficient of interest, capturing the gender difference in the likelihood of unemployment during 2020. By comparing the coefficients of with or without controlling for X_{ij}, we can tell to what extent individua(indi)1265 1sxtenes, cateturi91pegioustryo

gap. Therefore, we turn our attention to gender roles. Specifically, we look at how marital status and children affected female employment during the pandemic.

Household Fixed Effects Model

By extending the survey questions to spouses in the two follow-up surveys, we constructed a household-level dataset for married couples. The within-household analysis can identify the gender gap between husband and wife. Combined with the time-use survey and pre-pandemic income difference, this analysis sheds light on the family labor division and bargaining power. We estimated a model with household fixed effects as follows:

$$Y_{iht} = \quad + \quad Wife_{ih} + \quad {}_1X_{ih} + \quad {}_2Z_{iht} + H_h + Wave_t + "_{iht}; \tag{3}$$

where Y_{iht} denotes labor market outcomes of individual i in household h at time t. Labor market outcomes include unemployment, work resumption, weekly working hours, and log of monthly earnings. $Wife_{ih}$ is the indicator that equals 1 if individual i within family h is the wife; X_{ih} is a vector of time-invariant individual characteristics, including *hukou*, industry, firm ownership type, occupation, etc.; Z_{iht} is a vector of time-varying individual characteristics, including the number of children, age, etc.; H_h are family fixed effects; $Wave_t$ are wave dummies; and $"_{ihj}$ is the random error term.

Table 4 shows the regression results based on specification Eq. (3). As shown in columns (1) and (3), wives were more likely than husbands to be unemployed, by 3.6 percentage points, and were less likely than husbands to resume work (either going back to the workplace or working from home), by 4.4 percentage points. A child under 7 imposed an additional risk of 2.9 percentage points of the wife being unemployed

(column (2)). Having a child this age reduced the probability of the wife resuming work by 3.4 percentage points (column (4)).[16]

On the intensive margin, wives spent 2.4 hours less on work than husbands (column (5)). A child under 7 decreased the working time of employees by 4 hours. Wives' time commitment to work was further reduced by 1.8 hours with a child under 7. Moreover, mothers with a child under 7 earned 27 percent less than their husbands (columns (7) and (8)).

Can the gender gap in the equilibrium unemployment rate be mitigated if the wife had more bargaining power than her husband? We measured the bargaining power by the relative pre-pandemic earnings between husbands and wives: log (monthly salary in 2019) - log (spouse's monthly salary in 2019). Then, we tested whether it alleviated the marriage or motherhood penalty. We did so by adding interaction terms ($Ln(income\,gap)$*$wife$) and triple interactions ($Ln(income\,gap)$*$wife$*$child\,under\,6$) to the previous regression, which captured the moderating effect of earning advantage on gender gap in labor market outcomes, especially for those with a child under 7.

The regression results in columns (1) - (3) of Table 5 demonstrate that wives' earning advantage mitigated the adverse shocks of the COVID-19 pandemic. Specifically, wives with an earning advantage were much more likely to return to work than wives without this advantage (see column (2)). Results with the triple interaction terms are shown in columns (4) - (6).

Nevertheless, if a household had a child under 7, wives worked less, and the earning

[16] The R-squared in columns (3) - (4) was much larger than that in columns (1) - (2). The magnitude of the unemployment rate was far smaller than the work resumption rate. The additional explanatory power of the independent variables on work resumption may come from the higher probability of female employees working from home (WFH), as shown in Table 1.

advantage did not help them resume work. To validate the findings, we restricted the sample to households with a child under 7. The coefficients on the interaction terms ($Ln(income\,gap)$*$wife$) were insignificant for unemployment (column (7)), work resumption (column (8)), and hours worked (column (9)). In other words, for wives with a child under 7, the bargaining power induced by income advantage did not mitigate the pandemic's adverse effects on labor market outcomes.

We supplemented our findings with surveys on time use at home. As expected, working mothers spent significantly more hours with their children than did their husbands. Table A4 reports the detailed within-household gender gap in time use by activities.

Gender Disparity in Mental Health

In addition to the fear of contracting and dying from COVID-19, the consequent economic uncertainty, loneliness due to social distancing, and lifestyle changes may have impacted mental health status (Ellison et al., 2021). Many researchers have highlighted that women are generally more likely to suffer from mental illness than men (WHO, 2002; Afifi, 2007; Kiely et al., 2019). The pandemic, coupled with a higher risk of unemployment and increasing family responsibility for women, may have imposed an additional negative shock on the gender gap in mental well-being.

Since surveying retrospective questions on mental health status is impossible, we cannot compare mental well-being to pre-pandemic levels. Therefore, we do not know how large the gender gap and child penalty were before the pandemic and are handicapped to draw any causal relationship between the COVID-19 shock and worse mental

health. Nevertheless, we believe it's still valuable to portray mental health status during the pandemic in 2020, and we do this by including questionaries that evaluate mental health status in each wave. In what follows, we track the gender gap and the child penalty in March, June, and November 2020 and see if factors such as unemployment and time use contribute to the observed gaps.

For each wave, we ran a cross-section regression as specified in Eq. (4):

$$MH_{ij} = \quad + \quad {}_1 Female_{ij} + \quad {}_2 Child_{ij} + \quad X_{ij} + \quad {}_j + "_{ij} \tag{4}$$

where MH_{ij} is the mental health score of individual i in prefecture j. $Female_{ij}$ is a dummy variable that equals one if the survey respondent i in prefecture j is a woman. $Child_{ij}$ is a dummy variable that equals one if individual i in prefecture j has a child under 7 years old. X_{ij} is a list of individual-level controls, including educational levels, age groups, marriage status, *hukou*, log of monthly earnings in 2019, self-estimated probability of getting infected by COVID-19, job characteristics (detailed industry, industry ownership type, and occupational categories in 2019). ${}_j$ is a prefecture fixed effect.

We plotted the estimated coefficients of $Female_{ij}$ and $Child_{ij}$ in Figure 2. The coefficients on $Female_{ij}$ are consistently negative and statistically significant in each wave and particularly large in the March survey. The pattern confirmed that women had worse mental health status and highlighted their additional struggles during the outbreak's peak. Having a young child at home added an independent shock to mental well-being, and the magnitude was comparable to being a woman. Curiously, the

negative impact of having a child under 7 increased in June and November, alluding to the rising anxiety of fathers with a young child.

We followed the thread and broke the sample into four groups: women with a child under 7, women without a child under 7, men with a child under 7, and men without a child under 7 (comparison group). Then, we estimated Eq. (4), replacing the variables *Female* and *Child* with an indicator variable for each group. Table 6 presents the regression results.

The baseline results for each wave are presented in columns (1), (4) and (7). Compared to men without a child under 7, women consistently had lower mental health scores: roughly 0.8-1.0 points lower for women without a child under 7 and 1.2-1.5 points lower for women with a child under 7. Including controls related to employment status and salary changes in columns (2), (5), and (8) had minimal explanatory power for the gender gaps. When we added controls related to time use in columns (3) and (6), the coefficient for working mothers with a child under 7 remained unchanged, but the coefficient for women without a child under 7 became smaller.

Working fathers with a child under 7 were also severely affected, although not immediately. At the beginning of the outbreak, their mental health status was similar to men without a child under 7. In June, however, they became the worst performing group: with full controls, their mental health score was 1.35 points lower than the comparison group and 0.14 points lower than working mothers. By November, their mental health scores were still significantly lower than men without a child under 7, but the difference has become smaller.

Overall, there remained large and significant gaps across groups that cannot be

omicron variant spread, China's strict zero-COVID measures failed to prevent infections and led to deep economic disruptions. In 2022, China's GDP growth rate decreased to 3%, and the unemployment rate rose as high as 5.5% in December 2022, which was even higher than that in December 2020 (5.2 percent). Metropolitan cities like Shanghai and Beijing closed their schools for 82 days and 107 days in 2022, respectively.[17] Working mothers must have endured more childcare responsibilities in the past year compared to 2020. The estimated gender gaps in our study should only provide a lower bound for the "She-cession" in 2022.

We showed that the gender gap in labor market participation – measured in the unemployment rate, hours worked per week, and monthly salary – widened in November 2020, even though the economy temporarily recovered. An alarming implication of this finding suggests that the female and motherhood penalties will not disappear even if work and production resume.

[17] This does not include winter and summer holidays.

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Tables and Figures

Table 1 Summary Statistics

Panel A: Male				
	Nov. 2019	**Mar. 2020**	**Jun. 2020**	**Nov. 2020**
Work Status				
At work (%)	100	62.46	84.49	94.25
% Detailed Work Status				
Return to work place	100	45.86	76.49	94.25
Work at home	0	16.60	8.00	-
Furloughed	0	31.51	4.78	2.41
Unemployed	0	6.03	10.72	2.35
Work Intensity				
Weekly working hours	8.45	4.94	7.31	7.97
% work intensity of 2019	100	53.40	81.79	-
Earnings				
Monthly earning (RMB)	7056.56	4327.31	5666.75	6770.99
	(7589.36)	(9921.71)	(12766.44)	(6622.37)
% of average earning in 2019	100	61.32	80.3	86.91
Observations	2875	2875	2529	2250
Panel B: Female				
	Nov. 2019	**Mar. 2020**	**Jun. 2020**	**Nov. 2020**
Work Status				
At work (%)	100	63.97	83.79	82.98
% Detailed Work Status				
Return to work place	100	41.51	73.84	82.98
Work at home	0	22.45	9.95	-
Furloughed	0	26.33	4.65	6.63
Unemployed	0	9.70	11.56	7.41
Work Intensity				
Weekly working hours	7.85	4.67	6.92	6.57
Work intensity (% of 2019)	100	48.97	77.75	-
Earnings				
Monthly earning (RMB)	5113.50	3617.47	4300.32	4537.48
	(6377.68)	(7834.31)	(6419.60)	(4741.49)
% of average earning in 2019	100	70.74	84.1	81.62
Observations	2799	2799	2498	2289

Notes: The statistics in the table are weighted by sampling weight based on six individual characteristics, including residential province, employed industry, gender, age, education, and *hukou*.

Table 2 Gender Gap in Labor Market Outcomes, Nov. 2019 - Nov. 2020

	Unemployment				Hours worked per week				Log of monthly salary			
	All	Married	Child 0-6	Child 7-18	All	Married	Child 0-6	Child 7-18	All	Married	Child 0-6	Child 7-18
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Female * Mar. 2020	0.012*	0.014**	0.028***	0.013	0.054	-0.114	-0.039	0.187	0.075	0.023	0.212	-0.026
	[0.006]	[0.007]	[0.010]	[0.013]	[0.095]	[0.113]	[0.157]	[0.200]	[0.087]	[0.102]	[0.142]	[0.186]
Female * Jun. 2020	0.007	0.022***	0.041***	-0.005	-0.125	-0.318***	-0.422***	-0.049	-0.065	-0.221**	-0.457***	0.214
	[0.007]	[0.008]	[0.012]	[0.015]	[0.084]	[0.099]	[0.143]	[0.186]	[0.077]	[0.089]	[0.130]	[0.170]
Female * Nov. 2020	0.047***	0.061***	0.063***	0.039**	-0.619***	-0.795***	-0.626***	-0.663***	-0.413***	-0.531***	-0.600***	-0.211
	[0.007]	[0.008]	[0.011]	[0.016]	[0.088]	[0.105]	[0.154]	[0.194]	[0.073]	[0.088]	[0.127]	[0.170]
Mar. 2020	0.050***	0.039***	0.037***	0.046***	-2.563***	-2.378***	-2.460***	-2.818***	-1.837***	-1.749***	-1.890***	-1.920***
	[0.004]	[0.004]	[0.006]	[0.008]	[0.068]	[0.080]	[0.110]	[0.143]	[0.061]	[0.072]	[0.101]	[0.130]
Jun. 2020	0.070***	0.053***	0.049***	0.072***	-0.486***	-0.282***	-0.339***	-0.484***	-0.822***	-0.621***	-0.587***	-0.887***
	[0.005]	[0.005]	[0.007]	[0.011]	[0.059]	[0.067]	[0.098]	[0.131]	[0.055]	[0.061]	[0.090]	[0.120]
Nov. 2020	0.029***	0.022***	0.019***	0.024**	-0.468***	-0.314***	-0.505***	-0.195	-0.152***	-0.078	-0.037	-0.089
	[0.004]	[0.005]	[0.006]	[0.010]	[0.060]	[0.069]	[0.102]	[0.133]	[0.049]	[0.058]	[0.084]	[0.120]
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Individual FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.425	0.443	0.467	0.438	0.514	0.526	0.538	0.557	0.485	0.503	0.516	0.526
No. of observations	20,893	14,562	7,543	4,339	20,893	14,562	7,543	4,339	20,893	14,562	7,543	4,339
No. of individuals	5,674	4,118	2,270	1,262	5,674	4,118	2,270	1,262	5,674	4,118	2,270	1,262

Notes: This table shows the gender gap in three labor market outcomes: unemployment, hours worked per week and log of monthly salary. The time window of analysis is from November 2019 to November 2020, including observations in four waves. Estimations are based on Eq. (1) with individual fixed effects. The base group is November 2019 for all regressions. Regressions are run on the unbalanced panel dataset with all tracking respondents included. The regression sample in columns (2), (6) and (10) include respondents who are married at least once and do not include those who are divorced or bereft of one's spouse. The regressions in columns (3), (7) and (11) are run on the sub-sample of respondents who have a child 0-6 (including 6). The regressions in columns (4), (8) and (12) are run on the sub-sample of respondents who have a child 7-18 and do not have a child 0-6. Controls are included in all regressions, including time-varying factors like marriage status and the number of children. Robust standard errors are displayed in brackets. *** p<0.01, ** p<0.05, * p<0.1.

Table 3 Probability of Being Unemployed in 2020: Individual Sample, LPM Model

	If ever being unemployed during 2020					
Dep.Var	(1)	(2)	(3)	(4)	(5)	(6)
Female	0.022**	0.024**	0.029***	0.033***	0.037***	0.038***
	[0.010]	[0.010]	[0.010]	[0.010]	[0.010]	[0.010]
Prefecture FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	No	Yes	Yes	Yes	Yes	Yes
Firm ownership categories	No	No	Yes	Yes	Yes	Yes
Occupation FE	No	No	No	Yes	Yes	Yes
Individual FE	No	No	No	No	Yes	Yes
Family characteristics	No	No	No	No	No	Yes
Observations	4,539	4,539	4,539	4,539	4,539	4,539
R-squared	0.086	0.106	0.136	0.149	0.165	0.168

Notes: This table shows the estimates of gender difference in the probability of being unemployed throughout 2020 based on the LPM model (Eq. (1)). The estimated sample are those who are tracked in all three waves in 2020. Industry controls include 16 categories as presented in Appendix Table A1. Firm ownership categories include "government departments/Party and government organs/social organizations", "public institutions," "state-owned enterprises," "foreign/Hong Kong, Macao, and Taiwan enterprises," "employees of private enterprises," "private business owners," "individual industrial and commercial households." Occupations include "persons in charge of state organs, party and mass organizations, enterprises and public institutions," "professional and technical personnel," "administrative personnel and related personnel," "commercial workers," "service workers," "production and transportation workers," "self-employed," "agriculture, forestry, animal husbandry, and fishery workers," "others," Individual controls include educational levels, age groups, *hukou* categories and average monthly earnings in 2019. Family characteristics include the number of children, a child 0-6, and a child 7-18. Robust standard errors are displayed in brackets. *** p<0.01, ** p<0.05, * p<0.1.

Table 4 Gender Disparity in Labor Market Outcomes, Couple Sample, Jun. 2020 - Nov. 2020

	Unemployment		Return to work		Hours worked/week		Log of monthly salary	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Wife	0.036***	0.022***	-0.044***	-0.028***	-2.412***	-1.566***	-0.325***	-0.195***
	[0.005]	[0.006]	[0.005]	[0.007]	[0.312]	[0.400]	[0.046]	[0.059]
Wife*child 0-6		0.029***		-0.034***		-1.752***		-0.270***
		[0.008]		[0.009]		[0.521]		[0.078]
Having a child 0-6	-0.000	-0.015	-0.022	-0.005	-4.021***	-3.149**	0.117	0.250
	[0.019]	[0.019]	[0.021]	[0.021]	[1.299]	[1.327]	[0.183]	[0.189]
Answered by respondent	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Individual controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Household FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	12,552	12,552	12,552	12,552	12,552	12,552	12,552	12,552
R-squared	0.360	0.361	0.592	0.593	0.650	0.651	0.663	0.664

Notes: This table shows the gender disparity in four labor market outcomes (unemployment, return to work (return to office or work from home), hours worked per week and log of monthly salary) based on the couple sample dataset, i.e., employees that are in marriage. "Answered by respondent" is a dummy variable that equals one if the information for this observation is self-reported by the respondent, and equals zero if the information is for a respondent's spouse which is inferred by the respondent. Individual controls include educational levels, age groups, log of monthly earnings in 2019, and job characteristics (detailed industry, firm ownership, and occupation categories in 2019). Household fixed effects and the indicator for the main respondent are also controlled in all regressions. Robust standard errors are displayed in brackets. *** p<0.01, ** p<0.05, * p<0.1.

Table 5 Household FE Model With Earning Difference Between Wife and Husband: Jun. and Nov. 2020

	Full couple sample						Couples with child under 7		
	Unem-ployment	Work Resumption	Working Hours	Unem-ployment	Work Resumption	Working Hours	Unem-ployment	Work Resumption	Working Hours
.	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Female	0.034***	-0.041***	-2.299***	0.024***	-0.028***	-1.682***	0.038***	-0.050***	-2.809***
	[0.005]	[0.005]	[0.311]	[0.006]	[0.007]	[0.402]	[0.006]	[0.008]	[0.456]
Having a child 0-6	-0.001	-0.022	-4.002***	-0.010	-0.012	-3.810***			
	[0.019]	[0.021]	[1.292]	[0.019]	[0.021]	[1.340]			
Female*child 0-6				0.019**	-0.025***	-1.165**			
				[0.008]	[0.009]	[0.545]			
Income gap	-0.005*	0.007**	0.307*	-0.003	0.004	-0.117	-0.007*	0.011**	0.664***
	[0.003]	[0.003]	[0.164]	[0.004]	[0.004]	[0.213]	[0.004]	[0.004]	[0.226]
Female*Income gap	-0.004	0.011**	0.204	-0.004	0.015**	0.834**	-0.001	0.005	-0.448
	[0.005]	[0.005]	[0.269]	[0.007]	[0.007]	[0.365]	[0.008]	[0.008]	[0.384]
Income gap*child 0-6				-0.003	0.006	0.801***			
				[0.005]	[0.005]	[0.251]			
Income gap*female*child 0-6				-0.000	-0.008	-1.216***			
				[0.009]	[0.009]	[0.467]			
Individual controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Household FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	12,552	12,552	12,552	12,552	12,552	12,552	6,174	6,174	6,174
R-squared	0.364	0.599	0.652	0.365	0.600	0.653	0.381	0.630	0.673

Notes: This table shows the regression results on labor market outcomes employing couple unbalanced panel dataset from June 2020 to November 2020. Income gap is defined as "log of one's monthly earning in the lagged wave - log of one's spouse's monthly earning in the lagged wave". Individual controls include educational levels, age groups, number of children, log of monthly earnings in 2019, job characteristics (detailed industry, ownership and occupation categories in 2019). Household fixed effect and the indicator for main respondent are also controlled in all regressions. Robust standard errors are displayed in brackets. *** p<0.01, ** p<0.05, * p<0.1.

Table 6 Gender Disparity in Mental Health

	Mental health							
	Mar. 2020			Jun. 2020			Nov. 2020	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Female with a child 0-6	-1.497***	-1.271***	-1.228***	-1.370***	-1.207***	-1.203***	-1.723***	-1.528***
	[0.333]	[0.330]	[0.329]	[0.430]	[0.427]	[0.426]	[0.451]	[0.448]
Male with a child 0-6	-0.205	-0.144	-0.164	-1.094**	-1.171***	-1.346***	-1.001**	-0.994**
	[0.318]	[0.315]	[0.314]	[0.425]	[0.421]	[0.414]	[0.442]	[0.439]
Female without a child 0-6	-0.964***	-0.896***	-0.817***	-0.847***	-0.849***	-0.463*	-0.869***	-0.738***
	[0.233]	[0.230]	[0.230]	[0.260]	[0.256]	[0.252]	[0.270]	[0.272]
Channel I: Work & income	No	Yes	Yes	No	No	Yes	No	Yes
Channel II: Living arrangement	No	No	Yes	No	Yes	Yes	No	No
Individual controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Prefecture FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	5,674	5,674	5,674	5,027	5,027	5,027	4,539	4,539
R-squared	0.129	0.149	0.155	0.129	0.158	0.213	0.161	0.166

Notes: This table show the gender disparity in mental health. The regressions are run on the cross-section dataset of each wave, with 5,674 observations in March 2020, 5,027 observations in June 2020, and 4,539 observations in November 2020. Three key variables of interest are displayed in the table, including female with a child 0-6, female without a child 0-6, and male with a child 0-6. The comparison group is male without a child 0-6. Individual controls include educational levels, age groups, marriage status, number of children, a child 0-6, a child 7-18, *hukou* characteristics, log of monthly earnings in 2019, self-estimated probability of getting infected by COVID-19, job characteristics (detailed industry, ownership and occupation categories in 2019). The prefecture fixed effect is also controlled in all regressions. Estimation results in columns (1) - (3), columns (4) - (6) and columns (7) - (8) based on cross-section regressions for each wave in 2020, respectively. In the regressions for each wave, more controls are gradually included in the regressions to potential channels of the gender gap in mental health. The hypothesized channels are 1) work status and income shock, and 2) living arrangement. In our survey, work status in March and June 2020 lies in four categories: return to the office, work from home, furloughed, and unemployed. Work status in November 2020 lies in three categories, including the return to work (work more than 1 hour in the past week), furloughed, and unemployed. Income shock is measured by the relative income ratio in 2020 compared to 2019. Living arrangements include time use and social activities involvement. To be more specific, it includes social activities outside the home (going out to play, chatting with friends face to face, participating in club activities, participating in volunteering work, and doing sports), entertainment online (chatting with friends online and playing games online), taking training courses, spending time with a child (playing and studying with child) and doing housework. The time use information is collected in March and June 2020 only. Robust standard errors are displayed in brackets. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

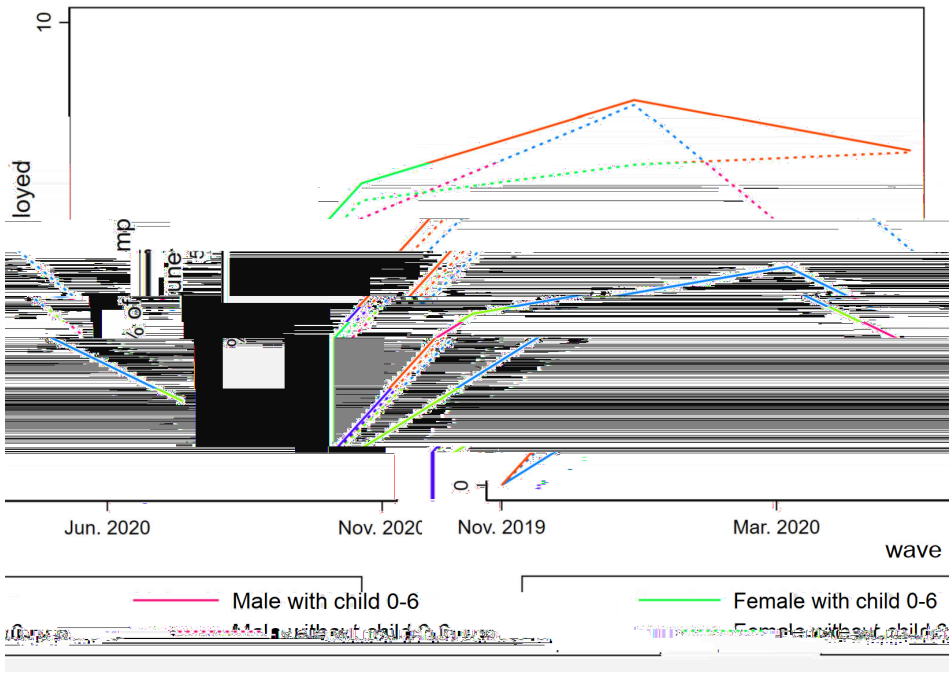

Figure 1 Gender Difference in Unemployment

Notes: This figure presents the cross-group comparison of the proportion of ever-unemployed labor force among 1) male with a child 0-6 (solid blue line); 2) male without a child 0-6 (blue dotted line); 3) female with a child 0-6 (solid red line); 4) female without a child 0-6 (red dotted line). The statistics are based on the unbalanced panel dataset with all tracking respondents included. The analyzed sample size is 5,474 in November 2020, 5,674 in March 2020, 5,027 in June 2020, and 4,539 in November 2020 (from left to right).

Figure 2 Gender Di erence in Regression Coe cients of Gender and Child Status on Mental Health

Notes: This gure presents the regression coe cients of gender and a child 0-6 on mental health for each wave in 2020. The line represents the con dence interval of 95%. The estimates are based on the unbalanced panel dataset with all tracking respondents included. The analyzed sample size is 5,674 in March 2020, 5,027 in June 2020, and 4,539 in November 2020 (from left to right).

Table A4 Gender Disparity in Time Use Inside and Outside Home, Couple Sample, June 2020

	Time with child		Housework		Social outside home		Entertainment online		Training	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Wife	1.454***	0.890***	0.433***	0.428***	-3.054***	-3.009***	-3.952***	-2.789***	0.665***	0.500***
	[0.078]	[0.089]	[0.031]	[0.038]	[0.416]	[0.543]	[0.377]	[0.468]	[0.145]	[0.172]
Wife*child 0-6		1.064***		0.011		-0.099		-2.560***		0.363
		[0.138]		[0.054]		[0.701]		[0.650]		[0.252]
Answered by respondent	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Individual controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Household FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	5,446	5,446	6,276	6,276	6,276	6,276	6,276	6,276	6,276	6,276
R-squared	0.718	0.723	0.686	0.686	0.801	0.801	0.775	0.776	0.676	0.676

Notes: This table shows the gender disparity in time use inside and outside home using the couple dataset in June 2020. The first two columns focus on time spent with a child, including playing and studying with a child. The regressions in columns (3) and (4) focus on time spent on housework. The regressions in columns (5) and (6) focus on the frequency (time/month) of engagement in social activities outside the home, including going out to play, chatting with friends face to face, participating in club activities, participating in volunteering work, and doing sports. The regressions in columns (7) and (8) focus on the frequency of engagement in entertainment online, including chatting with friends and playing games online. The regressions in columns (9) and (10) focus on the monthly frequency of taking training courses. "Answered by respondent" is a dummy variable that equals one if the information for this observation is self-reported by the respondent, and equals zero if the information is for a respondent's spouse which is inferred by the respondent. Individual controls include educational levels, age groups, number of children, log of monthly earnings in 2019, and job characteristics (detailed industry, ownership, and occupation categories in 2019). Household fixed effect is also controlled in all regressions. Robust standard errors are displayed in brackets. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

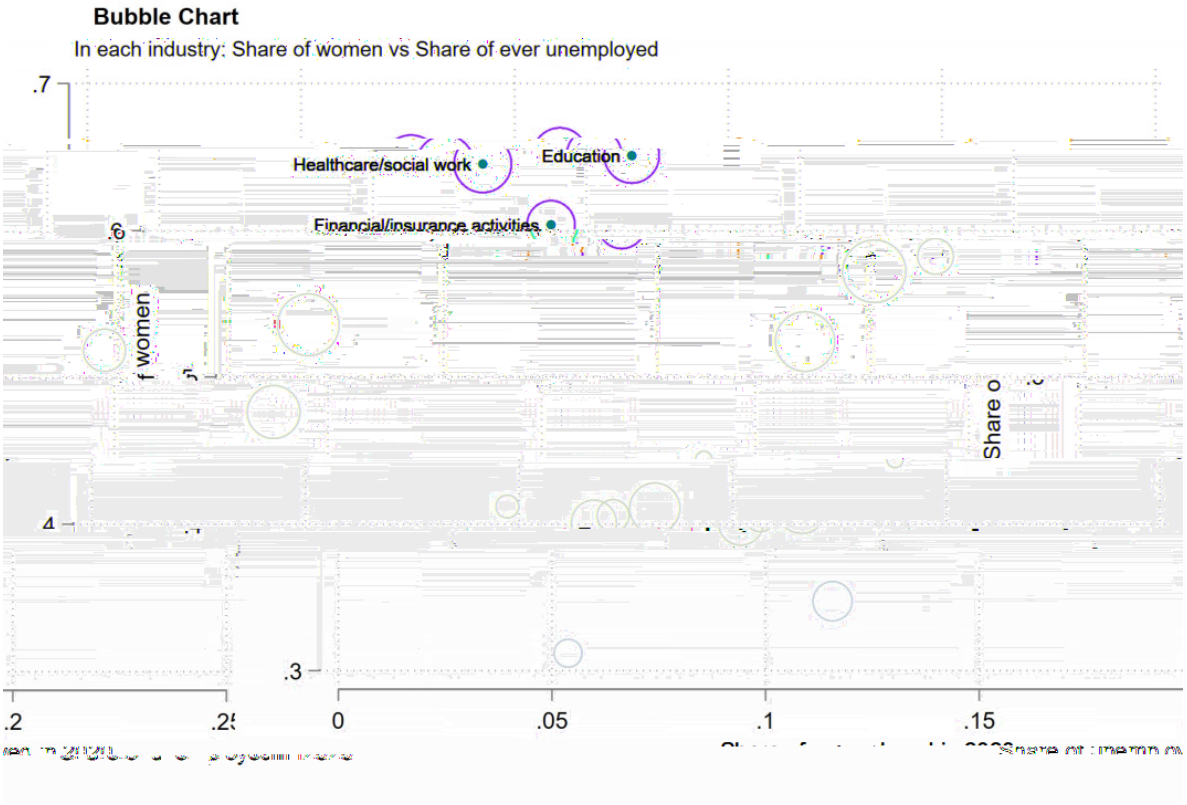

Figure A1 Unemployment and Share of Women by Industry

Notes: This figure is a scatter plot that shows the share of ever-unemployed labor force during 2020 (x-axis) and the share of women (y-axis) in each industry. The circle size represents the size of the labor force of that industry. The three industries with the highest share of women are highlighted in red.