This Time It's Different: The Role of Women's Employment in a Pandemic Recession*

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Abstract

In recent US recessions, employment losses have been much larger for men than for women. Yet, in the current recession caused by the Covid-19 pandemic, the opposite is true: unemployment is higher among women. In this paper, we analyze the causes and consequences of this phenomenon. We argue that women have experienced sharp employment losses both because their employment is concentrated in heavily affected sectors such as restaurants, and due to increased childcare needs caused by school and daycare closures, preventing many women from working. We analyze the repercussions of this trend using a quantitative macroeconomic model featuring heterogeneity in gender, marital status, childcare needs, and human capital. Our quantitative analysis suggests that a pandemic recession will i) feature a strong transmission from employment to aggregate demand due to diminished within-household insurance; ii) result in a widening of the gender wage gap throughout the recovery; and iii) contribute to a weakening of the gender norms that currently produce a lopsided distribution of the division of labor in home work and childcare.

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1 Introduction

Economic fluctuations display a number of regularities, such as comovement of output across sectors and higher volatility in aggregate investment than in aggregate consumption. These observations motivated Robert Lucas to famously claim that "business cycles are all alike" (Lucas 1977), and business cycle theory has been devoted to accounting for these regularities ever since.

As a consequence of the Covid-19 pandemic, in 2020 the United States and other countries entered the sharpest contraction in economic activity since the Great Depression. While this contraction displays some of the regularities of other economic downturns, in other ways it is unlike any other in recent history. Understanding the differences between regular and pandemic recessions is a key challenge for research, both to further our understanding of what the recovery from the current downturn will look like, and to inform policy responses to possible pandemic recessions in the future.

In this paper, we argue that a crucial difference between regular recessions and the current downturn lies in the role of and implications for women's employment. We document that in recent recessions preceding the current crisis, men were more severely affected by employment losses. This disproportionate impact was particularly pronounced in the Great Recession that followed the financial crisis of 2007–2008, which gave wide currency to the term "mancession" for this and earlier downturns.

The Covid-19 recession reverses the usual pattern. This time, it is women, rather than men, who have experienced larger employment losses and higher unemployment. In the United States, women's unemployment increased by 12.8 percentage points between February and April 2020, versus an increase of only 9.9 percentage points for men. Changes in employment rates (which also accounts for transitions into and out of the labor force) display the same pattern, with a substantially larger decline in employment for women than for men during the crisis. Similar patterns have been observed in other countries affected by the pandemic.

We identify two main causes of the large impact of the current pandemic recession on women in the labor market. Both relate to the fact that the recession has in large part been triggered by the "lockdown," i.e., the social distancing measures, business shutdowns, and stay-at-home orders implemented during the pandemic.

The first cause relates to the impact of a lockdown recession on different sectors of the economy. Regular recessions lead to large employment losses in sectors with a high

male employment share, such as construction and manufacturing. In contrast, the impact of the current recession has been greatest in high-contact service sectors such as restaurants, hospitality, and travel, which have been severely affected by social distancing.[1] These are sectors where women represent a large share of the workforce, leading to high employment losses for this group during the crisis.

The second cause of the large impact of the lockdown on working women relates to childcare. During the lockdown period, schools and daycare centers were closed and children were sent home. This massively increased families' childcare needs during working hours. In Alon et al. (2020a), we demonstrate that mothers took responsibility for a much larger share of childcare than fathers before the crisis. In part, this is because there are many more single moms than single dads, and many more stay-at-home mothers than stay-at-home fathers. But even among married parents who both work full time, women spend more than 40 percent more time on childcare than men do. This lopsided division of labor has been sustained in the crisis: women have taken on a larger share of the extra childcare duties during the lockdown than men. As a result, more women than men have been unable to work either full time or at all during the crisis.

We examine the wider implications of the impact of a pandemic recession on working women using a macroeconomic model with rich household heterogeneity. In the model, we distinguish between women and men, single and married households, and households with and without kids. Households decide on consumption, labor supply, and savings, and households with kids have to decide on how to meet childcare needs. The labor market is subject to search frictions: workers may lose jobs and unemployed workers must wait for job offers. Workers who receive job offers decide whether to accept or reject the offer and, if they accept, whether to choose full-time or part-time work. The skills of employed workers increase over time due to returns to experience, whereas the skills of workers who are out of employment depreciate. The ability of workers to combine work with childcare responsibilities depends on their occupation. Specifically, workers who can telecommute have an easier time meeting childcare needs. The division of labor within the household is in part governed by a social norm: there is a fraction of "traditional" households that prefer that childcare be provided by the mother rather than the father.

[1] The largest increases in unemployment have been in the "personal care and service" as well as "food preparation and serving" occupations, with June unemployment rates close to 30 percent in both cases. See *BLS Labor Force Statistics from the Current Population Survey*, Table A-30.

We use our macroeconomic model to compare the repercussions of a regular recession and those of a pandemic recession. We model regular recessions as a temporary shift in job destruction rates and job finding probabilities, calibrated to capture the larger impact of regular recessions on men's employment than on that of women. In contrast, a pandemic recession has an equally large impact on men's and women's labor market opportunities. In addition, a pandemic recession incorporates a large increase in parents' childcare needs, which captures the effects of school and daycare closures. This shock leads to additional endogenous employment reductions, as some parents reduce their hours or drop out of the labor force to take care of their children. We also allow for the possibility that a pandemic recession has a persistent effect on job characteristics (more jobs with the ability to telecommute) and on social norms (fewer traditional couples).

We calibrate the model to match a number of data moments for the US economy. The quantitative model successfully captures the much larger impact of a pandemic recession on women's employment compared to a regular recession. We find that regular and pandemic recessions not only affect women and men differently, but also differ in their aggregate impact on consumption, savings, and labor supply in the economy. In part, this is because a pandemic recession has a large impact on parents, whose marginal propensities to consume and save differ from those of average households. Single parents have an especially limited ability to offset income shocks, meaning that such shocks have a large impact on their consumption.

The most important channel for the distinct macro implications of regular and pandemic recessions concerns the role of within-family insurance. Because men are more likely to lose jobs than women during a regular recession, many wives are able to partially compensate for their husband's lost earnings by joining the labor force or working more. In line with recent findings in the literature, our model implies that such insurance in the family serves as an important shock absorber. In aggregate terms, within-family insurance lowers the transmission of aggregate income shocks to aggregate consumption during a regular recession. In contrast, we find that within-family insurance is more limited during a pandemic recession. In families with children, increased childcare needs during the lockdown make it impossible for many secondary earners to increase their labor supply. Even in families without children, within-family insurance is limited during a pandemic recession due to the fact that women and men are equally likely to lose their jobs and face the same difficulties in finding new jobs.

Taken together, these channels imply that a shock to aggregate employment during a

pandemic recession is more strongly transmitted into aggregate consumption and thus aggregate demand. In a setting where aggregate demand partly determines output, we would observe a greater amplification of the initial shock, a deeper recession, and potentially a delayed recovery, all else being equal. In our analysis, we focus on the household sector and do not spell out such an aggregate demand channel explicitly. Rather,we aim to characterize one key element of the distinct aggregate consequences of regular versus pandemic recessions, which future work might then combine with other relevant channels.

Our quantitative analysis also highlights distinct implications of regular and pandemic recessions for gender inequality in the labor market during the downturn and throughout the recovery. Workers who lose employment lose skills, which implies that the differential employment impact of a recession on women and men leads to changes in the gender wage gap. Given that regular recessions affect men comparatively more, they moderately reduce the gender wage gap. In contrast, a pandemic recession depreciates the skills of women who reduce their hours or drop out of the labor force all together, leading to a substantial widening of the wage gap that persists after the recession. Quantitatively, we find that regular recessions reduce the gender wage gap by 2 percentage points, whereas a pandemic recession increases it by 5 percentage points.

Nevertheless, our analysis also suggests that in the long run, a pandemic recession ultimately reduces gender gaps in the labor market. Even though women do the majority of childcare, our model indicates that fathers too substantially increase the time they spend on childcare during a pandemic recession. Moreover, there is a rise in the number of married couples in which the husband is the primary childcare provider. We conjecture that these changes erode social norms that underlie the unequal distribution of childcare between women and men, thus increasing the share of "modern" couples with egalitarian social norms. We also conjecture that the wide adoption of working-from-home arrangements during the crisis will lead to a persistent rise in the share of jobs in the economy for which telecommuting is an option. Together, these changes imply that the "new normal" after a pandemic recession will see a higher share of women in the labor force and a lower gender wage gap compared to the pre-recession economy.

Our work contributes to the literature on the role of women's employment in economic fluctuations. In December 2019, women accounted for the majority of the US labor force for the first time, capping a decades-long convergence between male and female employment. Yet, for a long time most business cycle models have been "unisex" models

that do not allow for gender differences, while many macroeconomic studies of labor supply have been calibrated to data on men's employment only. More recently, studies such as Albanesi (2020) and Fukui, Nakamura, and Steinsson (2019) argue that the role of women in aggregate fluctuations has changed substantially over time due to rising female labor force participation. Albanesi (2020) provides evidence that women's employment plays a crucial role in phenomena such as jobless recoveries, the productivity slowdown, and the great moderation. Bardóczy (2020) argues that joint household decision-making is an important determinant of the transmission of macroeconomic shocks. Other contributions to the literature on women's employment and household decision-making within macroeconomics include Greenwood, Seshadri, and Yorukoglu (2005) Ortigueira and Siassi (2013), Doepke and Tertilt (2016), Mankart and Oikonomou (2017), Borella, De Nardi, and Yang (2018), Mennuni (2019), Olsson (2019), and Wang (2019).[2] In addition, Albanesi and Şahin (2018) and Coskun and Dalgic (2020) note the impact that the gender breakdown of employment in various industries has on the contrasting cyclicality of male and female employment, which is a key element of how we model the impact of regular recessions.

One of the central mechanisms in our theory is within-family insurance of job loss and income shocks. In the labor literature, Lundberg (1985) introduced the notion of the "added worker effect," i.e., a worker joining the labor force in response to their spouse's job loss. More recent studies supporting the important role of within-family insurance include Attanasio, Low, and Sánchez-Marcos (2005), Blundell, Pistaferri, and Saporta-Eksten (2016, 2018), Birinci (2019), García-Pérez and Rendon (2020), Pruitt and Turner (2020), and Guner, Kulikova, and Valladares-Esteban (2020). Meanwhile Guler, Guvenen, and Violante (2012) and Pilossoph and Wee (2020) analyze the impact of within-family insurance on job searches. Ellieroth (2019) uses a joint-search model similar to our setting to characterize the quantitative importance of within-household insurance over the business cycle. Unlike existing search models with within-family insurance, our model allows for the accumulation and depreciation of human capital, incorporates single and married households, accounts for childcare needs, and allows for different occupations and social norms. All of these features play a central role in our analysis.

Our analysis also contributes to a rapidly growing body of work on the macroeconomic consequences of the Covid-19 recession. Much of this literature combines epidemiological and economic modeling to examine how policy interventions and endogenous

[2]Macroeconomic studies of the policy implications of joint household decisions include Guner, Kaygusuz, and Ventura (2012), Guner, Kaygusuz, and Ventura (2020), Bick (2016), and Krueger and Wu (2019).

behavioral adjustments shape the evolution of the pandemic and its macroeconomic consequences (see Eichenbaum, Rebelo, and Trabandt 2020, Berger, Herkenhoff, and Mongey 2020, Glover et al. 2020, and Brotherhood et al. 2020, among others). Our paper departs from such studies as it does not model the pandemic explicitly, but rather focuses on the economic consequences of the employment losses and increased childcare needs brought about by the pandemic.[3] In this regard, our approach is more similar to Lorenzoni et al. (2020), Gregory, Menzio, and Wiczer (2020), and Danieli and Olmstead-Rumsey (2020), who also focus on the macroeconomic transmission of the lockdown shock in models that abstract from epidemiology. These papers focus on distinct mechanisms from our own study, namely the role of incomplete markets and liquidity constraints, employment stability, and the sectoral distribution of the downturn. As such, our focus on within-family insurance and the differential impacts on women and men provides a novel contribution to this literature.

In the next section, we summarize evidence on how the current pandemic recession differs from earlier recessions. In Section 3, we describe our model economy. The model is calibrated to the data in Section 4. In Section 5 we compare the short-run implications of regular and pandemic recessions in the calibrated model. In Section 6 we consider repercussions of a pandemic recession for gender inequality in the labor market over a longer horizon, and consider how these repercussions depend on policy options such as opening schools or daycare centers early in the recession. Section 7 concludes.

2 Evidence on the Role of Gender in Regular versus Pandemic Recessions

The social distancing measures and stay-at-home orders imposed in many US states and other countries during the Covid-19 crisis have resulted in a drop in employment, a rise in unemployment, and an economic contraction. In this section, we document how the current pandemic recession differs from earlier recessions in its implications for women's versus men's employment.

[3]The pandemic itself also has a gender dimension, as men appear to be at higher risk of death than women. However, to date vastly more people are affected by the economic repercussions of the pandemic than by Covid-19 itself.

Table 1: Volatility of Hours Worked by Gender and Marital Status

	All			Married		Single	
	Total	Women	Men	Women	Men	Women	Men
				1989–2014			
Total Volatility	1.15	0.87	1.47	0.79	1.16	1.30	2.25
Cyclical Volatility	0.91	0.51	1.23	0.38	0.95	0.70	1.82
Hours Share		42.64	57.36	25.89	39.83	16.75	17.53
Volatility Share		23.68	76.32	10.80	41.51	12.88	34.81
				1962–1988			
Total Volatility	1.35	1.19	1.48	1.26	1.36	1.37	2.44
Cyclical Volatility	1.08	0.87	1.19	0.87	1.09	0.79	1.65
Hours Share		33.71	66.29	21.99	55.29	11.72	11.00
Volatility Share		27.14	72.86	18.02	56.29	8.67	17.02

Notes: All data from Current Population Survey, March and Annual Social and Economic Supplements, 1962 to 2014. Total volatility is the percentage standard deviation of the Hodrick-Prescott residual of average labor supply per person in each group. Cyclical volatility is the percentage deviation of the predicted value of a regression of the HP-residual on the HP-residual of GDP per capita. Hours share is share of each component in total hours. Volatility share is share of each group in the cyclical volatility of total hours. See Doepke and Tertilt (2016) for further details.

2.1 Gender Differences in Regular Recessions

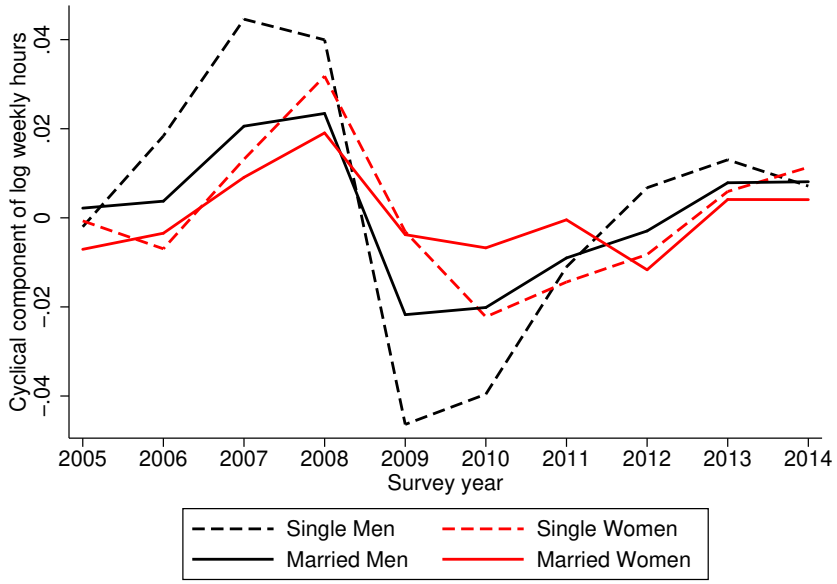
In other economic downturns preceding the current crisis, including the Great Recession of 2007–2009, the employment of male workers was usually affected more strongly than the employment of female workers. Doepke and Tertilt (2016) summarize the evidence on how employment varies over the business cycle for women and men. Table 1 shows that women's aggregate labor supply is less volatile overall than men's, as measured by the percentage standard deviation of the Hodrick-Prescott residual of average labor supply per person. For cyclical volatility, i.e., the component of overall volatility that is correlated with aggregate economic fluctuations, the gap between women and men is even larger. Over the period 1989–2014, men account for more than three quarters of overall cyclical fluctuations in employment, and women for less than one quarter.

The table also shows that the same qualitative pattern is apparent in the earlier period of 1962–1988, but the quantitative differences between the cyclicality of women's and men's employment are much smaller. Women account for a smaller fraction of the labor force (about one-third) in 1962–1988, but a larger share of aggregate volatility.

Figure 1 illustrates these results by displaying the cyclical component of hours worked by different groups for the period 2005–2014, i.e., just before and after the Great Reces-

sion of 2007–2009. Single men and women experience larger employment losses during the recession than their married counterparts, while employment losses within each group are much larger for men than for women. Overall, married women experience the smallest variation in employment throughout the Great Recession and the subsequent recovery.

Figure 1: Cyclical Component of Hours by Gender and Marital Status



Notes: Cyclical component of average weekly work hours for the United States by gender and marital status (the cyclical component is the deviation from Hodrick-Prescott trend, smoothing parameter 6.25). Source: Current Population Survey, March and Annual Social and Economic Supplements, 1962 to 2014. See Doepke and Tertilt (2016) for further details.

There are multiple reasons why female employment usually varies less over the cycle. One reason is insurance within the family—women's employment may be less affected by downturns precisely because some married women increase their labor supply to compensate for their husband's unemployment or higher unemployment risk.[4] One indication of the importance of this channel is that the cyclical volatility of labor supply illustrated in Table 1 and Figure 1 is much lower for married women (to whom the family insurance channel applies) than for single women. The compensating role of married women's labor supply can also account for the differences between the earlier and later periods in Table 1. Between the 1960s and the 1990s, the labor force participation and relative earnings of married women rose substantially. Hence, in the later period

[4]See Ellieroth (2019) for a study documenting the quantitative importance of this mechanism.

the within-household insurance effect is more pronounced, both because more married women work and because their earnings are sufficiently high to provide substantial insurance. These observations explain why the share of hours worked by women rose but their volatility share fell between the two periods in Table 1.[5]

In addition to within-family insurance, there are other channels that also contribute to differences in the volatility of women's and men's labor supply. This is apparent from the large volatility gap between single women and single men, to whom the within-family insurance channel does not apply. The second crucial channel is the different sectoral composition of female and male employment. In typical recessions, sectors such as manufacturing and residential construction are more severely affected compared to, say, education and health care. Men's employment is more concentrated in sectors with a high cyclical exposure, whereas women are more represented in sectors with relatively stable employment over the cycle. These facts are documented in a recent paper by Coskun and Dalgic (2020). The authors find that employment in the "Government" and "Education and Health Services" sectors is actually countercyclical. These two sectors account for 40 percent of women's employment, but only 20 percent of men's employment. Conversely, the highly cyclical sectors of "Manufacturing," "Construction," and "Trade, Transportation, Utilities" account for 46 percent of male but only 24 percent of female employment.

These two channels are neither exhaustive nor independent—for example, some women may choose to work in a countercyclical sector to compensate for their husbands' cyclical employment risk. But the bottom line is clear: past downturns have affected men's employment more severely than that of women, a trend that has become more pronounced in recent decades of relatively high female labor force participation.

2.2 Why a Pandemic Recession is Different

In Alon et al. (2020a), we predicted that unlike a regular recession, the current pandemic recession would reduce women's employment more than men's employment. This prediction, which has since been confirmed by the evidence, was based on two channels. The first consists of the impact of the social distancing measures in a pandemic across sectors and occupations; we argued that women account for a large share of employment in areas of the economy that were likely to be strongly affected by lockdown mea-

[5]The impact of the rising labor force participation among married women on aggregate fluctuations has been explored by Albanesi (2020) and Fukui, Nakamura, and Steinsson (2019), among others.

sures. The second channel is childcare. Social distancing measures in most countries included closures of schools and daycare centers, resulting in a large increase in the childcare burden for parents with young children. This channel is further amplified by the reduced availability of other means of childcare provision, such as from relatives, neighbors, nannies, or babysitters, during a lockdown with minimal social contact. This channel affects all parents' ability to work, but since women generally provide a much larger share of childcare than men do, the effect on women was likely to be larger.

To quantify the occupation channel, in Alon et al. (2020a), we combined data from the American Community Survey (ACS), the American Time Use Survey (ATUS), and the Current Population Survey (CPS) to rank occupations by the ability to work from home (meaning that work during the lockdown is possible) and by whether an occupation is critical during the lockdown (such as healthcare workers). We documented that women are underrepresented in the occupations with the highest ability to telecommute and in critical occupations, implying that women's employment has a stronger exposure to the pandemic recession shock.

For the childcare channel,we (Alon et al. 2020a) combined CPS and ATUS data to document that women provide a much larger share of overall childcare than men. There are many more single mothers than single fathers, and many more married mothers than fathers who work part-time or are a stay-at-home parent with their spouse working full-time. Even among married parents who both work full time, mothers provide about 40 percent more childcare than fathers.[6] Taken together, these observations suggested that women would end up shouldering most of the increased childcare needs during the recession, and would thus face reduced opportunities for employment.[7]

Since the onset of the current recession, a number of studies have provided additional evidence on the importance of these channels. Mongey, Pilossoph, and Weinberg (2020) use O*NET data on occupational characteristics to examine the burden of social distancing policies based on the ability to work from home and a measure of physical proximity at work in different occupations. In contrast to the time-use data used by Alon et al. 2020a, they find that women are more likely to be able to work from home, but that they are also over-represented in occupations requiring physical proximity. Combining these

[6]The gap between women's and men's provision of childcare is even larger during regular working hours (8 a.m. to 6 p.m. on weekdays; see Schoonbroodt 2018).

[7]Women provide the majority of childcare in all industrialized countries, though there is considerable variation between countries in the gap between women's and men's contributions (Doepke and Kindermann 2019).

factors, the authors expect the overall impact on women's and men's employment to be similar, and hence qualitatively different from regular recessions in which the most adversely affected occupations have a higher share of male employment. Albanesi et al. (2020) also examine the gender breakdown in employment between occupations that are high and low in personal contact, and find that women account for 74 percent of employment in high-contact occupations.

Dingel, Patterson, and Vavra (2020) quantify the extent to which childcare obligations will hold back the recovery. Based on ACS data, they document that 32 percent of the US workforce has a child under the age of 14 in their household, and that two-thirds of these households do not include an adult who is out of the labor force (e.g., a stay-at-home parent). In 30 percent of households with children, all offspring are under the age of 6,meaning that these households will be relieved of additional childcare needs when daycare centers reopen. These numbers underscore that childcare obligations have been a major driver of reduced employment during the recession, and that a strong recovery will not be possible until these needs are met.

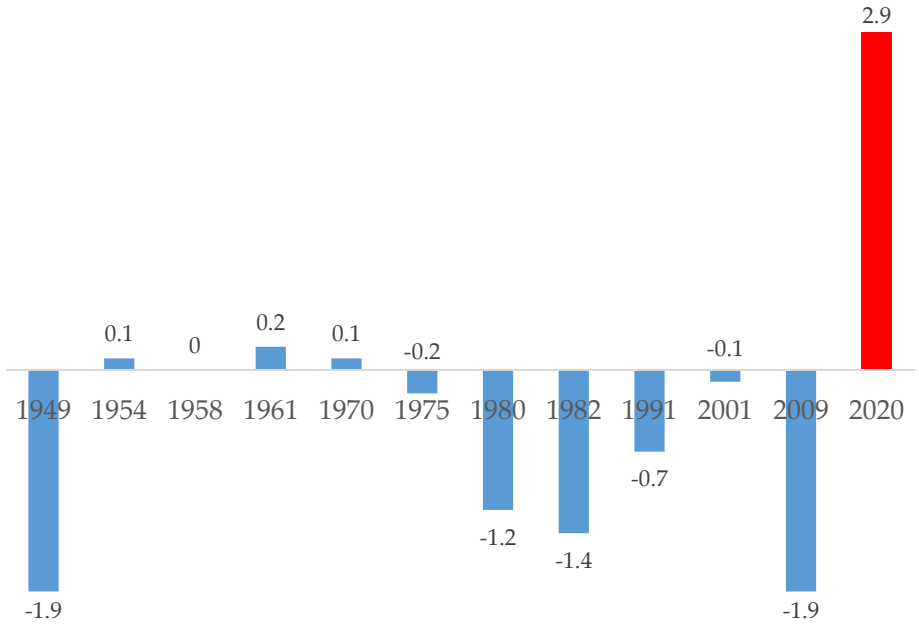
2.3 The Impact of the Covid-19 Recession on Women's vs. Men's Employment

We now document how the impact of the current pandemic recession on women's and men's employment differs from the typical pattern observed in earlier recessions. We indeed find that, unlike a regular recession, women's employment is more strongly affected than men's employment, consistent with the prominent role of the childcare and sector/occupation channels.

Consider, first, the impact of recessions on unemployment. Figure 2 displays the difference between the rise in women's and men's unemployment in every recession in the United States since 1948. For pre-Covid-19 recessions, we use the difference in the seasonally adjusted unemployment rate between the first and last months of each recession based on recession dates from the NBER Business Cycle Dating Committee. For the current recession, we use the difference between unemployment in February 2020 (the trough in unemployment before lockdown measures were taken) and April 2020 (the peak in unemployment so far). The results are similar if we instead consider the most recent figures.

The figure shows that women's and men's labor supply changed by a similar amount during recessions between the 1950s and the early 1970s, when married women's labor

Figure 2: Difference between Rise in Women's and Men's Unemployment, US Recessions from 1948 to 2020



Notes: Data from Bureau of Labor Statistics. Each bar is the rise in the women's unemployment rate minus the rise in the men's unemployment rate from the first to the last month of each recession according to NBER business cycle dates. The underlying series are seasonally adjusted monthly unemployment rates by gender.

supply was still relatively low. This is consistent with the notion that within-family insurance did not yet play a major role during this period. Subsequently, all recessions from 1975 to 2009 display a larger rise in unemployment among men than women. The difference is quantitatively large in all recessions except 2001, when the overall increase in unemployment was small for both women and men. The 1949 recession also displayed a much larger rise in men's unemployment.

Unlike all previous recessions, the figure shows that women's unemployment has risen much more than that of men during the current recession—a 2.9 percentage point gap between February and April of 2020. Hence, the impact of the current recession on men's and women's unemployment contrasts sharply with the typical characteristics of earlier economic downturns.

The disparate impact of the current recession on women and men is also evident when we consider data on employment rather than unemployment. Bick and Blandin (2020) conduct an online survey to provide real-time evidence on the labor market impact of the current recession. The survey is designed to be comparable to the data typically pro-

vided by the Current Population Survey (CPS), and matches the CPS well for the period when the surveys overlap. The authors show 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. The gender gap in hours worked is even larger: between February and May, women's average hours fell by 27 percent, versus a drop of only 20 percent for men. Cajner et al. (2020) come to similar conclusions using data from a major payroll processing company, which show a 21.5 percent decrease in women's employment from February to April 2020, compared to a 17.8 percent decrease for men.

Other studies shed light on the role of the sector/occupation and childcare channels for the employment impact of the recession. Papanikolaou and Schmidt (2020) examine whether the ability to telecommute, based on ATUS data (as used by Alon et al. 2020a), actually predicts employment losses during the current recession. They find (using industry data from the Bureau of Labor Statistics) that, indeed, sectors with a lower ability to telecommute experienced larger declines in employment. Moreover, the employment of women with young children was particularly affected, underlining the importance of the childcare channel. Similarly, Collins et al. (2020) examine changes in work hours from February to April 2020 in the CPS data, and find that mothers with young children reduced their labor supply by four to five times as much as fathers.

The gendered impact of the Covid-19 pandemic can also be observed in other countries. Both Adams-Prassl et al. (2020b) and Sevilla and Smith (2020) conducted real-time surveys in the UK and find that women were more likely to have reduced their labor supply during the pandemic than men. The studies show that occupation plays an important role but cannot explain the entire gender gap in employment rates. Rather, the presence of children and the division of childcare in the household is crucial. Farré et al. (2020) document that in Spain, women have been more likely than men to lose their jobs during the pandemic. Meanwhile, Lemieux et al. (2020) examine the labor market impact of the pandemic in Canada, and find that from February to April labor supply dropped by 30.1 percent for women compared to 27.7 percent for men. In Germany, the differential impact on women is small in comparison (Adams-Prassl et al. 2020b), which might be related to the policy instrument of *Kurzarbeit*, i.e., subsidized reduced employment without terminating the employment relationship. However, even in Germany, the increase in the unemployment rate from February to May has been higher for women (a rise of 19 percent) than for men (14 percent).[8]

[8]See Table 1.1 in Bundesagentur für Arbeit (2020).

To summarize, the evidence from a number of countries confirms the prediction of Alon et al. (2020a) that a pandemic recession has a disproportionate impact on women's employment. To assess the implications of this key distinction between regular and pandemic recessions for macroeconomic dynamics, gender inequality, and welfare, we now turn to our macroeconomic model.

3 A Dynamic Model of Work and Childcare

Our quantitative model focuses on the household side of an economy with search frictions. Macroeconomic shocks affect households primarily through changes in job-loss and job-finding probabilities. In our analysis, we take the impact of aggregate shocks on these labor-market variables as given, and focus on the question of how the household sector will respond in terms of labor supply, consumption demand, and the accumulation of skills.[9]

3.1 Demographics and State Variables

The economy is populated by a continuum of three types of households: single women, single men, and couples. Every period, a new cohort of singles and couples enters the economy. The household type is permanent. Singles and couples face a constant probability ω of death. Couples stay together and die together, and hence there are no widows, widowers, or divorcees in the economy.

The state variables of a household include assets/savings a and the labor market productivity h of each household member. Additional discrete state variables are kids $k \in \{0, s, b\}$ (no kids, small kid, big kid), employment of each member $e \in \{E, U\}$ (employed or unemployed), and the occupation of each household member $o \in \{TC, NT\}$ (can telecommute or cannot). The unemployed state $e = U$ in the model corresponds to both unemployment and being out of the labor force in the data. For couples, a final state variable is a social norm $m \in \{0, 1\}$ where $m = 0$ denotes a "traditional" social norm that values a within-household division of labor in which the mother provides the majority of childcare, whereas a couple with $m = 1$ has the "modern" view that no childcare arrangement is inherently superior.[10] The aggregate state variable for the

[9] It would be conceptually straightforward to expand towards a full general equilibrium analysis by modeling job creation and destruction by firms in the usual way and, if desired, adding additional features such as nominal rigidities.

[10] One indication for the relevance of social norms is that men raising children in same-sex couples provide more childcare than men in different-sex couples do (Prickett, Martin-Storey, and Crosnoe 2015).

economy is denoted by X, which captures whether the economy is or is not currently in a recession.

New singles and couples start out with zero assets. The initial human capital levels for singles are drawn from gender-specific distributions $F^g(h)$ and for couples from the joint distribution $F(h^f, h^m)$. The initial probability of each occupation and each social norm is given by the stationary distribution over these states implied by the current aggregate state. Singles or couples may already have a small or large child when they enter the economy. The probabilities of having a job offer in the initial period are identical to the offer probabilities for an unemployed individual of the same gender.

After the initial period, the level of assets is determined by a household's consumption-savings decision. Labor market productivity evolves as a function of shocks and labor supply. Employment status and occupation type evolve as a function of shocks—individuals can get laid off, and finding a job in a particular occupation is random. People can also decide to reject a job offer or quit a job. Labor supply (conditional on having a job) is either part-time or full-time, chosen by the worker.

For singles, the transition probabilities for kids are given by $\pi^g(k'|k)$, and for couples these probabilities are given by $\Pi(k'|k)$. The transition probabilities for employment are given by $\pi^g(e'|e, X)$. Naturally, employment transition probabilities depend on the aggregate state X, which captures that in a recession jobs are easier to lose and harder to find. The transition probabilities also depend on the current employment state e and gender g. The employment state e' at the beginning of the next period denotes whether the worker receives a job offer. If a job offer is received, the worker can still decide whether to accept the offer and, if so, whether to work full-time or part-time. The transition probabilities for human capital $\pi(h'|h, n)$ are independent of gender and only depend on current human capital h and labor supply n. People also face constant probabilities of switching occupations and social norms, given by $\pi(o'|o, X)$ and $\pi(m'|m, X)$.

3.2 The Decision Problem for Singles

We use v to denote the value functions of singles, while V denotes the value functions of couples. Similarly, $\tilde{v}$ and $\tilde{V}$ denote the value functions at the beginning of the period before job offers are accepted or rejected. The value function for an employed single is given by:

$$v_E^g(a, h, k, o, X) = \max_{a',c,l,n,t} \left\{ u^g(c, l) + \omega\beta E\left[w_{e'}^g(a', h', k', o', X')\right] \right\}.$$

Here β is the time discount factor, c denotes consumption, l denotes leisure, $n \in \{0, 0.5, 1\}$ is labor supply (part time or full time), and t is time spent on childcare. The period utility function is given by:

$$u^g(c, l) = \log(c) + \alpha^g \log(l).$$

We allow leisure preference to depend on gender to facilitate matching labor supply to the data. The social norm does not apply to singles because it only affects the time allocation of couples. The constraints for employed singles are as follows:

$$\begin{aligned} c + a' &= w^g h n^\theta + (1 + r)a, \\ t + \phi(k)\, n\, I(o = TC) &\geq \gamma(k, X), \\ l + n + t &= T. \end{aligned}$$

The first constraint is the budget constraint. The parameter $\theta > 0$ allows for increasing or decreasing returns in labor supply. For example, part-time workers (who supply half as much labor as full-time workers) may be less than half as productive because of commuting time, or more than half as productive because workers get tired. The second constraint is the childcare constraint, which says that total childcare time has to be at least as large as the childcare need $\gamma(k, X)$, where $\gamma(s, X) > \gamma(b, X) > \gamma(0, X) = 0$. The term $\phi(k)\, nI(o = TC)$ reflects the fact that in a telecommuting job ($o = TC$), fraction $\phi(k)$ of work time can be used to simultaneously provide childcare. Intuitively, workers with TC jobs can supervise a child at home while still getting some work done, and they do not have to take an entire day off of work if a child is sick at home. This matters a lot when childcare requirements rise during a pandemic recession. The ability of a worker in a TC occupation to simultaneously work and provide childcare depends on the age of the child. Specifically, a younger child requires more full-time attention than does an older child. The remaining childcare time is denoted as t. The final constraint is the time constraint, where T is the time endowment.

The value function and constraints for unemployed singles are:

$$v_U^g(a, h, k, o, X) = \max_{a', c, l, t} \left\{ u^g(c, l) + \omega\beta E\left[w_{e'}^g(a', h', k', o', X')\right] \right\}.$$

$$\begin{aligned} c + a' &= z w^g h + (1 + r)a, \\ t &= \gamma(k, X), \end{aligned}$$

$$l + t = T.$$

Here z denotes the unemployment benefit replacement rate relative to potential productivity $w^g h$. Notice that even when unemployed, occupation o is defined, because the current occupation defines the probability distribution of receiving job offers in each possible occupation.

The value function at the beginning of the period for a single with a job offer is:

$$\tilde{v}_E^g(a, h, k, o, X) = \max \left\{ v_E^g(a, h, k, o, X), v_U^g(a, h, k, o, X) \right\}.$$

Without a job offer, there is no choice to be made, so we have:

$$\tilde{v}_U^g(a, h, k, o, X) = v_U^g(a, h, k, o, X).$$

3.3 The Decision Problem for Couples

We now turn to married households. The overall structure of the decision problem is the same as for singles. The spouses act cooperatively with bargaining weights λ for the wife and $1 - \lambda$ for the husband. Here, the household decision problem also reflects the role of the social norm. If $m = 0$ (the traditional social norm applies), the household suffers a utility loss of ψ per unit of time if the father provides more childcare than the mother, and a utility benefit if she does more. The value function for two working spouses is given by:

$$\begin{aligned} V_{EE}(a, h^f, h^m, k, o^f, o^m, m, X) = \max \big\{ & \lambda u^f(c^f, l^f) + (1 - \lambda) u^m(c^m, l^m) \\ & - (1 - m)\psi(t^m - t^f) + \omega\beta E \left[W_{(e^f)', (e^m)'}(a', (h^f)', (h^m)', k, (o^f)', (o^m)', m', X') \right] \big\}. \end{aligned}$$

The budget and time constraints are:

$$\begin{aligned} c^f + c^m + a' &= w^f h^f (n^f)^\theta + w^m h^m (n^m)^\theta + (1 + r)a, \\ t^f + t^m + \phi(k) \left(n^f I(o^f = TC) + n^m I(o^m = TC) \right) &= \gamma(k, X), \\ l^f + n^f + t^f &= T, \qquad (1) \\ l^m + n^m + t^m &= T. \qquad (2) \end{aligned}$$

If only the woman has a job, the decision problem is:

$$V_{EU}(a, h^f, h^m, k, o^f, o^m, m, X) = \max \big\{ \lambda u^f(c^f, l^f) + (1-\lambda) u^m(c^m, l^m) \\ - (1-m)\psi(t^m - t^f) + \omega\beta E \left[W_{(e^f)', (e^m)'}(a', (h^f)', (h^m)', k, (o^f)', (o^m)', m', X') \right] \big\}$$

subject to (1) and:

$$c^f + c^m + a' = w^f h^f (n^f)^\theta + z w^m h^m + (1+r)a, \\ t^f + t^m + \phi(k)\, n^f I(o^f = TC) \geq \gamma(k, X), \\ l^m + t^m = T.$$

The reverse case is analogous. If both are unemployed, the decision problem is:

$$V_{UU}(a, h^f, h^m, k, o^f, o^m, m, X) = \max \big\{ \lambda u^f(c^f, l^f) + (1-\lambda) u^m(c^m, l^m) \\ - (1-m)\psi(t^m - t^f) + \omega\beta E \left[W_{(e^f)', (e^m)'}(a', (h^f)', (h^m)', k, (o^f)', (o^m)', m', X') \right] \big\}$$

subject to (1), (2), and:

$$c^f + c^m + a' = z(w^f h^f + w^m h^m) + (1+r)a, \\ t^f + t^m = \gamma(k, X).$$

At the beginning of the period, if both spouses have a job offer, we get:

$$\tilde{V}_{EE}(a, h^f, h^m, k, o^f, o^m, m, X) = \max \big\{ V_{EE}(a, h^f, h^m, k, o^f, o^m, m, X), \\ \tilde{V}_{EU}(a, h^f, h^m, k, o^f, o^m, m, X), V_{UE}(a, h^f, h^m, k, o^f, o^m, m, X), \\ V_{UU}(a, h^f, h^m, k, o^f, o^m, m, X) \big\}.$$

The initial value functions for the other permutations are analogous.

3.4 The Stochastic Process for Labor Productivity

Human capital h evolves as a function of shocks and captures both random shocks to productivity and the returns to experience. There is a finite grid $h \in H = \{h_1, h_2, \ldots, h_I\}$ of possible human capital levels, where the ratio of subsequent points is constant, i.e., $\log(h_{i+1}) - \log(h_i)$ is constant across i. There are returns to experience to working full time, meaning that full-time workers upgrade to the next human capital level with a fixed probability η:

$$\pi(h_{i+1}|h_i, 1) = \eta, \quad \pi(h_i|h_i, 1) = 1 - \eta.$$

Individuals who do not work face possible skill depreciation with probability δ:

$$\pi(h_{i-1}|h_i, 0) = \delta, \quad \pi(h_i|h_i, 0) = 1 - \delta.$$

The human capital of part-time workers is constant: $\pi(h_i|h_i, 0.5) = 1$.

3.5 The Aggregate State

The aggregate state X takes four possible values: $X \in \{N, NN, R, P\}$. Here N denotes normal times, before a recession hits. R denotes a regular recession, modeled as a large decline in job-finding probabilities and large rise in job-loss probabilities for men and smaller changes in the same direction for women, with unchanged childcare requirements. P denotes a pandemic recession, where there are considerable changes in labor market flows for both men and women, as well as a large increase in childcare requirements. Finally, NN denotes the "new normal," or the state of the economy after a pandemic recession is over. This state allows us to model the consequences of permanent transformations brought about by a pandemic, such as a rise in the share of TC jobs and a shift in social norms.

The transition matrix between these four states is parameterized as follows:

$$\pi(S'|S) = \begin{pmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 1-\rho_R & 0 & \rho_R & 0 \\ 0 & 1-\rho_P & 0 & \rho_P \end{pmatrix}.$$

Note that the N and NN states are absorbing; in either the normal or the new-normal state, people expect to stay in that state forever. Recessions therefore arise as unexpected "MIT shocks" (this could be easily generalized). Once in a regular R recession, the economy returns to normal N with probability $1 - \rho_R$. If in a pandemic P recession, then the economy switches to the new normal with probability $1 - \rho_P$.

3.6 The Stochastic Processes for Occupation and Social Norm

The transition probabilities of occupation and the social norm depend only on the state variable itself and on the aggregate state. Hence, the transition probabilities for occupation are given by numbers $\pi(o'|o, X)$, while the transition probabilities for the social

norm are denoted as $\pi(m'|m, X)$. The dependence on the aggregate state captures the possibility that a pandemic recession can promote the spread of TC jobs and the modern social norm. The transition matrix for $o \in \{TC, NT\}$ is given by:

$$\pi(o'|o, X) = \begin{pmatrix} \rho_{TC}(X) & 1 - \rho_{TC}(X) \\ 1 - \rho_{NT}(X) & \rho_{NT}(X) \end{pmatrix}$$

and similarly for the social norm $m \in \{0, 1\}$ we have:

$$\pi(m'|m, X) = \begin{pmatrix} \rho_0(X) & 1 - \rho_0(X) \\ 1 - \rho_1(X) & \rho_1(X) \end{pmatrix}.$$

For both transition matrices, we assume that one set of coefficients applies to the aggregate states N and R (normal and regular recession), and a second set of coefficients applies to the states P and NN (pandemic recession and new normal).

4 Calibrating the Model to Normal Times and Recessions

We aim to quantify the impact of regular versus pandemic recessions on different households and on the aggregate behavior of the household sector. To this end, we first calibrate the normal state $X = N$ of the economy to match a number of characteristics of the US economy before the onset of the current pandemic recession. We then pin down the properties of regular versus pandemic recessions using data on earlier recessions and on the current one. Finally, we calibrate the new normal after a pandemic recession based on changes in telecommuting during the crisis and evidence on the dynamics of social norms.

4.1 Externally Calibrated Parameters

The model economy operates at a quarterly frequency. Newly born people in the model correspond to singles and couples at age 25 in the data. A number of model parameters directly correspond to specific empirical observations and can be pinned down individually. These parameters are listed in Table 2. The survival probability ω determines life expectancy in the model. Given that we do not model retirement, we interpret the lifespan in the model as corresponding to active working life. As an increasing number of people retire starting around age 55 in the data, we set ω to match a life expectancy of

55 years.[11] We set the discount factor to $\beta = 0.98$ at a quarterly frequency. The discount factor primarily drives asset accumulation. In addition, because assets determine how financially constrained households are, the discount factor drives the distributions of marginal propensities to consume (MPCs) and save in the economy. Macroeconomic models have typically been calibrated to match overall asset accumulation in the economy, but a recent literature documents that such models imply counterfactually low MPCs (e.g., Kaplan and Violante 2014). We therefore choose a lower value than in typical macroeconomic calibrations, which in turn raises the average MPC of single and married households in the economy to a more realistic value.[12] The interest rate is set to $r = 0.02$, a relatively high value allowing for the fact that households are not compensated for accidental bequests left at their death. We normalize the time endowment to $T = 1.5$. Since we interpret a labor supply of $n = 1$ as a full-time job of 40 hours, this corresponds to a time endowment of 60 hours per week.[13] The childcare parameters $\gamma(s, N)$ and $\gamma(b, N)$ are calibrated based on information on time spent on childcare in families with younger and older children from the American Time Use Survey. The returns to experience parameter η is set to match a return to labor market experience of 1.1 percent per quarter, which is computed using the NLSY97 data set. The skill-depreciation parameter δ matches a quarterly depreciation of skills of 2.5 percent, which matches observations by Davis and von Wachter (2011) on the earnings implications of job loss during recessions. Further details on the calibration and the underlying data sources are provided in Appendix A.

In addition to the parameters listed in Table 2, we calibrate the initial distributions of human capital $F^g(h)$ and $F(h^f, h^m)$ to match evidence on the distribution of earnings of singles and couples at age 25 (see Appendix A.4). We match the transition probabilities for children $\pi^g(k'|k)$ and $\Pi(k'|k)$ with evidence on the distribution of different types of households (having younger children, older children, or neither; see Appendix A.3). The calibration yields a stationary distribution in which 59 percent of households are married, 51 percent are parents, 7 percent of households are single mothers, and 3 percent are single fathers. Among households with children, 45 percent have young kids

[11] Explicitly modeling retirement would primarily affect asset-accumulation decisions in the model. However, given that death is modeled as a shock, people still accumulate a substantial amount of assets and leave accidental bequests.

[12] Kaplan and Violante (2014) and Auclert, Bardóczy, and Rognlie (2020) report a quarterly MPC of about 0.25 for the US economy.

[13] We interpret our model as allocating fungible time during a typical weekday. Thus, we subtract sleep and personal care time and weekends to arrive at a time endowment of 60 hours per week.

Table 2: Externally Calibrated Parameters

Parameter	Value	Interpretation
ω	0.99	Expected retirement at age 60
β	0.98	Discount factor
r	0.02	Interest rate
T	1.5	Time endowment
$\gamma(s, N)$	0.34	Younger kids require 13.7 hours of childcare per week
$\gamma(b, N)$	0.11	Older kids require 4.2 hours of childcare per week
η	0.03	Return to labor market experience
δ	0.06	Skill depreciation in unemployment
ρ_{NT}	0.999	8.2% of pre-pandemic jobs are telecommuting

Notes: Hours are converted into fractions based on our assumptions that one unit of time corresponds to 40 hours per week.

under the age of six. Similarly, we initialize telecommuting status to match occupational patterns by gender and marital status observed in the data. Couples are jointly initialized so as to reflect the extent of occupational correlation between spouses (which, according to Malkov 2020, is quantitatively important for couples' exposure to risk in the current pandemic). Transitions between telecommuting and non-telecommuting jobs are then chosen such that the stationary equilibrium matches the prevailing level of telecommuters just before the pandemic, as documented in Bick and Blandin (2020).[14] The resulting fraction of telecommuters in the labor force is 12.9 percent. The share of telecommuters is substantially higher among married than single workers. Finally, we set the pre-pandemic share of married couples with traditional social norms to 30 percent, to match evidence from the General Social Survey. Appendix A provides additional details on these parameter values and the data sources.

4.2 Jointly Calibrated Parameters

The remaining parameters are jointly calibrated to match a set of target moments that characterize the US economy before the onset of the current recession. Table 3 displays the calibrated parameter values, and Table 4 shows the model fit. Though the parameters are jointly chosen, in most cases there is a fairly direct mapping from a particular parameter to a particular moment.

[14]Specifically, we normalize the persistence of telecommuting jobs to 0.99, and choose the persistence of non-telecommuting jobs to match the target.

Table 3: Jointly Calibrated Parameters

Description	Parameter	Value
Exogenous gender wage gap	w^f	0.91
Wife's bargaining power in married couples	λ	0.40
Diminishing returns to market work	θ	0.55
Women's leisure preference	α^f	0.64
Men's leisure preference	α^m	0.43
Telecommuters' childcare bonus for younger children	$\phi(s)$	0.07
Telecommuters' childcare bonus for older children	$\phi(b)$	0.14
Job offer probability for employed women	$\pi^f(E\|E,N)$	0.93
Job offer probability for non-employed women	$\pi^f(E\|U,N)$	0.40
Job offer probability for employed men	$\pi^m(E\|E,N)$	0.93
Job offer probability for non-employed men	$\pi^m(E\|U,N)$	0.40
Utility cost of violating social norms	ψ	0.23

We normalize men's wage per efficiency unit of labor to one, $w^m = 1$. We then choose the exogenous part of the gender wage gap (women's wage per efficiency unit of labor w^f) to match an overall gender wage gap of 0.81 (see Appendix A.2 for details on how we compute this target). The resulting parameter is $w^f = 0.91$, implying that about half of the gender wage gap is due to this exogenous gap, with the remainder accounted for by differences in labor supply and in the accumulation of experience over the life cycle between women and men.

The parameters for leisure preference and for women's bargaining power primarily determine the distribution of labor supply across women and men and within couples. The social-norm parameter also helps match labor supply, as this parameter specifically affects the labor supply of married women with children. With regard to the childcare bonus for telecommuters, we impose that the bonus is twice as large for older compared to younger kids, based on the notion that older children require less supervision and therefore interfere less with working from home. The level of the childcare bonus for telecommuters is pinned down based on the observation that, in the ATUS data, men who telecommute do 50 percent more childcare than those who do not work from home (conditional on being married to women who do not telecommute, see Alon et al. 2020a). The returns to scale parameter θ for market work helps to match the breakdown between part-time and full-time work.

For labor-market flows, we impose that job-offer probabilities are identical for women and men in normal times. This assumption makes our results easier to interpret, in that it implies that gender differences in job flows in the model are entirely due to endogenous behavior (i.e., job-acceptance decisions) rather than hard-wired differences. Furthermore, as Table 4 shows, the observed job flows are still matched fairly well. The higher persistence in the model of non-employment for women compared to men arises because women reject more offers, primarily due to childcare obligations.

Table 4: Model Fit for Target Moments

	Data	Model
Gender wage gap	0.81	0.81
Childcare division, full-time couples, men-to-women	0.65	0.66
Men who telecommute do 50% more childcare	1.50	1.48
Relative labor supply, men-to-women	1.19	1.17
Labor supply of married women without kids	0.72	0.73
Labor supply of married women with younger kids	0.56	0.59
Labor supply of married women with older kids	0.64	0.70
Share of married mothers not employed	0.30	0.26
Share of married mothers working part-time	0.18	0.19
Share of married mothers working full-time	0.52	0.55
Women's Labor Market Flows: E-to-E	0.91	0.92
Women's Labor Market Flows: U-to-U	0.77	0.73
Men's Labor Market Flows: E-to-E	0.93	0.92
Men's Labor Market Flows: U-to-U	0.66	0.66

Notes: See Appendix A for further details and data sources. Labor market state U here refers, as in the model, to all individuals who are either unemployed or out of the labor force. For telecommuters, childcare time in the model is computed as $t^g + 0.5\phi(k)\, n^g$*, that is, time that is spend on childcare and work simultaneously is counted as 50 percent childcare. Counting all of the combined time as childcare leads to similar results.*

As Table 4 shows, the calibrated model matches the target moments well. Even though we use relatively few parameters to match these moments (nine degrees of freedom to match 14 moments), the model provides a good fit for the distribution of married women across employment states and for the impact of having children on women's labor supply. Generally, as in the data, women's labor supply in the model is more responsive to having children than is that of men. While the social norm does matter for traditional couples, the main driver behind specialization in childcare is wage differences between wives and husbands (as in Alon, Coskun, and Doepke 2020). The exogenous

part of the gender wage gap implies that among a majority of couples, the wife is the secondary earner when the first child arrives, making it more likely that she will reduce her employment to meet childcare needs. As reducing employment means forgoing returns to labor market experience and potentially suffering skill loss, the within-couple wage gap will tend to grow, leading to even more childcare specialization as time passes.

4.3 Fit for Non-Targeted Moments

Table 5: Model Fit for Non-Targeted Moments

	Data	Model
Composition of single fathers by employment state:		
– not employed	0.16	0.15
– part-time	0.07	0.08
– full-time	0.77	0.77
Composition of married fathers by employment state:		
– not employed	0.07	0.19
– part-time	0.04	0.05
– full-time	0.89	0.75
Composition of single mothers by employment state:		
– not employed	0.24	0.15
– part-time	0.17	0.37
– full-time	0.59	0.48
Share of full-time dual earner couples by kids' age:		
– no kids	0.61	0.53
– younger kids	0.43	0.21
– older kids	0.49	0.47

Notes: See Appendix A for further details and data sources for the data moments.

Table 5 shows how well the model performs in terms of matching a larger set of moments that were not explicitly targeted in the calibration. While we focused on matching the overall women-to-men labor supply ratio and specific patterns of married women's labor supply in the calibration procedure, Table 5 shows that the model nevertheless matches the employment breakdown for men and single women fairly well (and remarkably well for single fathers). The model accounts for the observation that most married fathers work full time, and that single fathers are more likely to work than single mothers. Even though the model underpredicts the share of dual full-time earner

couples couples with small children, it does capture the overall variation in this share with fertility, and matches well the fraction of dual full-time earners among couples with either older kids or without kids.

4.4 Modeling Regular versus Pandemic Recessions

The calibration described thus far pins down the economy in the normal state $X = N$, before a recession takes place. We now turn to the parameters that characterize the aggregate changes when the economy enters a regular recession R or a pandemic recession P. We impose that regular and pandemic recessions have the same expected duration of six quarters, i.e., $\rho_R = \rho_P = \frac{5}{6}$. We model the aggregate changes during recessions in a stylized way so as to allow for a transparent comparison of the different types of recessions. Specifically, to capture the larger impact of regular recessions on men's employment, we impose that in a regular downturn the job-offer probabilities for men are reduced twice as much as those for women. This scaling allows for a simple decomposition of which employment changes are due to shocks (i.e., job loss) versus changes in behavior (i.e., probability of accepting job offers). In a pandemic recession, we instead impose that both women and men experience the same change in job offer probabilities as men in a regular recession. The different impacts on women versus men are thus primarily accounted for by changing childcare obligations (which only occur in a pandemic recession) rather than hard-wired differences in job flows.

Table 6 summarizes all the parameter values that differ across aggregate states. The pandemic recession leads to a substantial increase in childcare obligations, from 13.7 to 42 hours per week for younger kids, and from 4.2 to 26 hours per week for older kids. The underlying assumption is that small children need near-constant supervision, meaning that the time cost of childcare is just as a large as working full time. While older kids require less time, there is still a large increase, in part due to the need to homeschool them. These values can be compared to the findings of Adams-Prassl et al. (2020b), who show that in a typical work week during the pandemic, US parents working from home spent roughly 22.5 (men) and 30 (women) hours doing childcare and homeschooling, for a total of 52.5 hours. Given that there are also single parents and married couples where only one parent works from home, the childcare burden in the model for younger kids roughly corresponds to the half-way point between the total childcare burden of 52.5 hours provided by a couple and the 30 hours a mother provides on her own during the pandemic.

Table 6: Parameters Varying across Aggregate States

Parameter	Interpretation	Normal N	Recession R	Pandemic P	New Norm. NN
$\gamma(s, X)$	Childcare time, younger kids	0.34	0.34	1.05	0.34
$\gamma(b, X)$	Childcare time, older kids	0.11	0.11	0.65	0.11
$\rho_1(X)$	Persistence modern norms	0.99	0.99	0.99	0.99
$\rho_0(X)$	Persistence traditional norms	0.98	0.98	0.94	0.94
$\rho_{TC}(X)$	Persistence TC occupations	0.99	0.99	0.99	0.99
$\rho_{NT}(X)$	Persistence NT occupations	0.999	0.999	0.996	0.996
$\pi^m(E\|E, X)$	Job offer, employed men	0.93	0.91	0.91	0.93
$\pi^m(E\|U, X)$	Job offer, unemployed men	0.40	0.38	0.38	0.40
$\pi^f(E\|E, X)$	Job offer, employed women	0.93	0.92	0.91	0.93
$\pi^f(E\|U, X)$	Job offer, unemployed women	0.40	0.39	0.38	0.40

The job offer probabilities during regular recessions were chosen to match employment flows during previous US recessions, as described in Appendix A.2 (see Table 7). While this facilitates comparisons of regular and pandemic recessions in the model, it also means that our model somewhat understates the direct employment impact of the current pandemic recession (e.g., Kahn, Lange, and Wiczer 2020 report that there were 30 percent fewer vacancy postings in April 2020 than at the beginning of the year).

We allow for a one-time jump in the share of telecommutable jobs at the beginning of a pandemic recession, which captures the immediate rise in telecommuting at the beginning of the lockdown. Bick, Blandin, and Mertens (2020) report that in May 2020 more than 30 percent of the labor force worked from home, up from less than 10 percent in February. To match this increase, at the start of a pandemic recession, workers in NT occupations (who cannot telecommute) experience a one-time probability that their job switches to TC (telecommutable), where this probability is chosen to move the share of TC workers to 30 percent. After this one-time shock, the transition probabilities displayed in Table 6 apply, and the share of telecommuters remains at 30 percent throughout the pandemic.

Our model posits that after a pandemic recession, rather than returning to its previous state, the economy approaches a new normal NN due to permanent changes brought about by the recession. We allow for such permanent effects along two dimensions: work organization and social norms. In terms of work organization, we impose that the occupational transition probabilities during the pandemic recession continue to apply during the new normal. This implies that the fraction of telecommutable jobs will stay elevated, at about 30 percent. With regard to social norms, we conjecture that the share of

traditional couples will ultimately decline by half, from 30 to 15 percent. The transition probabilities that apply both during the pandemic recession P and the new normal NN were chosen such that the modern state is highly persistent (0.99 probability of staying modern), and such that the persistence of the traditional state results in the desired long-run share of traditional couples of 15 percent. In addition, new cohorts also display these new long-run shares of 85 percent modern and 15 percent traditional couples.

Clearly, the future evolution of social norms is difficult to predict. Our calibration here should be regarded less as an empirical estimate and more as an "if-then" scenario. In other words, our simulations answer the question of how the economy will evolve if the current pandemic ends up having a substantial impact on the evolution of gender norms. Below, we also provide a decomposition analysis that examines different outcomes where social norms fail to respond. Still, in the past, gender norms have often evolved rapidly in response to economic changes (e.g., Fernández 2013 and Fogli and Veldkamp 2011). In our simulation, the change in social norms is slower than that implied by the learning model of Fernández (2013) during the rise of female labor force participation in the United States from the 1960s to the 1980s. The data already plainly show that the Covid-19 recession has led to a historically unprecedented increase in men's participation in childcare. Based on past experiences, we believe that such transformations are bound to have a substantial impact on social norms. Hence, while our assumptions on shifting social norms are necessarily more speculative than other aspects of our analysis, we believe a shift towards more gender-equal norms is the most likely scenario.

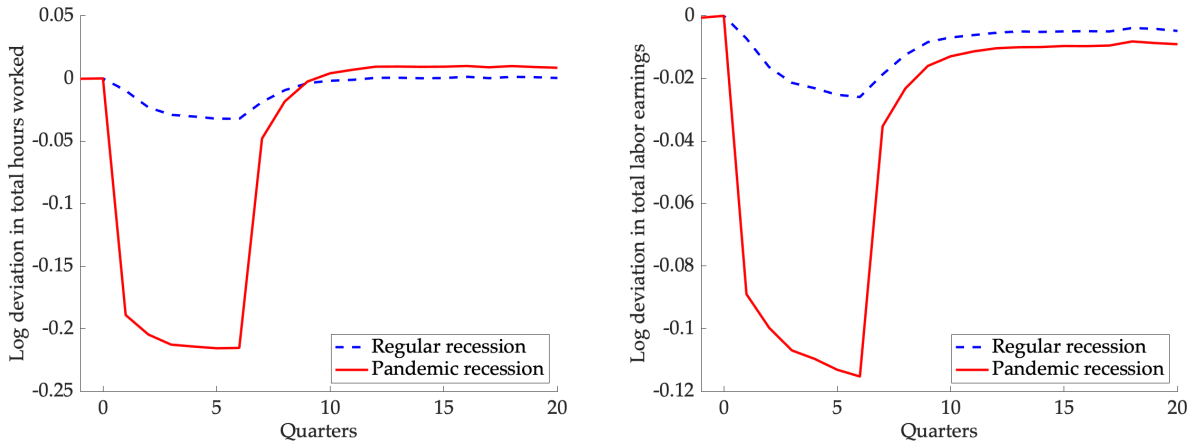
5 Macroeconomic Consequences of Regular versus Pandemic Recessions

We now use our quantitative model to compare the consequences of regular versus pandemic recessions for macroeconomic aggregates and changes in gender inequality. We display outcomes for recessions that last for six quarters (the expected duration of a recession given $\rho_R = \rho_P = \frac{5}{6}$), and then revert to the normal state N in the case of a regular recession or the new normal NN in the case of a pandemic recession.

5.1 The Anatomy of Regular and Pandemic Recessions

Figures 3a and 3b compare the impact of regular and pandemic recessions on total labor supply and on total labor earnings in the economy. Labor supply declines by more than

Figure 3: Hours Worked and Aggregate Labor Earnings, Pandemic vs. Regular Recessions



(a) Total Hours Worked

(b) Aggregate Labor Earnings

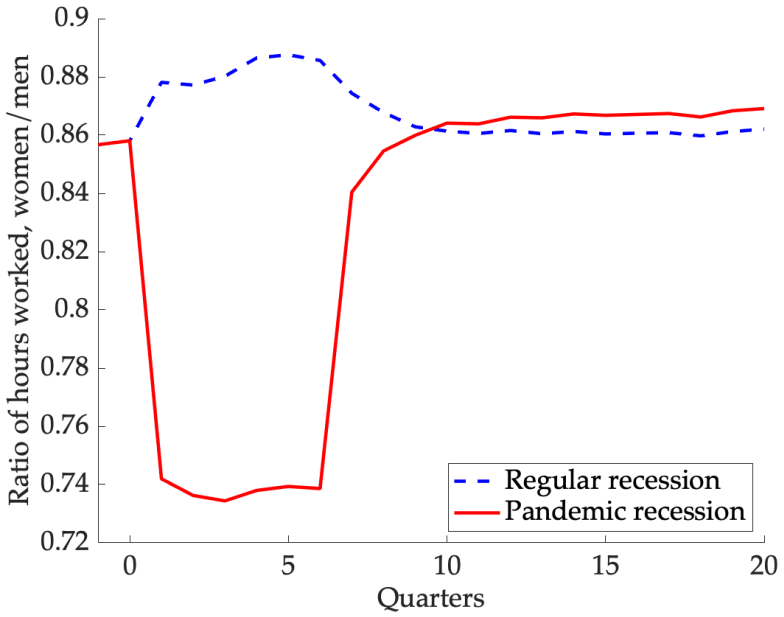
20 percent in the pandemic recession, versus less than 3.3 percent in the regular recession. At the trough of the recession, the decline in labor supply in the model roughly matches the 24 percent decline in hours reported by Bick and Blandin (2020) for the US economy from February 2020 to the May to June average.

The decline in total labor earnings (which measures the decline in labor supply in efficiency units) is only about half as large as the decline in hours in the pandemic recession. This reflects the fact that the workers who drop out of employment or reduce their hours during the recession tend to have low earnings to begin with. Given that job separation and job finding probabilities do not depend on earnings, this selection effect is entirely due to endogenous decisions on accepting or rejecting job offers. Selection on earnings is less pronounced in a regular recession.

During the recovery after the end of a recession, labor supply quickly recovers. However, total labor earnings remain lower than before the recession, particularly so after a pandemic recession. The persistent decline in total labor earnings reflects the depreciation of human capital suffered by many workers who lose employment during the recession.

When considering the different implications for women versus men, we observe (Figure 4) that in regular recessions, the ratio of women's to men's labor supply increases. This dynamic reflects the greater job losses for men and, to a lesser extent, within-family insurance, i.e., married women increasing labor supply in response to their husband's

Figure 4: Women's vs. Men's Labor Supply, Pandemic vs. Regular Recessions

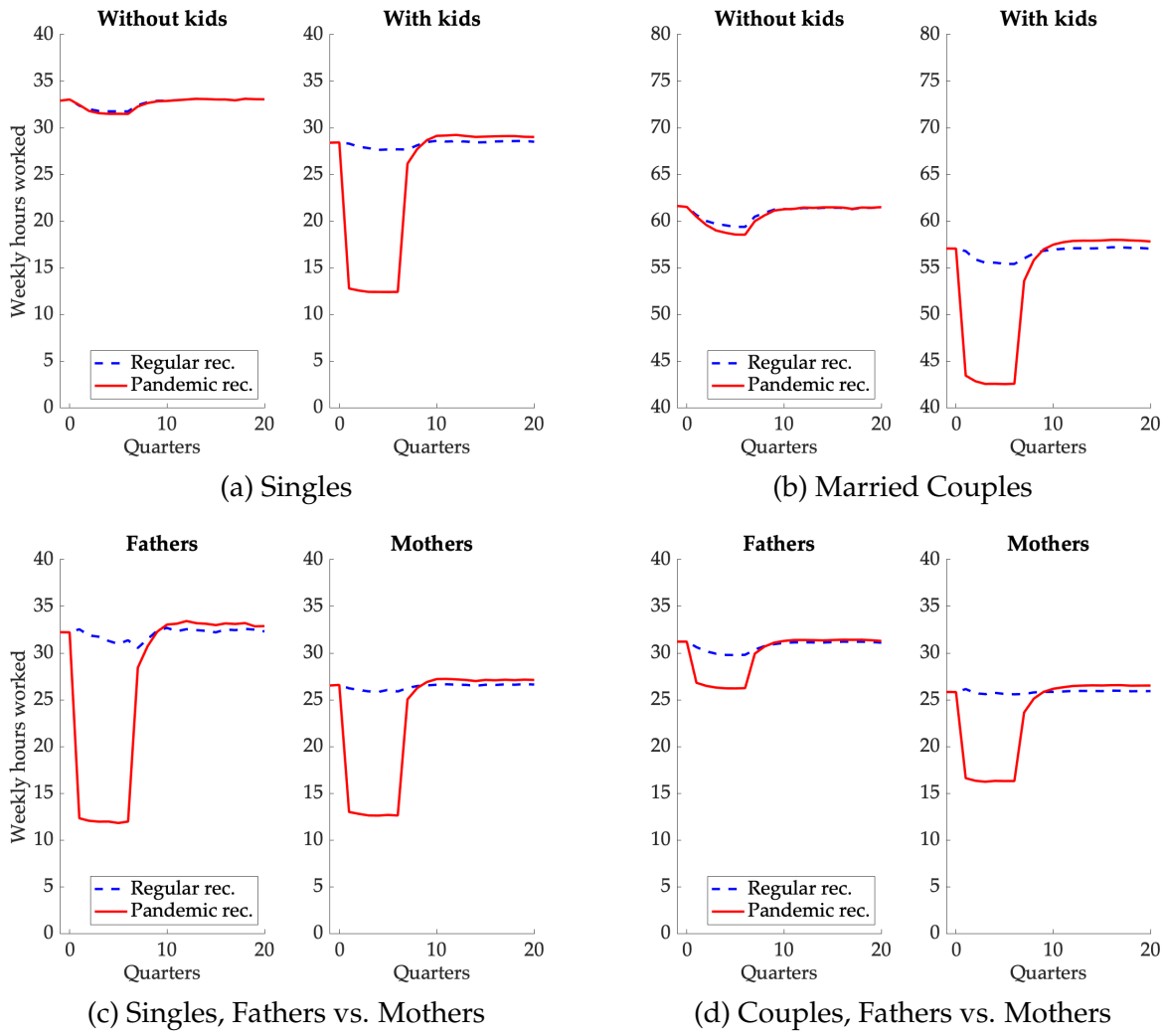


job loss. In contrast, consistent with the evidence presented in Section 2, in a pandemic recession women's labor supply declines sharply relative to men. This drop in women's relative labor supply primarily reflects the uneven burden of childcare across genders.

Figure 5 breaks down changes in employment during and after recessions by marital status, gender, and fertility. We scale these figures so that 40 hours corresponds to the full-time employment of a single worker (80 hours for a couple in which both work full time). The left panels in Figures 5a and 5b show that for both singles and couples without children, the impact of a regular versus a pandemic recession is similar, whereas if kids are present (right panels) a pandemic recession leads to a much larger reduction in labor supply. Increased childcare obligations due to school closures affects all parents' ability to work during the pandemic. The impact on single parents is particularly large, because they lack certain margins of adjustment from which couples instead may benefit (i.e., couples where both parents can telecommute or where one was not working before the pandemic).

Within couples, mothers reduce working hours considerably more than fathers (Figure 5d), which again coincides with the empirical observations discussed in Section 2. Among single parents, fathers' labor supply drops more than that of mothers. This difference is primarily due to the fact that single fathers (who make up a small share of the

Figure 5: Labor Supply by Types of Family



(a) Singles

(b) Married Couples

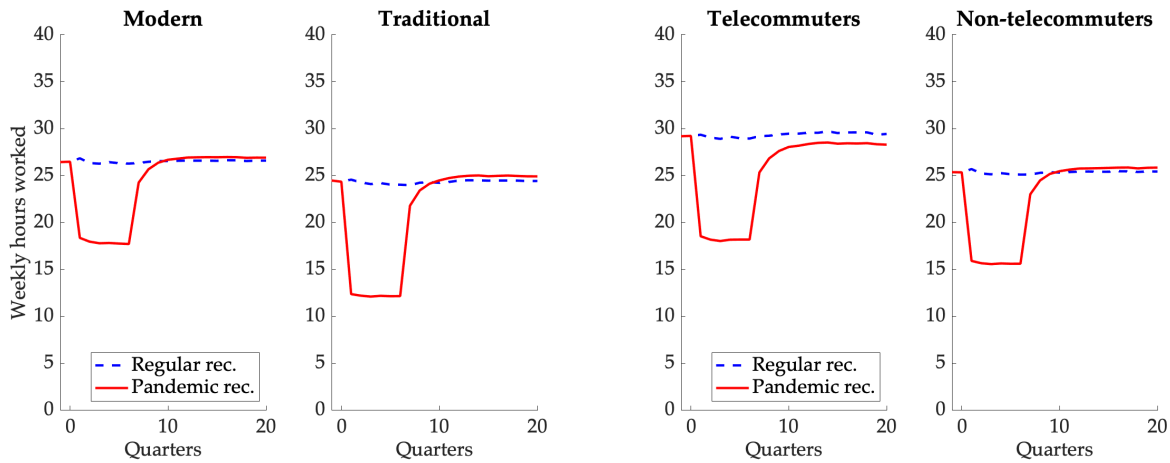
(c) Singles, Fathers vs. Mothers

(d) Couples, Fathers vs. Mothers

population) start out with a higher labor supply. For single parents of either gender with small children, working full time at a job that does not allow telecommuting is infeasible during the pandemic, necessitating a large drop in labor supply.

Figure 6a highlights the role of traditional versus modern social norms for couples' labor supply. In regular times, the labor supply of traditional mothers is only slightly lower than that of modern mothers. Indeed, with the relatively low childcare requirements in normal times, many traditional mothers are able to both work and provide the majority of childcare within the family. In a pandemic recession, in contrast, the traditional division of labor is reinforced, and traditional mothers reduce their labor supply more than modern mothers.

Figure 6: Mothers' Labor Supply by Social Norm and Occupation



(a) in Modern vs. Traditional Couples (b) By Occupation

Figure 6b shows that occupation (TC vs NT) primarily has a level effect on labor supply. Being able to telecommute leads mothers to supply more labor both in regular times and during a recession. The reduction in labor supply in a pandemic recession is similar across occupations.

Another notable finding depicted in both panels of Figure 6 is that during a normal recession, average hours worked by mothers are roughly constant. While some mothers lose their jobs, others are entering the labor force just as their husbands lose their jobs. We examine this family insurance effect in greater detail in the next section.

5.2 Family Insurance

Family members provide one another with an important insurance mechanism against shocks to earnings and employment (see Attanasio, Low, and Sánchez-Marcos 2005; Blundell, Pistaferri, and Saporta-Eksten 2016, 2018; Ellieroth 2019). If a primary earner faces wage cuts or unemployment, the family's secondary earner can either enter the labor force or increase their hours to make up for the reduction in the family's income. This insurance mechanism is particularly relevant during regular recessions, when many men (who are often primary earners) lose their jobs, while women's employment prospects are less affected. Doepke and Tertilt (2016) argue that family insurance is a primary reason behind the low cyclical volatility of married women's labor supply (as documented in Section 2), which obtains even though married women's labor supply is highly elastic at the micro level.

Figure 7: Spousal Insurance: Hours Worked for Married Women Who Worked Part-Time Before Recession while Husband Worked Full-Time

(a) All Women in this Group

(b) By Husband's Job Loss

The family insurance mechanism is quantitatively important in our model. Figure 7 shows how labor supply changes over the course of recessions for married women who worked part time just before the recession while their husbands worked full time. This group of households generally displays the highest levels of family insurance because the secondary earner is already in the labor force, and is thus able to increase hours. The left panel of the figure shows that women in this group increase their labor supply during a regular recession. In the right panel, we further decompose labor supply in this group to compare women whose husband loses his job (i.e., is not working in the current period, even though he was working full time before the recession) versus those whose husband remains employed. We observe that the increase in hours in a regular recession is indeed driven by women whose husbands lost a job, as suggested by the family insurance mechanism. The effect is quantitatively large: conditional on the husband's job loss, labor supply during the recession increases by more than 50 percent for this group of women.

Figure 7 charts these same groups during a pandemic recession. The left panel shows that the family insurance mechanism is no longer present in terms of total labor supply, which drops throughout the entire recession for this group of women. Again, the right panel decomposes the overall change in labor supply between women whose husbands lost his job and those whose husbands are still employed. Women whose husbands become unemployed still increase their labor supply in the initial period of the recession,

though only by half as much as in a regular recession. However, this insurance effect becomes smaller in subsequent periods. As the pandemic regression progresses, many of the women who initially worked part time drop out of the labor force to meet child-care needs, which makes it more difficult to find a job and expand employment later on. Family insurance continues to exist in the sense that women whose husbands are unemployed work more than others, but this takes the form of not cutting hours rather than increasing hours. Families are able to soften the blow of falling earnings, but truly compensating for income losses by working more is not feasible for most couples during a pandemic recession.

5.3 Marginal Propensities to Consume

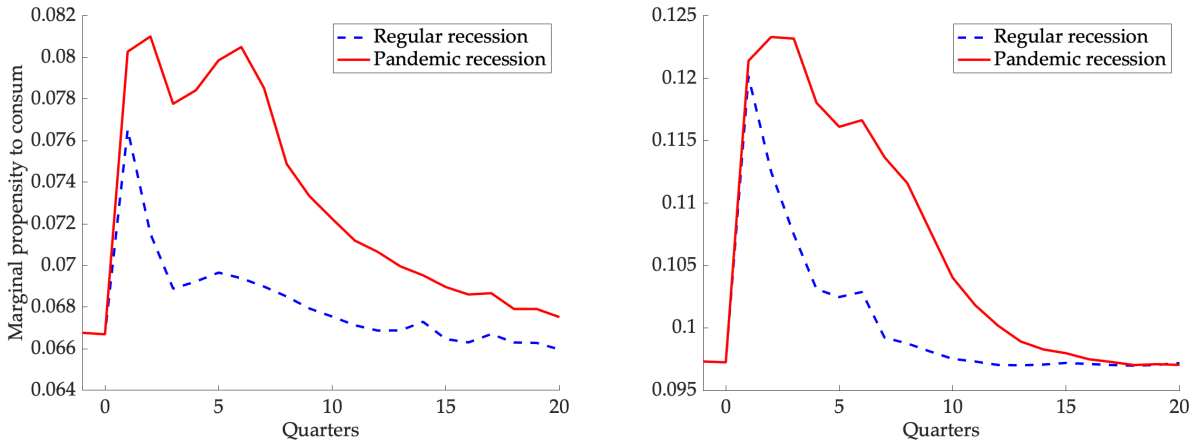
In addition to driving the labor supply response to a pandemic, family insurance plays a role in the transmission of income shocks to household spending and consumption. Households that lose access to insurance mechanisms are less able to compensate for income losses, resulting in a strong transmission from income shocks to reduced consumption. These changes are reflected in the distribution of marginal propensities to consume (MPCs) throughout the economy.

A recent body of macroeconomic work demonstrates the central role of MPC distributions for the transmission of macroeconomics shocks (e.g., Berger et al. 2017, Auclert 2019, Auclert, Bardóczy, and Rognlie 2020, Patterson 2019). If the average MPC is high, a negative shock to household income will result in a larger reduction in consumption demand. In models where demand shocks affect output (e.g., because of nominal frictions), a higher average MPC results in deeper recessions for a given initial shock.

Thus, understanding the ways in which MPCs change over time during a pandemic recession is crucial to ascertain how the shock of a pandemic recession is transmitted throughout the economy and to assess the possibility of a highly persistent downturn driven in part by demand channels. Figure 8 addresses this question by illustrating how the average MPC evolves in the economy during both types of recessions.

Two important differences between regular and pandemic recessions stand out. First, on impact the pandemic recession raises MPCs by a greater amount than a regular recession, especially for single households. This initial difference arises primarily because a pandemic recession causes a bigger drop in earnings, which pushes households closer to financial constraints. Second, the rise in MPCs is more persistent during a pandemic

Figure 8: Average Marginal Propensities to Consume



(a) Singles (b) Couples

recession than a regular recession for both single and married households. Two different mechanisms contribute to this persistence. For single households, the persistent increase in MPCs is primarily driven by single parents, a large number of whom drop out of the labor force for the entire pandemic recession. This persistent earnings loss drives assets down and leaves little room for self-insurance, even during the early years of the recovery. The same factor is at play for married households, but in addition these households also suffer from the loss of family insurance as shown above. The loss of family insurance implies that married households are less able to compensate for earnings losses; they consequently draw down their assets and ultimately end up with a high MPC.

These results show that MPCs are higher during a pandemic recession than a regular recession, and continue to be elevated during the recovery period. This implies that the aggregate transmission from income shocks to aggregate demand is high, a fact that can amplify the downturn through demand-driven channels. Conversely, high MPCs also imply that economic stimulus measures are likely to be highly effective. Overall, these results highlight the important role of the dynamics of female labor supply and family decision-making in shaping the macroeconomic properties of recessions.

6 Medium and Long Run Implications for Gender Inequality

We now move on from the macroeconomic implications to focus on the repercussions of regular and pandemic recessions for gender inequality. We have already shown that

unlike regular recessions, pandemic recessions reduce women's labor supply relative to men's, and that mothers' childcare responsibilities play an important role in this reduction. These shifts in labor supply have direct implications for gender inequality in the labor market through the accumulation of experience while working and skill loss while not employed. Regular recessions primarily lower men's employment and therefore result in a corresponding reduction in men's labor market experience that contributes to a narrowing of the gender wage gap. Conversely, a pandemic recession puts many women out of work and, at least initially, lowers women's relative wages.

We also consider the possibility that the experience of a pandemic recession can lead to changes in gender inequality that long outlast the pandemic itself. Gender inequality in the labor markets of advanced economies is linked, in large part, to childbearing and the unequal division of childcare responsibilities between women and men (Miller 2011; Adda, Dustmann, and Stevens 2017; Kleven, Landais, and Søgaard 2019; Kleven et al. 2019; Gallen 2018; Hannusch 2019; Xiao 2020). As we have documented, the current pandemic recession has led to massive changes in how families organize childcare: along with mothers, many fathers have also increased the time they spend caring for their children during the crisis, while numerous employers have reorganized work to enable their staff to continue working while caring for children at home. We argue that some of these changes are likely to persist, leading to long-term changes in gender inequality in the labor market.

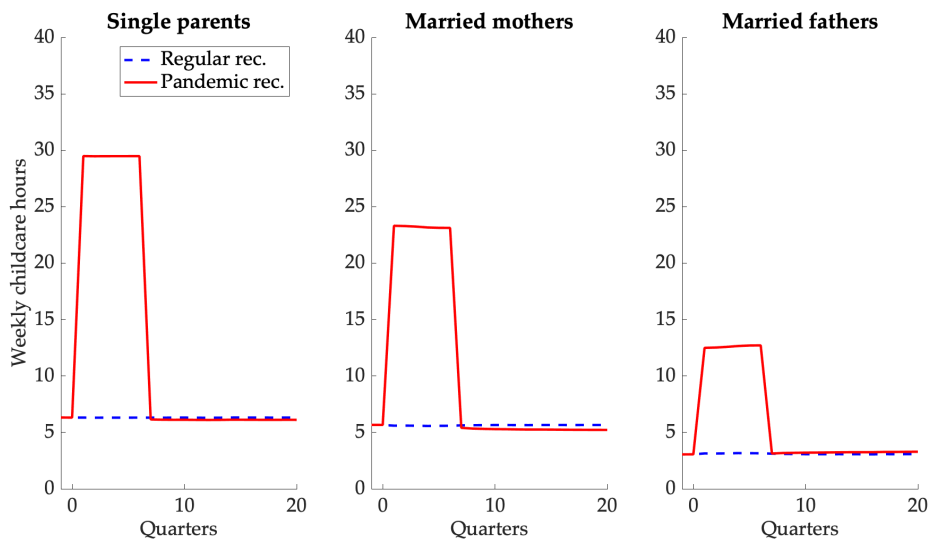
Since we interpret these long-term changes as responses to changes in the division of childcare during the pandemic, we start by taking a closer look how regular and pandemic recessions affect the division of childcare within families in our model. We then continue to our analysis of the short-, medium-, and long-run implications of recessions for gender inequality.

6.1 Division of Childcare and Leisure during the Pandemic Recession

Our labor supply results suggest that women are more affected than men by the large increase in childcare needs during a pandemic recession. This is confirmed by Figure 9, which compares the increase in childcare time during the pandemic for mothers and fathers. Naturally, the increase in childcare is largest for single parents, whose weekly time spent on childcare increases by about 23 hours. Single mothers and fathers react in a similar way. Among married couples, the increase in childcare hours is much larger for women than for men. These model implications align well with empirical findings that

both women and men are spending more time on childcare during the crisis, but that this increase is much larger for women (see, e.g., Adams-Prassl et al. 2020b for evidence on the US, UK, and Germany).[15]

Figure 9: Childcare Provided by Single and Married Parents



Notes: For telecommuters, childcare time in the model is computed as $t^g + 0.5\phi(k)\, n^g$, that is, time that is spend on childcare and work simultaneously is counted as 50 percent childcare. Counting all of the combined time as childcare leads to similar results.

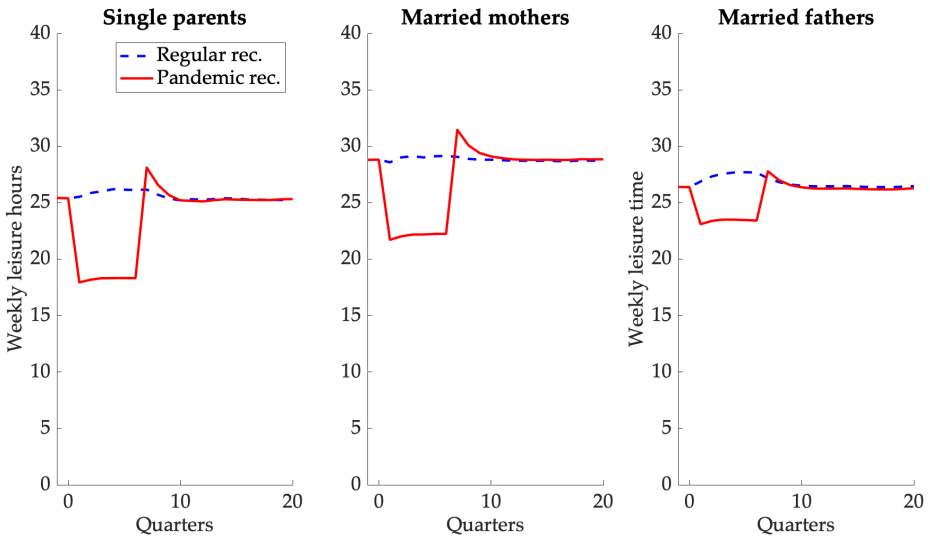
The increase in childcare comes partly at the expense of parents' labor supply: many women switch from full-time to part-time work or drop out of the labor force entirely to meet the extra childcare needs. Parents provide for another sizeable fraction of the extra childcare needs by reducing leisure. Among married couples, the reduction in leisure is larger for women than for men (see Figure 10). On average, married women had more leisure than married men before the pandemic, but married women's leisure drops below that of men during the pandemic. The leisure of single parents (most of whom are women) is even lower than that of married mothers. The reduction in leisure implies that women experience a larger welfare loss during the pandemic than men do (see Figure 17 in Appendix A.6). This finding may help explain the observed increase in the gender gap in mental health during the pandemic.[16] These findings are consistent

[15]Researchers have documented that women are taking over the majority of increased childcare needs in a wide range of countries; see, e.g., Costoya et al. (2020) for evidence on Argentina.

[16]See Adams-Prassl et al. (2020a) for the United States and Oreffice and Quintana-Domeque (2020) for the UK. In addition, Biroli et al. (2020) document an increase in reported tensions in families in Italy, the UK, and the US.

with empirical evidence from Wozniak (2020), who reports that households with school-age children indicated a greater decline in well-being during the shutdown than other households.

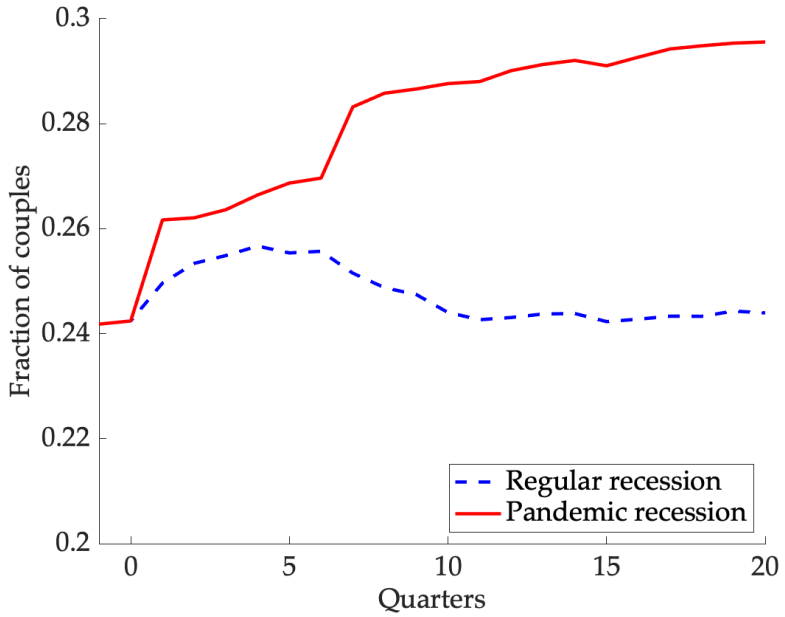
Figure 10: Leisure for Single and Married Parents



In our view, the evidence supports the expectation that increased childcare needs during the pandemic will ultimately lead to more gender-equal norms in terms of the division of childcare, even in spite of the gender gap we observe. There are two observations that support this claim. First, while women remain responsible for the majority of childcare during the crisis, the increase in childcare is slightly larger in relative terms for married fathers than for married mothers. Arguably, having to do a lot of childcare is a bigger shock for most men than for most women. Many men learn for the first time how much work childcare entails and the full range of tasks that it involves. Men's increased awareness of the challenges of combining childcare and work may erode gender norms that work against men contributing equally to childcare.

To be sure, this may not apply to every individual case. Indeed, some men may be even more hesitant to provide childcare after their pandemic experience. However, existing evidence from policy-induced increases in father's contributions to childcare (e.g., through paternity leave) does suggest that the rise in men's engagement during the crisis will result in a higher involvement of fathers in childcare in the future, and a corresponding greater ability of mothers to pursue their careers (see., e.g., Farré and González 2019 for evidence from Spain and Tamm 2019 for evidence from Germany).

Figure 11: Fraction of Married Couples with Children in which the Father is the Main Childcare Provider



Notes: For telecommuters, childcare time in the model is computed as $t^g + 0.5\phi(k)\, n^g$, that is, time that is spent on childcare and work simultaneously is counted as 50 percent childcare. Counting all of the combined time as childcare leads to similar results.

A second, arguably even more important, factor is that a pandemic recession actually increases the share of couples in which the husband is the main provider of childcare. In normal times, specialization in the household is primarily driven by the within-couple gender wage gap and, for traditional couples, by gender-unequal social norms. Both factors push toward a division of labor that makes mothers the main provider of childcare. Although these factors remain present during a pandemic recession, the parents' occupations begin to play a major role—specifically, whether or not they can be carried out remotely. When a husband can telecommute while his wife cannot, the husband often becomes the primary childcare provider, since he can more easily combine childcare with work. One example of such a couple would be a wife who is a doctor or nurse working in a hospital married to an office worker who can work from home during the crisis. Alon et al. (2020a) document that there are millions of such couples in the United States (about 12 percent of married couples with children).

Because the fraction of telecommutable jobs increases during the pandemic recession and remains high in the new normal, the result is a sustained rise in the fraction of

men who are main childcare providers. Figure 11 shows that the fraction of men who are primary childcare providers in the model jumps immediately at the beginning of a pandemic recession and continues to rise throughout the pandemic and the subsequent recovery. The initial jump is primarily due to telecommuting fathers. Later on, the gradual increase in the share of modern couples (i.e., a change social norms) also plays a role. Couples are also more likely to share childcare during the pandemic. The fraction of couples where both parents do at least ten percent of childcare increases from 31 percent in normal times to 43 percent in the first period of the pandemic. Similarly, the fraction of fathers who do any childcare at all rises from 53 percent to 76 percent.

In a regular recession, there is also a rise in the number of men who are the main childcare providers as more men lose their jobs and take on childcare responsibilities, but this increase is smaller and disappears in the recovery.

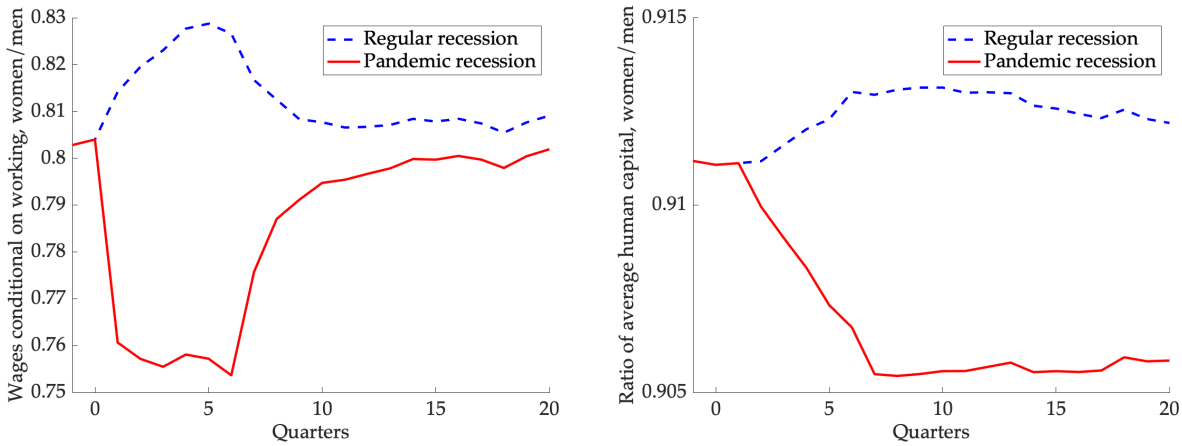
The model prediction of a rise in men who are primary childcare providers and a rise in shared childcare is consistent with the evidence. Carlson, Petts, and Pepin (2020) find that in the United States 28 percent of women reported sharing childcare equally prior to the pandemic, which increased to 34 percent during the pandemic. This increase was even larger for families with older children: from 29 to 42 percent. Similar observations have been made in other countries: see von Gaudecker et al. (2020) for the Netherlands, Möhring et al. (2020) for Germany, and Del Boca et al. (2020) for Italy. In addition, Biroli et al. (2020) find that the proportion of families that divide childcare responsibilities equally increased by 8 percentage points in the UK and 17 percentage points in Italy. The central role of telecommuting in driving these changes is supported by the findings of Adams-Prassl et al. (2020b), who observe that fathers working from home in the United States in April 2020 spent 4.8 hours per day on childcare and homeschooling, while fathers who could not work from home but still had a job spent less than half as much time (2.3 hours).

Fathers who are the main providers of childcare can be role models whose example repudiates existing gender-unequal norms for the division of childcare. We explore the implications of such potential shifts in social norms below.

6.2 The Evolution of the Gender Wage Gap During the Recovery

The link between job losses and persistent losses in earnings is well-documented in the literature (e.g., Stevens 1997), as is the fact that such losses are especially severe for layoffs that occur in recessions (Davis and von Wachter 2011). Laid-off workers forgo

Figure 12: Gender Inequality in the Labor Market during Recessions



(a) Relative Wages (b) Relative Skills

returns to experience, may face difficulty finding a new job in the same occupation or with the same level of responsibility, and are less likely to have secure employment in the future (Jarosch 2015). These consequences are not limited to workers who lose their jobs, but also affect those about to enter the labor market for the first time.[17]

We have documented that both in the data and in our model recessions affect women's and men's employment in different ways. These differences have consequences for the evolution of gender inequality in the labor market during and after recessions. Figure 12a shows that gender inequality shrinks during a regular recession, with women's wages increasing by close to two percent relative to those of men. This matches empirical evidence that gender wage gaps usually narrow during recessions (Solon, Barsky, and Parker 1994), an effect that was particularly pronounced in the Great Recession of 2007–2009 (Marchand and Olfert 2013; Chen and Kelly 2019). In contrast, we find that a pandemic recession leads to a widening of the gender gap by five percentage points, as it hits women's employment harder than men's.[18] Changes in relative wages during recessions do revert to some extent during the recovery, but the gap is persistent: even five years after a recession, the gender wage gap is smaller after a regular recession compared to a pandemic recession.

[17]See, for example, Altonji, Kahn, and Speer (2016), Oreopoulos, von Wachter, and Heisz (2012), and Schwandt and von Wachter (2019).

[18]We abstract from general equilibrium effects that could arise from limited substitutability between women's and men's labor. Such general equilibrium effects would dampen the increase in the gender wage gap during the pandemic but not after, because women's relative labor supply actually increases in the recovery from the pandemic.

The changes in the observed gender wage gap are due both to skill accumulation and loss, and to selection effects. Figure 12b isolates the contribution of relative skill levels by displaying how the ratio of human capital (i.e., efficiency units of labor) between women and men changes during a recession. As expected, in regular recessions (when men face high unemployment) women's skills increase relative to men's, whereas in a pandemic recession (when many women stop working) women's relative skills drop sharply. Changes in skills are more persistent than changes in the wage gap, reflecting how some workers who face skill loss stop working permanently, and therefore no longer affect the measured gender gap among those in the labor force.[19] Figures 12a and 12b show that the initial changes in the gender wage gap during a recession are primarily due to selection, but the importance of skill accumulation increases over time.

6.3 The Long-Run Impact on the Gender Gap: Work Organization and Social Norms

The coronavirus pandemic has resulted in a historically unprecedented increase in the provision of childcare by working mothers and fathers, with many fathers becoming primary providers of childcare for the first time. The pandemic has also led to an equally unprecedented reorganization of the workplace, with a large fraction of the labor force working from home during the crisis and employers quickly adjusting to this new reality of pervasive remote work.

Experience shows that such a temporary but profound shift in the division of labor between genders and the reorganization of the workplace can lead to permanent shifts in gender norms and economic outcomes. The closest historical analog is arguably the entry of millions of married women into the US labor force during World War II. Before the war, most women would stop working once they got married, a convention that was supported by social norms that favored the single-earner model and formal restrictions such as bans on the participation of married women in many occupations. The unparalleled rise in women's wartime labor force participation had a large and persistent effect on female employment.[20]

The long-term impact of World War II on women's labor market participation was not attributable solely to its direct effect on the wartime generation of working women (many

[19] These effects on the relative skills of women and men are similar to the finding by Heathcote, Perri, and Violante (2020) that if less-skilled workers lose their jobs in a recession, their attachment to the labor force tends to decrease.

[20] See, for example, Acemoglu, Autor, and Lyle (2004) and Goldin and Olivetti (2013). Doepke, Hazan, and Maoz (2015) argue that the persistent impact of World War II on the female labor market was also one of the root causes of the post-war baby boom.

of whom dropped out of the labor force, at least temporarily, at the end of the war), but also to shifting social norms. For example, Fernández, Fogli, and Olivetti (2004) show that boys who grow up with a working mother are more likely to marry women who likewise continue to work when married.[21] The example provided by their own parents arguably created a preference among these boys for a more equal division of labor in the family that was then reflected in their own choices as husbands and fathers.[22] Going beyond World War II, Fernández (2013) and Fogli and Veldkamp (2011) argue that observing working women in their families and neighborhoods created an awareness of the costs and benefits of employment and was a major engine behind the secular rise in married women's labor force participation from the 1950s to the 1990s.[23] This implies that temporary shocks can accelerate social change, in this case by providing additional learning opportunities.

Our model of a pandemic recession and the subsequent new normal incorporates the expectation that, like World War II, the substantial changes in childcare responsibilities and work organization during the crisis will have long-term effects. In particular, the pandemic recession has been marked from the outset by more couples switching from traditional to modern family roles, with modern couples especially prevalent among younger cohorts. While we do not model the exact nature of the adjustment process, we view this transformation as being driven by "learning by doing" as many fathers experience a major increase in childcare responsibilities, and by the role model effect produced by the increasing share of fathers who are the primary providers of childcare during the crisis.

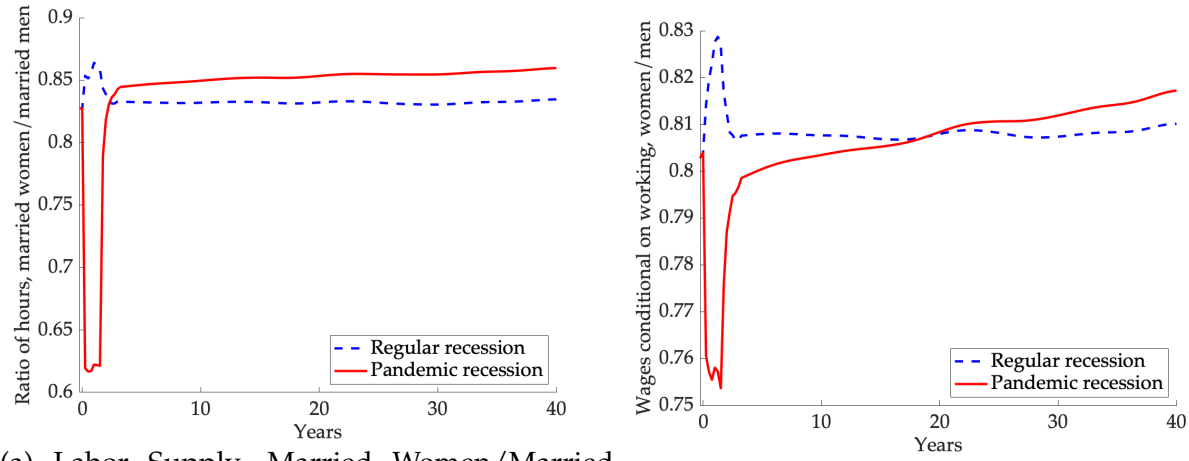
We also expect that the increased work flexibility that arises at the beginning of the pandemic, with a larger fraction of jobs done by telecommuting, will persist in the new normal. This change can once again be justified with learning by doing, in this case by both employers and employees. Furthermore, it is consistent with numerous news reports of employers planning to keep work-from-home arrangements in place after the pandemic. More flexible work arrangement can benefit women by lowering the overall burden of childcare and by increasing the childcare responsibilities of men who find telecommutable jobs. The notion that low workplace flexibility is a barrier for women's

[21] Fernández, Fogli, and Olivetti (2004) use the World War II shock to generate exogenous variation that can establish a causal effect.

[22] See Grosjean and Khattar (2018) for evidence on the persistence of gender norms over even longer periods.

[23] Along similar lines, Olivetti, Patacchini, and Zenou (2020), show that girls who are exposed to their peers' working mothers during their teenage years are more likely to end up working themselves.

Figure 13: Gender Inequality in the Long Run



(a) Labor Supply, Married Women/Married Men

(b) Gender Wage Gap

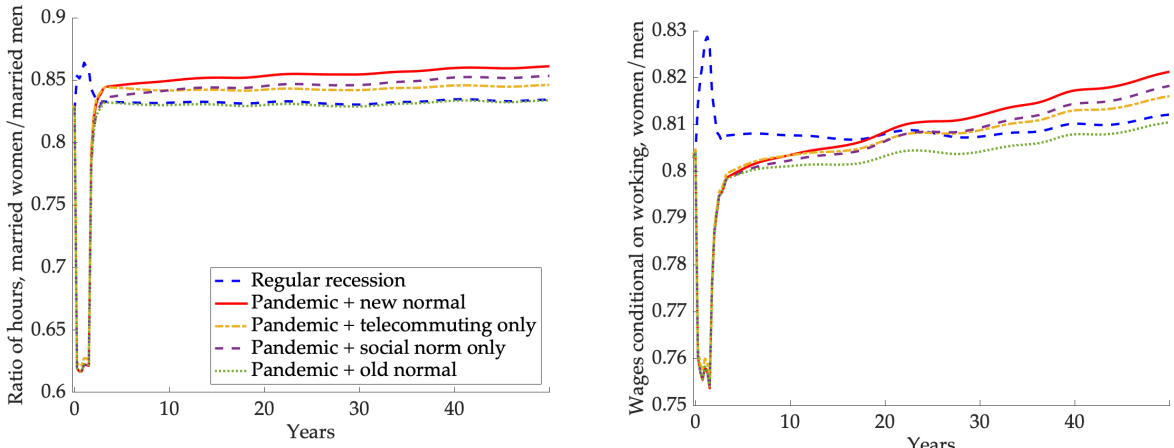
careers has been advanced by Goldin and Katz (2011) and Erosa et al. (2017), among others.[24]

Given these driving forces of long-run changes, Figure 13a shows how women's relative labor supply changes over the long term (40 years) in pandemic versus regular recessions. Despite the losses in employment and job skills that women face during a pandemic recession (see Figure 12b), female labor supply rises above its original level right at the start of the recovery; indeed, labor supply increases faster than following a regular recession. Figure 14a provides a decomposition that shows how the two long-run forces (changes in social norms and increase in TC jobs) contribute to this outcome. We observe that if, counterfactually, both social norms and the share of telecommutable jobs reverted to the pre-pandemic levels at the beginning of the recovery, women's labor supply would continue to be depressed and remain slightly below the level observed in the aftermath of a regular recession over the long term. Thus, both long-run forces are crucial for raising women's labor supply and the contribution of each is similar in magnitude.

Figure 13b shows the impact of this change in women's labor supply on the gender wage gap. As shown in Figure 12a, a pandemic recession increases the gender wage gap in the medium term through the depreciation of women's skills during the pandemic. However, the subsequent rise in female labor supply accelerates the accumulation of

[24]See also Cubas, Juhn, and Silos (2019) and Iacopo and Moser (2020).

Figure 14: Gender Inequality in the Long Run: Decomposition of Channels



(a) Labor Supply, Married Women/Married Men

(b) Gender Wage Gap

skills and gradually raises women's relative wages. After about 20 years, the gender wage gap returns to its original level, and continues to close in response to women's higher labor supply. The decomposition in Figure 14b shows that both the change in social norms and the increase in job flexibility play a quantitatively important role in narrowing the gender gap.

Two decades is a long time, and our long-run results do not contradict our basic finding that a pandemic recession is a setback for women's equality in the workplace. Nevertheless, the long-run results do provide a silver lining. A pandemic recession has the potential to be a watershed moment in terms of the division of labor in the family and in terms of a family-friendly organization of the workplace. Through these channels, the pandemic can contribute to reducing gender inequality over the long run.

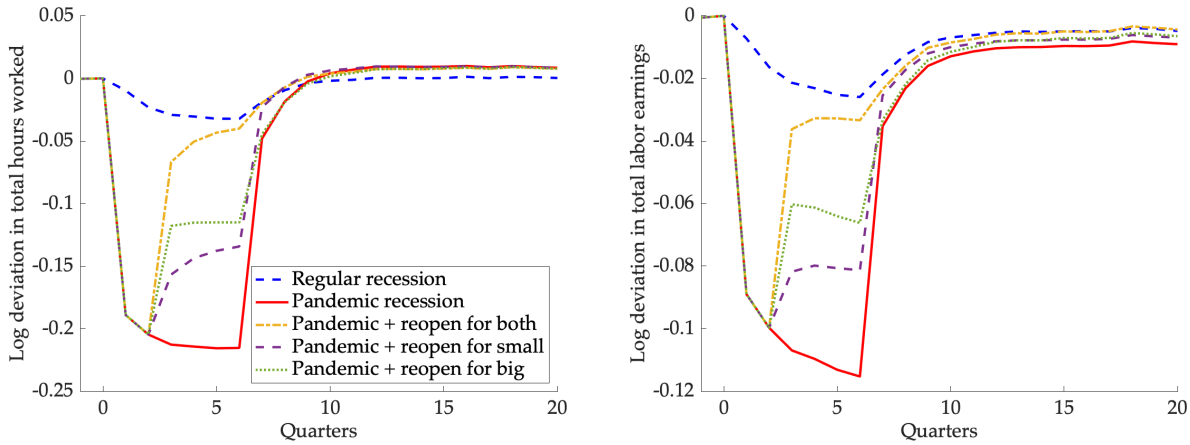
6.4 The Impact of School Closures on Gender Inequality

The severe impact of the current downturn on employment, earnings, and, ultimately, welfare raises the question of what public policy can do to offset some of the economic consequences of the pandemic. Our economic model can help inform this debate. For example, our findings on family insurance and MPCs suggest that fiscal policy, such as extended unemployment insurance and transfer payments to affected families, can be disproportionately effective during a pandemic recession in terms of stimulating aggregate demand.

The policy issue most directly linked to our analysis is the role that school openings can play in accelerating the recovery from the crisis. A full analysis of this question would require an assessment of the health consequences of opening schools and daycare centers while the pandemic is still ongoing, an issue that we abstract from here.[25] Our analysis can, however, shed light on the repercussions of school openings for the labor market and the evolution of gender inequality during the recession and recovery.

In our setting, the primary effect of opening schools and daycare centers is to free up the labor supply of women and men who are currently not working because they need to look after and homeschool their children. Empirical estimates show that this effect may be especially important. Dingel, Patterson, and Vavra (2020) show that 32 percent of the US workforce has a child under the age of 14 in their household. Fuchs-Schündeln, Kuhn, and Tertilt (2020) report that the same is true for 26 percent of the workforce in low-fertility Germany, while this share is as high as 41 percent in other European countries.

Figure 15: Hours Worked and Aggregate Labor Earnings under School Reopenings



(a) Total Hours Worked

(b) Aggregate Labor Earnings

Figure 15 shows how aggregate hours worked would change over time in a pandemic recession if schools were to reopen two quarters into the recession, rather than stay-

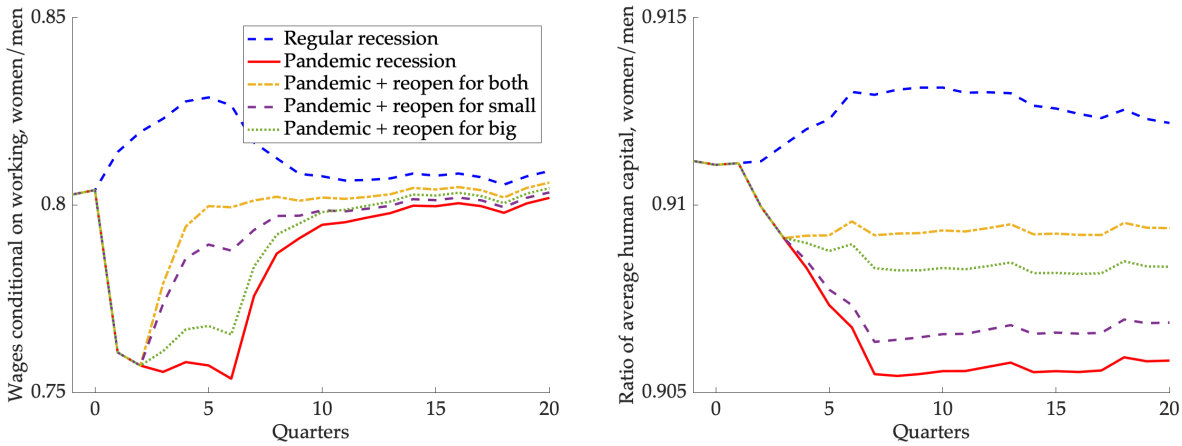
[25] A cautionary note is provided by Alon et al. (2020b), who argue that schools can be a major vector of disease transmission, particularly in developing countries due the high prevalence of multi-generation households, a feature that Bayer and Kuhn (2020) argue can contribute to high case-fatility rates. Baqaee et al. (2011) emphasize that measures such as reintroducing restrictions on social gatherings, wearing masks, and increasing testing and quarantine are necessary before wider re-openings are feasible. The effect of school closures on the US healthcare workforce specifically is analyzed in Bayham and Fenichel (2020).

ing shut for the entire pandemic. Formally, opening schools would mean that childcare requirements return to the pre-recession level after two quarters, while job separation probabilities would continue to be elevated and the other aspects of the pandemic recession would remain in place. The figure also illustrates the results of returning only young children to school (i.e., by opening daycare centers and preschools) or only older children (opening K-12 schools). We observe that opening schools would immediately mitigate the economic impact of the pandemic by reversing more than half of the decline in labor supply brought about by the recession. The impact on labor earnings is even larger: losses in labor earnings are reduced by about two-thirds. This large economic impact underscores the key role of increased childcare requirements for the drop in economic activity during the pandemic, and shows that reopening schools is much more effective, in economic terms, than reopening specific sectors with small shares of aggregate employment shares (such as gyms, bars, and restaurants).

Figure 16 shows how opening schools early affects gender inequality in the labor market in terms of women's relative wages and relative skills. Since women bear the largest part of the extra childcare burden during the pandemic, relieving this burden will disproportionately benefit women. The gender wage gap is immediately reduced, and opening schools early avoids about half of the recession-induced relative skill losses that women experience. Sending younger kids back to school does the most to reduce the gender wage gap. This result is primarily driven by a composition effect, with high-skill women more likely to return to work when childcare becomes available. As Panel (b) in Figure 16 shows, opening schools for older kids early reduces the widening skill gap by more than opening daycare centers for younger kids. In part, this is because there are more families with older than with younger kids, so more households are affected by opening schools. In addition, many women with young kids work part-time or not at all even in normal times, leaving a bit more room for dealing with extra childcare needs during the pandemic. Women also benefit disproportionately from school openings in terms of welfare (see Figure 17 in Appendix A.6).

These results suggest that prioritizing school openings (relative to, say, opening bars and restaurants) can be an effective strategy for mitigating the economic impact of a pandemic recession. Of course, this policy implication comes with the caveat that the health consequences of opening schools must also be taken into account. Such a policy is a realistic option only if the pandemic is sufficiently controlled such that opening schools will not reignite or amplify the pandemic itself.

Figure 16: The Impact of School Reopenings on Gender Inequality



(a) Relative Wages (b) Relative Skills

7 Conclusions

As a result of the Covid-19 pandemic, countries around the world, including the United States, have entered the sharpest economic downturn since the Great Depression. In this paper, we argue that the central economic distinction between this downturn and other recent recessions, aside from its severity, lies in its impact on women's employment.

The lockdown measures implemented in a pandemic recession have a large effect on high-contact sectors such as hotels and restaurants, which have large shares of female employment. Thus, unlike in a regular recession, more women than men are directly affected by layoffs. In addition, daycare and school closures during the pandemic result in considerably higher childcare obligations. Women shoulder the majority of this additional responsibility, further decreasing their ability to work.

We develop a macroeconomic model that can account for the distinct features of regular and pandemic recessions. We use the model to examine the wider economic repercussions of the disproportionate impact of a pandemic recession on working women. In terms of macroeconomic implications, we find that the outsized impact of a pandemic recession on women's employment reduces the role of families as a shock absorber. Very few married workers are able to increase employment to make up for their spouse's lost earnings. As a result of this loss of insurance, earnings losses are strongly translated to lower consumption demand, and marginal propensities to consume increase by a greater amount than in regular recessions.

We also find that a pandemic recession has sizeable repercussions for gender inequality. In the short and medium term, a pandemic recession erodes women's position in the labor market, first through direct employment losses, and later through the loss in labor market experience brought about by low employment during the recession. These forces lead to a widening of the gender wage gap during a pandemic recession and in its immediate aftermath.

Nevertheless, we also argue that a pandemic recession can trigger changes that ultimately reduce gender inequality over the longer term. Specifically, the rise in work flexibility during a pandemic recession is likely to be persistent, and disproportionately benefits women who have major childcare responsibilities. We also note the possibility of shifting social norms towards a more equal sharing of childcare obligations between mothers and fathers, triggered by an increase in men's childcare provision and a rising fraction of men who are the main provider of childcare in their family. In our quantitative analysis, these changes imply that a pandemic recession ultimately reduces the gender wage gap, although it takes many years to fully make up for women's initial skill losses.

A more general lesson from our analysis is that accounting for family behavior and gender differences should be a central element of research on economic fluctuations. Authors such as Albanesi (2020), Doepke and Tertilt (2016), and Fukui, Nakamura, and Steinsson (2019) have already shown that the secular rise in female labor force participation in the twentieth century has changed the nature of aggregate labor supply and is the underlying cause behind recent changes in the nature of economic fluctuations. Our study adds to these arguments by accounting for the macroeconomic consequences of childcare responsibilities, skill accumulation, and work organization, factors that all play a central role in the current pandemic recession. A traditional, single-gender macroeconomic model would be unable to capture some of the most distinct characteristics of the economic environment brought about by the coronavirus pandemic.

Our work could be extended to consider the impact of the Covid-19 crisis on additional dimensions of gender equality, such as the rise in domestic violence that appears to have occurred during the crisis (see Leslie and Wilson 2020, Bullinger, Carr, and Packham 2020, and Rivera et al. 2020). Moreover, our analysis has focused on advanced economies that are characterized by high income levels and high participation of women, including many mothers, in the formal labor market. As we have documented, the current pandemic recession has similar features in terms of the relative economic impact on women

and men across countries in this group. An urgent challenge for future research is to assess the impact of pandemic recessions in middle-income and developing countries. The existing work on this issue (e.g., Alon et al. 2020b) has generally focused on issues other than gender or women's labor force participation. Yet, the pandemic is a global phenomenon, and policy measures such as school closings are being implemented around the world. At the same time, different economic conditions in terms of income levels, women's labor force participation, and the ability to work remotely suggest that the impacts of the pandemic recession and the resulting policy tradeoffs may be substantially different in developing economies. Given the severity of the ongoing health and economic crisis, research on the impact of the coronavirus epidemic on women's work and gender inequality in a wider range of countries is urgently needed.

References

Acemoglu, Daron, David H. Autor, and David Lyle. 2004. "Women, War, and Wages: The Effect of Female Labor Supply on the Wage Structure at Midcentury." *Journal of Political Economy* 112 (3): 497–551.

Adams-Prassl, Abi, Teodora Boneva, Marta Golin, and Christopher Rauh. 2020a. "The Impact of the Coronavirus Lockdown on Mental Health: Evidence from the US." Unpublished Manuscript, University of Zurich.

———. 2020b. "Inequality in the Impact of the Coronavirus Shock: Evidence from Real Time Surveys." CEPR Discussion Paper 14665.

Adda, Jérôme, Christian Dustmann, and Katrien Stevens. 2017. "The Career Costs of Children." *Journal of Political Economy* 125 (2): 293–337.

Albanesi, Stefania. 2020. "Changing Business Cycles: The Role of Women's Employment." NBER Working Paper 25655.

Albanesi, Stefania, and Ayşegül Şahin. 2018. "The Gender Unemployment Gap." *Journal of Political Economy* 30:47–67.

Albanesi, Stefania, Rania Gihleb, Jialin Huo, and Jiyeon Kim. 2020. "Household Insurance and The Macroeconomic Impact of the Novel Coronavirus." Unpublished Manuscript, University of Pittsburgh.

Alon, Titan, Sena Coskun, and Matthias Doepke. 2020. "Trends in Work and Leisure: It's a Family Affair." Unpublished Manuscript, Northwestern University.

Alon, Titan, Matthias Doepke, Jane Olmstead-Rumsey, and Michèle Tertilt. 2020a. "The Impact of COVID-19 on Gender Equality." *Covid Economics: Vetted and Real-Time Papers* Issue 4:62–85.

Alon, Titan M., Minki Kim, David Lagakos, and Mitchell VanVuren. 2020b. "How Should Policy Responses to the COVID-19 Pandemic Differ in the Developing World?" NBER Working Paper 27273.

Altonji, Joseph G., Lisa B. Kahn, and Jamin D. Speer. 2016. "Cashier or Consultant? Entry Labor Market Conditions, Field of Study, and Career Success." *Journal of Labor Economics* 34 (S1): S361–S401.

Attanasio, Orazio, Hamish Low, and Virginia Sánchez-Marcos. 2005. "Female Labor Supply as Insurance Against Idiosyncratic Risk." *Journal of the European Economic Association* 3 (2/3): 755–64.

Auclert, Adrien. 2019. "Monetary Policy and the Redistribution Channel." *American Economic Review* 109 (6): 2333–67 (June).

Auclert, Adrien, Bence Bardóczy, and Matthew Rognlie. 2020. "MPCs, MPEs and Multipliers: A Trilemma for New Keynesian Models." Unpublished Manuscript, University of Arizona.

Baqaee, David, Emmanuel Farhi, Michael Mina, and James H. Stock. 2011. "Policies for a Second Wave." Forthcoming, Brookings Papers on Economic Activity.

Bardóczy, Bence. 2020. "Spousal Insurance and the Amplification of Business Cycles." Unpublished Manuscript, Northwestern University.

Bayer, Christian, and Moritz Kuhn. 2020. "Intergenerational Ties and Case Fatality Rates: A Cross-Country Analysis." IZA Discussion Paper 13114.

Bayham, Jude, and Eli P Fenichel. 2020. "Impact of School Closures for COVID-19 on the US Health-Care Workforce and Net Mortality: A Modelling Study." *The Lancet: Public Health* 5 (5): e271–e278.

Berger, David, Veronica Guerrieri, Guido Lorenzoni, and Joseph Vavra. 2017. "House Prices and Consumer Spending." *The Review of Economic Studies* 85 (3): 1502–1542.

Berger, David, Kyle Herkenhoff, and Simon Mongey. 2020. "An SEIR Infectious Disease Model with Testing and Conditional Quarantine." NBER Working Paper 26901.

Bick, Alexander. 2016. "The Quantitative Role of Child Care for Female Labor Force Participation and Fertility." *Journal of the European Economic Association* 14 (3): 639–668.

Bick, Alexander, and Adam Blandin. 2020. "Real-Time Labor Market Estimates During the 2020 Coronavirus Outbreak." Unpublished Manuscript, University of Arizona.

Bick, Alexander, Adam Blandin, and Karel Mertens. 2020. "Work from Home After the COVID-19 Outbreak." Unpublished Manuscript, University of Arizona.

Birinci, Serdar. 2019. "Spousal Labor Supply Response to Job Displacement and Implications for Optimal Transfers." Federal Reserve Bank of St. Louis Working Paper 2019-020B.

Biroli, Pietro, Steven Bosworth, Marina Della Giusta, Amalia Di Girolamo, Sylvia Jaworska, and Jeremy Vollen. 2020. "Family Life in Lockdown." IZA Discussion Paper 13398.

Blundell, Richard, Luigi Pistaferri, and Itay Saporta-Eksten. 2016. "Consumption Inequality and Family Labor Supply." *American Economic Review* 106 (2): 387–435.

———. 2018. "Children, Time Allocation, and Consumption Insurance." *Journal of Political Economy* 126 (S1): S73–S115.

Borella, Margherita, Mariacristina De Nardi, and Fang Yang. 2018. "The Aggregate Implications of Gender and Marriage." *Journal of the Economics of Ageing* 11:6–26.

Brotherhood, Luiz, Philipp Kircher, Cezar Santos, and Michèle Tertilt. 2020. "An Economic Model of the COVID-19 Epidemic: The Importance of Testing and Age-Specific Policies." CEPR Discussion Paper 14695.

Bullinger, Lindsey Rose, Jilian B. Carr, and Analisa Packham. 2020. "COVID-19 and Crime: Effects of Stay-at-Home Orders on Domestic Violence." Unpublished Manuscript, Vanderbilt University.

Bundesagentur für Arbeit. 2020. "Monatsbericht zum Arbeits- und Ausbildungsmarkt, Mai." Statistik der Bundesagentur für Arbeit Berichte: Blickpunkt Arbeitsmarkt.

Cajner, Tomaz, Ryan A. Crane, Leland D.and Decker, John Grigsby, Adrian Hamins-Puertolas, Erik Hurst, Christopher Kurz, and Ahu Yildirmaz. 2020. "The U.S. Labor Market during the Beginning of the Pandemic Recession." Unpublished Manuscript, University of Chicago.

Carlson, Daniel L., Richard J. Petts, and Joanna Pepin. 2020. "Men and Women Agree: During the COVID-19 Pandemic Men Are Doing More at Home." Council on Contemporary Families, Brief Reports, May 20.

Chen, Yanan, and Kyle A. Kelly. 2019. "The Gender Difference in Wages and the Returns to Schooling Over the Great Recession in the U.S." *Research in Economics* 73 (2): 190–198.

Collins, Caitlyn, Liana C. Landivar, Leah Ruppanner, and William J. Scarborough. 2020. "COVID-19 and the Gender Gap in Work Hours." Forthcoming, Gender, Work, and Organization.

Coskun, Sena, and Husnu Dalgic. 2020. "The Emergence of Procyclical Fertility: The Role of Gender Differences in Employment Risk." CRC TR 224 Discussion Paper Series No. 142.

Costoya, Victoria, Lucia Echeverria, Maria Edo, Ana Rocha, and Agustina Thailinger. 2020. "The Impact of Covid-19 on the Allocation of Time Within Couples: Evidence for Argentina." Unpublished Manuscript, Universidad de San Andrés.

Cubas, German, Chinhui Juhn, and Pedro Silos. 2019. "Coordinated Work Schedules and the Gender Wage Gap." Unpublished Manuscript, University of Houston.

Danieli, Ana, and Jane Olmstead-Rumsey. 2020. "Sector-Specific Shocks and the Expenditure Elasticity Channel During the COVID-19 Crisis." Unpublished Manuscript, Northwestern University.

Davis, Steven J., and Till von Wachter. 2011. "Recessions and the Costs of Job Loss." *Brookings Papers on Economic Activity*, no. 2:1–72.

Del Boca, Daniela, Noemi Oggero, Paola Profeta, and Maria Cristina Rossi. 2020. "Women's Work, Housework and Childcare, before and during COVID-19." *Covid Economics: Vetted and Real-Time Papers* 28:70–90.

Dingel, Jonathan I., Christina Patterson, and Joseph Vavra. 2020. "Childcare Obligations Will Constrain Many Workers When Reopening the US Economy." BFI Working Paper 2020-46.

Doepke, Matthias, Moshe Hazan, and Yishay D. Maoz. 2015. "The Baby Boom and World War II: A Macroeconomic Analysis." *Review of Economic Studies* 82 (3): 1031–1073.

Doepke, Matthias, and Fabian Kindermann. 2019. "Bargaining over Babies: Theory, Evidence, and Policy Implications." *American Economic Review* 109 (9): 3264–3306.

Doepke, Matthias, and Michèle Tertilt. 2016. "Families in Macroeconomics." Chapter 23 of *Handbook of Macroeconomics, Vol. 2*. North Holland.

Eichenbaum, Martin S., Sergio Rebelo, and Mathias Trabandt. 2020. "The Macroeconomics of Epidemics." NBER Working Paper 26882.

Ellieroth, Kathrin. 2019. "Spousal Insurance, Precautionary Labor Supply, and the Business Cycle." Unpublished Manuscript, Indiana University.

Erosa, Andrés, Luisa Fuster, Gueorgui Kambourov, and Richard Rogerson. 2017. "Hours, Occupations, and Gender Differences in Labor Market Outcomes." NBER Working Paper No. 20271.

Farré, Lídia, Yarine Fawaz, Libertad González, and Jennifer Graves. 2020. "How the COVID-19 Lockdown Affected Gender Inequality in Paid and Unpaid Work in Spain." Unpublished Manuscript, Universitat Pompeu Fabra.

Farré, Lídia, and Libertad González. 2019. "Does Paternity Leave Reduce Fertility?" *Journal of Public Economics* 172:52–66.

Fernández, Raquel. 2013. "Cultural Change as Learning: The Evolution of Female Labor Force Participation over a Century." *American Economic Review* 103 (1): 472–500.

Fernández, Raquel, Alessandra Fogli, and Claudia Olivetti. 2004. "Mothers and Sons: Preference Formation and Female Labor Force Dynamics." *Quarterly Journal of Economics* 119 (4): 1249–99.

Fogli, Alessandra, and Laura Veldkamp. 2011. "Nature or Nurture? Learning and the Geography of Female Labor Force Participation." *Econometrica* 79 (4): 1103–38.

Fuchs-Schündeln, Nicola, Moritz Kuhn, and Michèle Tertilt. 2020. "The Short-Run Macro Implications of School and Child-Care Closures." CEPR Discussion Paper 14882.

Fukui, Masao, Emi Nakamura, and Jón Steinsson. 2019. "Women, Wealth Effects, and Slow Recoveries." Unpublished Manuscript, University of Berkeley.

Gallen, Yana. 2018. "Motherhood and the Gender Productivity Gap." Unpublished Manuscript, University of Chicago.

García-Pérez, J. Ignacio, and Sílvio Rendon. 2020. "Family Job Search and Wealth: The Added Worker Effect Revisited." NBER Working Paper 26901.

Glover, Andrew, Jonathan Heathcote, Dirk Krueger, and Jose-Victor Rios Rull. 2020. "Health versus Wealth: On the Distributional Effects of Controlling a Pandemic." CEPR Discussion Paper 14606.

Goldin, Claudia, and Lawrence F. Katz. 2011. "The Cost of Workplace Flexibility for High-Powered Professionals." *The Annals of the American Academy of Political and Social Science* 638 (1): 45–67.

Goldin, Claudia, and Claudia Olivetti. 2013. "Shocking Labor Supply: A Reassessment of the Role of World War II on Women's Labor Supply." *American Economic Review* 103 (3): 257–62.

Greenwood, Jeremy, Ananth Seshadri, and Mehmet Yorukoglu. 2005. "Engines of Liberation." *Review of Economic Studies* 72 (1): 109–33.

Gregory, Victoria, Guido Menzio, and David Wiczer. 2020. "Pandemic Recession: L- or V-Shaped?" *Federal Reserve Bank of Minneapolis Quarterly Review* 40 (1): 1–28.

Grosjean, Pauline, and Rose Khattar. 2018. "It's Raining Men! Hallelujah? The Long-Run Consequences of Male-Biased Sex Ratios." *Review of Economic Studies* 86 (2): 723–754.

Guler, Bulent, Fatih Guvenen, and Gianluca Violante. 2012. "Joint-Search Theory: New Opportunities and New Frictions." *Journal of Monetary Economics* 59 (4): 352–369.

Guner, Nezih, Remzi Kaygusuz, and Gustavo Ventura. 2012. "Taxation and Household Labour Supply." *Review of Economic Studies* 79:1113–1149.

———. 2020. "Child-Related Transfers, Household Labor Supply and Welfare." Forthcoming, Review of Economic Studies.

Guner, Nezih, Yuliya Kulikova, and Arnau Valladares-Esteban. 2020. "Does the Added Worker Effect Matter?" Unpublished Manuscript, CEMFI.

Hannusch, Anne. 2019. "Taxing Families: The Impact of Child-related Transfers on Maternal Labor Supply." Unpublished Manuscript, Mannheim University.

Heathcote, Jonathan, Fabrizio Perri, and Giovanni L. Violante. 2020. "The Rise of US Earnings Inequality: Does the Cycle Drive the Trend?" NBER Working Paper 27345.

Iacopo, Morchio, and Christian Moser. 2020. "The Gender Pay Gap: Micro Sources and Macro Consequences." Unpublished Manuscript, Columbia University.

Jarosch, Gregor. 2015. "Searching for Job Security and the Consequences of Job Loss." Unpublished Manuscript, Princeton University.

Kahn, Lisa B., Fabian Lange, and David G. Wiczer. 2020. "Labor Demand in the Time of COVID-19: Evidence from Vacancy Postings and UI Claims." NBER Working Paper 27061.

Kaplan, Greg, and Giovanni L. Violante. 2014. "A Model of the Consumption Response to Fiscal Stimulus Payments." *Econometrica* 82 (4): 1199–1239.

Kleven, Henrik, Camille Landais, Johanna Posch, Andreas Steinhauer, and Josef Zweimüller. 2019. "Child Penalties across Countries: Evidence and Explanations." *AEA Papers and Proceedings* 109:122–26.

Kleven, Henrik, Camille Landais, and Jakob Egholt Søgaard. 2019. "Children and Gender Inequality: Evidence from Denmark." *American Economic Journal: Applied Economics* 11 (4): 181–209.

Krueger, Dirk, and Chunzan Wu. 2019. "Consumption Insurance Against Wage Risk: Family Labor Supply and Optimal Progressive Income Taxation." Forthcoming, American Economic Journal: Macroeconomics.

Lemieux, Thomas, Kevin Milligan, Tammy Schirle, Wilfrid Laurier, and Mikal Skuterud. 2020. "Initial Impacts of the COVID-19 Pandemic on the Canadian Labour Market." Forthcoming, Canadian Public Policy.

Leslie, Emily, and Riley Wilson. 2020. "Sheltering in Place and Domestic Violence: Evidence from Calls for Service during COVID-19." Forthcoming, Journal of Public Economics.

Lorenzoni, Guido, Veronica Guerrieri, Ludwig Straub, and Iván Werning. 2020. "Macroeconomic Implications of COVID-19: Can Negative Supply Shocks Cause Demand Shortages?" NBER Working Paper 26918.

Lucas, Robert E. 1977. "Understanding Business Cycles." *Carnegie-Rochester Conference Series on Public Policy* 5:7–29.

Lundberg, Shelly. 1985. "The Added Worker Effect." *Journal of Labor Economics* 3 (1): 11–37.

Malkov, Egor. 2020. "Nature of Work and Distribution of Risk: Evidence from Occupational Sorting, Skills, and Tasks." Unpublished Manuscript, University of Minnesota.

Mankart, Jochen, and Rigas Oikonomou. 2017. "Household Search and the Aggregate Labor Market." *Journal of Economic Perspectives* 84 (4): 1735–1788.

Marchand, Joseph, and Sara Olfert. 2013. "The US Gender Gap Through the Great Recession Using an Alternative Approach to Cyclicality." *Applied Economics Letters* 20 (3): 276–281.

Mennuni, Alessandro. 2019. "The Aggregate Implications of Changes in the Labour Force Composition." *European Economic Review* 116:83–106.

Miller, Amalia R. 2011. "The Effects of Motherhood Timing on Career Path." *Journal of Population Economics* 24 (3): 1071–1100.

Mongey, Simon, Laura Pilossoph, and Alex Weinberg. 2020. "Which Workers Bear the Burden of Social Distancing Policies?" NBER Working Paper 27085.

Möhring, Katja, Elias Naumann, Maximiliane Reifenscheid, Annelies G. Blom, Alexander Wenz, Tobias Rettig, Roni Lehrer, Ulrich Krieger, Sebastian Juhl, Sabine Friedel, Marina Fikel, and Carina Cornesse. 2020. "Mannheimer Corona-Studie: Schwerpunktbericht zu Erwerbst ätigkeit und Kinderbetreuung." Unpublished Manuscript, University of Mannheim.

Olivetti, Claudia, Eleonora Patacchini, and Yves Zenou. 2020. "Mothers, Peers, and Gender-Role Identity." *Journal of the European Economic Association* 18 (1): 266–301.

Olsson, Jonna. 2019. "Structural Transformation of the Labor Market and the Aggregate Economy." Unpublished Manuscript, University of Amsterdam.

Oreffice, Sonia, and Climent Quintana-Domeque. 2020. "Gender Inequality in COVID-19 Times: Evidence from UK Prolific Participants." Unpublished Manuscript, University of Exeter.

Oreopoulos, Philip, Till von Wachter, and Andrew Heisz. 2012. "The Short- and Long-Term Career Effects of Graduating in a Recession." *American Economic Journal: Applied Economics* 4 (1): 1–29.

Ortigueira, Salvador, and Nawid Siassi. 2013. "How Important is Intra-household Risk Sharing for Savings and Labor Supply?" *Journal of Monetary Economics* 60 (6): 650–666.

Papanikolaou, Dimitris, and Lawrence D. W. Schmidt. 2020. "Working Remotely and the Supply-side Impact of Covid-19." Unpublished Manuscript, Northwestern University.

Patterson, Christina. 2019. "The Matching Multiplier and the Amplification of Recessions." Unpublished Manuscript, Northwestern University.

Pilossoph, Laura, and Shu Lin Wee. 2020. "Household Search and the Marital Wage Premium." Forthcoming, American Economic Journal: Macroeconomics.

Prickett, Kate C., Alexa Martin-Storey, and Robert Crosnoe. 2015. "A Research Note on Time With Children in Different- and Same-Sex Two-Parent Families." *Demography* 52:905–18.

Pruitt, Seth, and Nicholas Turner. 2020. "Earnings Risk in the Household: Evidence from Millions of US Tax Returns." *American Economic Review: Insights* 2 (2): 237–54.

Rivera, Carolina, Yu-Chieh Hsu, Fernanda Pavez Esbry, and Esuna Dugarova. 2020. "Gender Inequality and the Covid-19 Crisis: A Human Development Perspective." UNDP Human Development Working Paper.

Schoonbroodt, Alice. 2018. "Parental Child Care During and Outside of Typical Work Hours." *Review of the Economics of the Household* 16:453–476.

Schwandt, Hannes, and Till von Wachter. 2019. "Unlucky Cohorts: Estimating the Long-Term Effects of Entering the Labor Market in a Recession in Large Cross-Sectional Data Sets." *Journal of Labor Economics* 37 (S1): S161–S198.

Sevilla, Almudena, and Sarah Smith. 2020. "Baby Steps: The Gender Division of Childcare During the COVID19 Pandemic." CEPR Discussion Paper 14804.

Solon, Gary, Robert Barsky, and Jonathan A. Parker. 1994. "Measuring the Cyclicality of Real Wages: How Important is Composition Bias." *Quarterly Journal of Economics* 109 (1): 1–25.

Stevens, Ann Huff. 1997. "Persistent Effects of Job Displacement: The Importance of Multiple Job Losses." *Journal of Labor Economics* 15 (1): 165–188.

Tamm, Marcus. 2019. "Fathers' Parental Leave-Taking, Childcare Involvement and Labor Market Participation." *Labour Economics* 59:184–197.

von Gaudecker, Hans-Martin, Radost Holler, Lena Janys, Bettina Siflinger, and Christian Zimpelmann. 2020. "The Early Impact of the COVID-19 Pandemic on Gender Inequality: Working Hours and Childcare Arrangements." Unpublished Manuscript, University of Bonn.

Wang, Haomin. 2019. "Intra-household Risk Sharing and Job Search Over the Business Cycle." *Review of Economic Dynamics* 34:165–182.

Wozniak, Abigail. 2020. "Disparities and Mitigation Behavior during COVID-19." Opportunity and Inclusive Growth Institute Working Paper 32.

Xiao, Pengpeng. 2020. "Wage and Employment Discrimination by Gender in Labor Market Equilibrium." Unpublished Manuscript, Yale University.

A Additional Tables and Details on the Calibration

A.1 Overview of Calibration Data Sources

The calibration targets draw on data from several different sources. Data on childcare hours by gender and marital status come from the American Time Use Survey (ATUS). The telecommuting status of different occupations is derived from the Leave Module of the American Time Use Survey(2017-2018) and is then merged into the Current Population Survey (CPS) to calculate the aggregate occupation shares. All data on employment status, household composition, and

the presence of children is likewise taken from the CPS or related Census data sources. Labor market flows are calculated using the CPS matched basic monthly files from 2000–2020. Data on the share of households with traditional or modern social views is derived from questions in the General Social Survey (GSS). Finally, auxiliary data used to calculate average child rearing duration comes from the National Survey of Family Growth (NSFG) and data on the returns to (broad) labor market experience is estimated using the National Longitudinal Survey of Youth 1997 (NLSY97).

A.2 Further Details on the Calibration Procedure

Moments on the gender wage gap, labor supply, and labor market flows are calculated from the Current Population Survey. The primary sample includes all households ages 25 to 55 with non-missing entries for marital status, gender, and employment status. The age limit of 55 is chosen to be consistent with our focus on prime-age workers below an age when early retirement becomes common. Unless otherwise stated, the sample period spans the years 2017 to 2018. Individuals are grouped by gender (male, female), marital status (single, married), type of children (none, younger, older), employment status (not employed, part-time, full-time), and occupation type (telecommuting, non-telecommuting).

Child groups correspond to the age of the parents' youngest child in a household, with younger kids corresponding to ages 0–5 and older kids corresponding to ages 6–16. Employment groups are identified using labor force status and usual hours worked. The non-employed includes those who are either unemployed or not in the labor force, part-time includes all those who are employed and usually work fewer than 35 hours per week, and full-time includes all those who usually work more than 35 hours per week.

Telecommuting status is assigned using Census occupational codes following the classification procedure in Alon et al. (2020a). Subsequent labor market flows between telecommuting and non-telecommuting jobs are calculated to match the employment shares of each type during the period immediately preceding and during the pandemic, as documented in Bick and Blandin (2020).

The gender wage gap is calculated as the average hourly wage of employed women relative to employed men, where wages are derived from CPS data on total annual income, weeks worked, and usual weekly hours.

Moments on labor market flows by gender, marital status, employment status, and aggregate state of the economy are calculated using the matched CPS Basic Monthly Files from 2000 to 2020. Recessions are identified using the NBER's business cycle dates. Monthly flows are then converted to the quarterly frequency so as to conform to the timing convention in our model.

Table 7: Job Flows during Regular Recessions, by Gender and Employment Status

Recession Labor Market Flows	Data	Model
men E-to-E	0.93	0.91
men U-to-U	0.64	0.67
women E-to-E	0.91	0.91
women U-to-U	0.76	0.72

The flows during normal times are included as targets in the model's joint internal calibration. Flow parameters during recessions are fit separately in an auxiliary calibration to reflect their typical cyclical variation. Table 7 summarizes the data and model fit for labor market flows during recessions; flow targets for normal times are included in Table 3 of the main text.

Data on childcare requirements by gender, telecommuting status, and age of child are calculated using the American Time Use Survey. Childcare time includes all time diary entries related to (1) caring for and helping household children [030100], (2) activities related to household children's education [030200], and (3) activities related to household children's health [030300]. Time use variables are converted to average weekly levels by collapsing across household types using the ATUS supplied weights. The resulting childcare variables are then re-normalized to be consistent with the time endowment of the model, which sets full-time work equal to unity.

The initial shares of households with traditional versus modern social norms are derived from the General Social Survey. Specifically, we consider the survey question "Preschool kids suffer if their mothers work (agree/disagree)" and calculate the share of modern married couples as the fraction answering either disagree or strongly disagree in the 2018 wave of the GSS. The procedure yields a 30 percent share of couples with traditional social norms.

A.3 Calibrating Child Dynamics

The parameters governing the arrival and aging of children are set to jointly match targets on the life cycle of child-rearing by gender and marital status. The share of households initialized with children ($\bar{\pi}$) is calculated to match the share of each gender and marital status group with children by age 25, the model's first period. These shares are taken from Table 1 in the 2018 Census Fertility Report and Table 2 in the Census Fatherhood Report.

The remaining moments governing the arrival rate of younger children (after age 25), the aging of younger children into older children, and the aging of older children into adults are chosen to jointly match (1) the share of households with children, (2) the ratio of older to younger children, and (3) the average duration of child-rearing. Targets (1) and (2) are calculated from our primary CPS dataset so as to be consistent with our other targets. The average duration of child rearing

Table 8: Parameters Governing Child-Rearing Dynamics

Parameter	Value	Target	Data	Model
$\bar{\pi}_f$	0.1500	Share single females have first child by age 25	0.15	0.15
$\pi^f(s\|0)$	0.00467	Single women, share with children	0.35	0.35
$\pi^f(b\|s)$	0.02604	Single moms, ratio older-to-younger children	1.67	1.67
$\pi^f(0\|b)$	0.00002	Single moms, avg. duration of child-rearing in quarters	88.61	81.36
$\bar{\pi}_m$	0.0850	Share single men have first child by age 25	0.085	0.085
$\pi^m(s\|0)$	0.00133	Single men, share with children	0.15	0.15
$\pi^m(b\|s)$	0.02083	Single dads, ratio older-to-younger children	1.30	1.32
$\pi^m(0\|b)$	0.00003	Single dads, avg. duration of child-rearing in quarters	83.23	83.92
$\bar{\pi}_c$	0.5280	Share married couples have first child before age 25	0.528	0.528
$\Pi(s\|0)$	0.05429	Couples, share with children	0.69	0.69
$\Pi(b\|s)$	0.05952	Couples, ratio older-to-younger children	1.17	1.18
$\Pi(0\|b)$	0.04167	Couples, avg. duration of child-rearing in quarters	88.89	82.59

is calculated by summing the duration of childhood in quarters (16×4) with the median inter-pregnancy interval (measured in quarters) multiplied by the average number of children minus one. The inter-pregnancy interval value is taken from the National Survey of Family Growth. The resulting parameters, data targets, and model fit are summarized in Table 8.

A.4 Calibrating Skill Formation

The human capital grid consists of five grid points with a constant ratio of 1.4 between adjacent points (i.e., moving one step up the ladder increases full-time earnings by 40 percent). The constant ratio of grid points implies that returns to experience and the impact of skill loss are equalized along the grid. We identify the initial position of individuals in the human capital grid using their hourly wage in the CPS. The grid values are initialized so that the boundary between the first and second skill regions equals the average wage of the employed population. The initial distribution of individuals on the grid is chosen to match the (joint) distribution of wages by gender and marital status for those aged 25 to 30.[26] Specifically, we assign to the first grid point the share of people with incomes below the first grid point, to the second grid point we assign the share of all those between the first and second grid points, and so on. Couples are initialized on a two-dimensional grid to capture the assortativeness of marriage markets. Table 9 summarizes the initial distribution of human capital for single men, single women, and the joint distribution for couples.

The parameters that govern human capital dynamics on the grid are δ and η. Both parameters map analytically into observable data moments. Specifically, the expected wage growth amongst

[26]Couples are included in the sample based on the age of the husband.

Table 9: Initial Distribution of Human Capital by Gender and Marital Status

Couples					
Husband \ Wife	(1)	(2)	(3)	(4)	(5)
(1)	0.652	0.094	0.003	0.000	0.000
(2)	0.155	0.089	0.002	0.000	0.000
(3)	0.003	0.002	0.000	0.000	0.000
(4)	0.000	0.000	0.000	0.000	0.000
(5)	0.000	0.000	0.000	0.000	0.000
Singles					
Men	0.825	0.170	0.005	0.000	0.000
Women	0.856	0.140	0.004	0.000	0.000

employed individuals will equal ηh_{step}. We therefore set η to match a 1.1 percent average quarterly return to labor market experience that we estimate from longitudinal micro-data in the NLSY97 controlling for individual and year fixed effects. Similarly, the expected wage loss from a quarter of unemployment is equal to δh_{step}. We therefore choose δ to match an average quarterly wage loss of 2.5 percent during non-employment, consistent with the annual estimates of lost earnings one year after job displacement in Davis and von Wachter (2011).

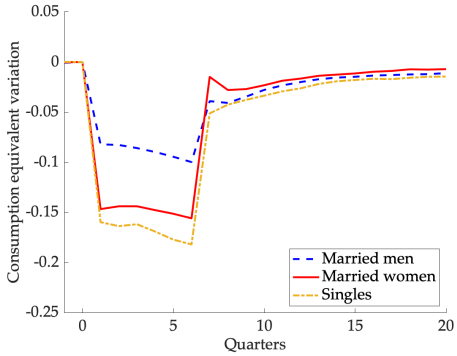
A.5 Details on Computing the Model

The model is solved via value function iteration with discrete grids for all state variables. The grid for human capital is described above. The asset grid has 25 equally spaced grid points from 0 to 2.5 times maximum individual earnings. This maximum asset level is set such that very few households have maximum assets in steady state. Dynamic simulations are carried out by simulating 250,000 individuals over many periods, so that an initial N steady state is reached before the recession shock takes place. For both regular recessions R and pandemic recessions P, the probability that the recession will end in every period is set to $1/6$, that is, $\rho_R = \rho_P = 5/6$.

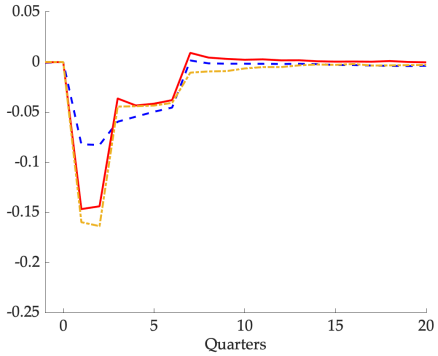
A.6 Welfare Implications of School Openings

Figure 17 provides details on how welfare changes over time for singles, married women, and married men under different policy scenarios for school openings. School openings occur either after the recession (quarter 6, panel a) or after two quarters of recession (in quarter 3, panels b–d).

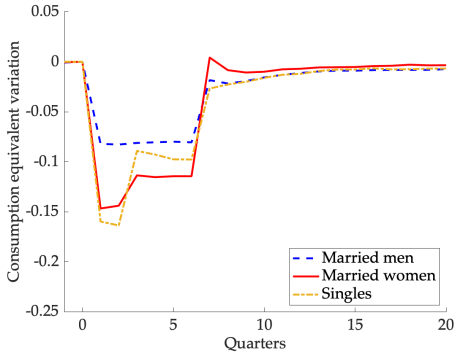
Figure 17: Welfare Implications of School Reopenings



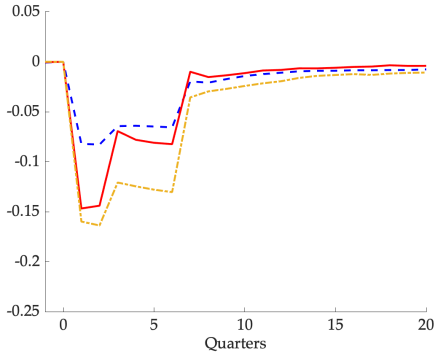
(a) Welfare during the pandemic



(b) Welfare with school reopenings



(c) Welfare with school reopening, big kids only



(d) Welfare with school reopening, small kids only