Home Production and Leisure During the COVID-19 Recession*

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April 10, 2021

Abstract

Between the months of February and April of 2020, average weekly market hours in the U.S. dropped by 6.25, meanwhile 36% of workers reported switching to remote work arrangements. In this paper, we examine implications of these changes for the time allocation of different households, and on aggregate. We estimate that home production activity increased by 2.65 hours a week, or 42.4% of lost market hours, due to the drop in market work and rise in remote work. The monthly value of home production increased by $39.65 billion – that is 13.55% of the concurrent $292.61 billion drop in monthly GDP. Although market hours declined the most for single, less educated individuals, the lost market hours were absorbed into home production the most by married individuals with children. Adding on the impact of school closures, our estimate of weekly home production hours increases by as much as 4.92 hours. The increase in the value of monthly home production between February and April updates to $73.57 billion. We also report the estimated impact of labor markets and telecommuting on home production for each month in 2020.

JEL Codes: D13 (household production), E32 (business cycles), J22 (time allocation and labor supply)

Keywords: Shutdown, COVID-19, pandemic, home production, remote work

*We thank the research economists at the Federal Reserve Bank of St Louis for valuable feedback and Devin Werner for valuable research assistance.

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1 Introduction

The labor market effects of the strict economic shutdown implemented during the months of March, April, and May of 2020 have been widely discussed. Less is known about what type of families suffered the most and how they spent the extra time at home. If those extra hours were spent on home improvement projects, home schooling and cooking dinners, the loss in market output would be partly offset by the gain in home production. In this paper, we estimate the effects of the pandemic on time allocation of different types of households, and on aggregate.

The main source of time use data in the U.S. is the American Time Use Survey (ATUS). The ATUS is a monthly survey, but there is a significant time lag between data collection and its availability, which makes it less relevant for real-time policy making.[1] Most importantly, ATUS data collection was suspended altogether during the COVID-19 shutdown resuming ony in mid-May.[2] Therefore, time diary based information does not exist for this period and one will have to rely on estimates to get a sense of time allocation patterns during the pandemic recession. We offer estimates based on combining real-time data on work hours and remote work with their effects on time allocation. We also explain how our estimates of home production adjust after taking into account school closures.

Why are these estimates useful? They help assess the cost of a shutdown. They help paint a more accurate picture of the pandemic experience across household types and allow for a more accurate cross-household welfare assessment. They also provide useful calibration targets for researchers studying the pandemic recession and pandemic-related policies through models that explicitly feature home production, family-level decision making, and/or household heterogeneity.[3]

The ideal way to collect time allocation data is by way of time diaries, where a person specifies primary and secondary activities for each time interval. This is how ATUS collects its data. We want to emphasize we are not aware of any survey conducted in the U.S. during the ATUS suspension period that would allow us to assess the time allocation across various primary activities. We discuss this further in Section 5.

The effects of a job loss will likely depend on the type of household experiencing it. Single workers with less education may decide to spend the extra time taking an online training class, while married workers

[1] The 2019 data were released in June of 2020, indicating a 14 to 18 month delay in data availability for the first four months of 2019.

[2] See https://www.bls.gov/covid19/effects-of-covid-19-pandemic-on-employment-and-unemployment-statistics.htm#ATUS

[3] Explicit modeling of home production has long been recognized to help business cycle models fit the data and to matter for policy analysis (e.g. Greenwood and Hercowitz [1991], McGrattan et al. [1997]). Doepke and Tertilt [2016] effectively motivate the importance of incorporating family-level decision making into macroeconomic analysis.

with children may spend the extra time turning their backyard into a vacation oasis. We therefore separately consider several types of households, differentiated by marital status, gender, partner's employment status, education and the presence of children in the household. We focus on individuals of age 18 to 65.

Although we report on both home production and leisure when discussing the impact of reduced market hours, we focus our discussion on home production for the remainder of the paper. We separately discuss changes due to lost market hours (Section 3) and changes due to the rise in remote work (Section 4), combining the two effects in Section 4. This is done in order to facilitate comparison to previous studies such as Aguiar et al. [2013] for the effects of lost market hours and Pabilonia and Vernon [2020] for telecommuting effects. While we focus on the period marking the sharpest decline in market hours (February-April), we also report our results for each month in 2020. We finally discuss the additional effects on home production hours arising due to school closures during the lockdown period (Section 5).

We estimate changes in home production (and leisure) due to market hours by combining losses of market hours experienced by each household type with our estimates of substitution rates across time use categories.

On average, market weekly hours were reduced by 6.25 hours between February and April. The less educated were affected the most. The least affected groups were the college educated married men. We estimate the substitution rates between time use categories, separately for each type of household, by applying the identification strategy used in Aguiar et al. [2013]. We employ the 2003-2018 waves of ATUS, pooling two waves at a time to increase the sample of each household type. This methodology assumes the same aggregate trend in time allocation patterns across the U.S. states, thereby allowing us to identify the causal effects from cross-state variation of changes in time allocation. The presence of aggregate trends in time use is widely documented (e.g. Ramey [2009]). In addition, we allow for differential substitution rates and differential trends across household types, highlighted, for example, in Bar and Leukhina [2011]. Depending on the type of household considered, we find that home production activities absorb anywhere from 12% to 53% of lost market hours.[4]

Combining the magnitude of lost market hours with their substitution rates into home production, we find that the total impact on home production hours ranges from 1 hour per week to 4 hours per week.[5] Generally speaking, home production increased more for married individuals and households with children. We also

[4]Leisure absorption rates are much greater, ranging between 48% and 72%.

[5]The impact on leisure hours is much greater, ranging between 2 to 7 hours a week.

decompose the total impact into the part implied by changes in employment (the extensive margin) and the part implied by reduction in hours of the employed (the intensive margin). Aggregating over household groups, we derive the total impact of reduced market work hours. Starting at about 20.8 weekly hours in January, home production hours remained unchanged in February, rose by 0.36 hours in March and by nearly 1.5 hours in April, totaling to the 1.9 hour increase between February and April.[6]

While the 1.9 weekly hour increase may not seem like a lot, it is 30% of the 6.25 hour decline in weekly market hours. Moreover, it places the estimated change in the value of monthly home production between February and April at $28.10 billion, or 9.60% of the $292.61 billion drop in monthly GDP over the same time period. We estimate the home production value using a method similar to the "specialist cost method" described in Bridgman [2016].

These estimates of the impact on home production (due to lost market hours) likely represent a lower bound of the actual changes that took place during the pandemic recession, while the opposite is true for leisure activities. This is because leisure options – such as going to the gym, watching baseball or basketball, and eating out – were severely limited during the pandemic recession. Of course, households were likely substituting other leisure activities for those they missed out on (e.g. watch a TV show instead of March Madness), but we expect some movement away from leisure and towards home production activities, and especially so for households with small children whose daycare/school closed down. Thus, we go on to adjust our estimates of home production hours for the rise in remote work and school/childcare closures. We then think of the total effect on leisure as the residual component.

In addition to the loss in market hours, the pandemic recession marked an unprecedented rise in work-from-home arrangements. Working from home saves on commute time and allows for a more flexible schedule and therefore easier access to household and child-related chores throughout the day. We estimate its contribution to the rise in home production by combining the telecommuting rates for various households with the estimates of remote work effects on home production hours.

According to the representative survey conducted by Brynjolfsson et al. [2020], 35% of the employed workers surveyed in the beginning of April reported having switched from commuting to remote work, and no additional switches recorded in the beginning of May. We obtain our own estimates of the rise in remote work from the Current Population Survey. Not everyone had equal opportunity to switch to remote work, with the less educated households more likely to hold service jobs that cannot be performed remotely.

[6] Starting at 109.3 weekly hours in January, leisure hours remained unchanged in February and increased by 3.8 by April.

We then estimate the effects of remote work on home production hours for different types of employed workers on post-Great Recession ATUS data. Combining these two steps, we find that home production increased between 0.23 to 1.44 hours hours a week, as a direct result of the rise in telecommuting. The college-educated workers were affected the most.

Updated with remote work effects, average weekly home production hours among the employed increased by an additional 0.77 hours between March and April, bringing the cumulative increase between February and April to 2.65 hours, or 42.4% of lost market hours. The increase in the value of monthly home production between February and April updates to $39.65 – a $11.55 billion gain in value and a 13.55% of the estimated $292.61 billion drop in monthly GDP.

Finally, adding on the impact of school closures on childcare hours, we found that weekly home production hours increased by an additional 2.27 hours between March and April, bringing the cumulative increase between February and April to 4.92 hours. The increase in the value of monthly home production between February and April updates to $73.57 billion – a 25.14% of the estimated $292.61 billion drop in monthly GDP.

The rest of the paper proceeds as follows. In Section 2, we discuss our data sources. In Section 3, we explain our methodology and report the estimated changes in home production and leisure hours generated by lost work hours. We augment these estimates with remote work effects in Section 4 and report the results for each month in 2020 and for each household type in the appendix. We adjust our estimates for school closures in Section 5. Conclusions are given in Section 6.

2 Data: CPS and ATUS

We obtain labor market and demographic characteristics from the monthly Current Population Surveys (CPS), conducted by the Census Bureau, which we obtain through IPUMS for each month of 2020 (see Flood et al. [2020]).[7] There are 766,736 observations per month in our 2020 CPS sample of working age individuals, which is about 64,000 per month.

Market work questions refer to the week that includes the 12th day of each month. We measure average employment rates and overall market hours for twenty groups of working-age population (18 to 65) defined according to marital status,[8] gender, education (college/less than college), presence of own children in the

[7] In an earlier stage of this project, we used the real-time population survey data from Bick and Blandin [2020].

[8] Married individuals not living together are considered single.

household, and spousal employment.[9] We deem an individual to be employed only if they report to be at work during the reference week. This definition excludes furloughed workers and those on payroll but not at work (e.g. those on vacation or in quarantine) and therefore better serves our purpose of identifying changes in time allocation patterns. We measure hours worked for working individuals using the reported number of hours worked during the reference week. We also calculate the distribution of working-age individuals across groups (population shares).

The telecommuting question in CPS is asked in May and every month after that. The reference period for this question is a four-week period whose last week includes the 12th day of the month. We discuss this further in Section 4.

We obtain time allocation data from the 2003-2019 waves of the ATUS. This survey is conducted by the Census Bureau via telephone interviews, and individuals in the sample are drawn from the exiting sample of the CPS. Our sample includes all working age respondents with complete time use records and non-missing information on demographic characteristics. There are 138,351 observations in our ATUS sample.

ATUS respondents complete detailed time-use diaries over a 24-hour period, which allows them to distinguish between primary and secondary activities. All activities are classified into seventeen time-use categories. Aguiar et al. [2013] segment individual time endowment into seven categories of primary time use: market work, other income-generating activities, job search, child care, non-market work, leisure, and other time use.[10] We adhere to the same definition of leisure, but combine child care and non-market work into the single "home production" category, and exclude travel related to work from the "market work" category. We implement the latter choice for consistency with the CPS measure of market hours. Finally, we use records of activity location to document the fraction of hours worked from respondents' homes.

3 Analysis

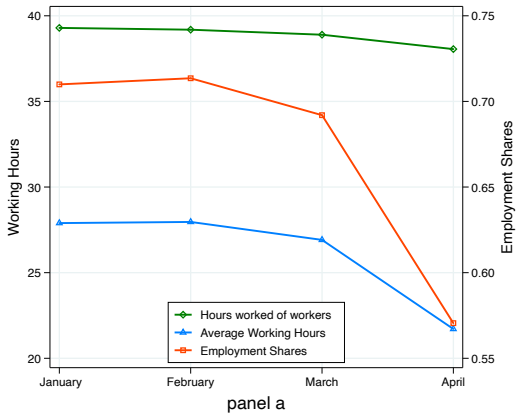
Our objective is three-fold. We first document the loss of employment and reduction of total market hours for different types of households (Section 3.1). Second, we quantify the impact of lost market hours on

[9] We use spousal employment to differentiate between married men only, as the sample of married women with nonworking spouses is too small.

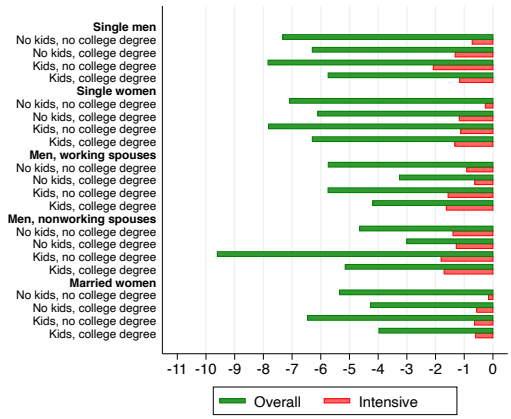
[10] The following classification is used in Aguiar et al. [2013]. Market hours are the total of hours worked on the main job, second job and in overtime, hours spent on work-related activities and travel related to work. Leisure hours are measured as time spent in activities for which time complements monetary expenditures (e.g. watching TV, sleeping, exercising). Non-market work encompasses housework (e.g. cooking, cleaning, lawn care), home ownership activities (e.g. home improvement and lawn care), care for other adults, and obtaining goods and services.

Figure 1: Trends in Market Hours and Employment

(a) Aggregate Trends



(b) Loss by Household Type



Notes: Panel a shows the evolution of average market hours and employment between the months of January and April, 2020. Panel b illustrates changes in market hours for each type of household. The green bars, entitled "Overall," mark the total change in average hours. The red bars, entitled "Intensive," mark the change in average hours of the employed.
Source: Current Population Survey, authors' calculations.

home production and leisure for different types of households, and on aggregate (Sections 3.2-3.4). Third, we proxy the impact on home production implied by the rise in remote work and explain how this added effect changes our prior estimates (Section 4).

3.1 Trends in Market Hours and Employment

Figure 1 (panel a) reveals that average weekly market hours were reduced by 6.25 hours between February and April, i.e. by 22.35%. We also find that the drop in overall hours was mainly due to lost employment – which declined by about 14 percentage points (i.e. a 20% drop) – rather than reduced hours on the job. In fact, average weekly hours among the employed declined by only 1.13 hours.

In Figure 1 (panel b), the overall loss of hours is broken down by household type. The green bars depicting the overall change indicate that, among the groups affected the most, were the less educated married men with children and stay-at-home wives (almost 10 hours) and single households with kids and no college degree (7.8 hours for both men and women). Among those least affected were college educated men with no kids (3.3 hours for men with a stay-at-home wive and 3 hours for men with a working spouse).

We further decompose the overall average drop in hours into hours reduction of the employed (the intensive margin ΔI_t^j) and the drop in employment (the extensive margin ΔE_t^j) according to

$$\Delta h_t^j = p_t^j h_t^{emp,j} - p_{t-1}^j h_{t-1}^{emp,j} = \Delta I_t^j + \Delta E_t^j, \tag{1}$$

where $\Delta I_t^j = (h_t^{emp,j} - h_{t-1}^{emp,j})(\frac{p_t^j + p_{t-1}^j}{2})$, $\Delta E_t^j = (p_t^j - p_{t-1}^j)(\frac{h_t^{emp,j} + h_{t-1}^{emp,j}}{2})$, p_t^j and $h_t^{emp,j}$ denote the employment share and the average market hours of the employed type j households.

The red bars in Figure 1 (panel b) illustrate the change in hours along the intensive margin, while the extensive margin can be visualized as the difference between the two bars. It is clear that, for all household types, the drop in hours is mainly accounted for by lost employment. Indeed, average weekly hours among the employed declined by at most 2.1 among the household groups we considered, with most groups experiencing only a 1 hour decline.

In contrast to a typical recession that disproportionately affects the male-dominated sectors, this shutdown marked similar losses across genders—6.35 hours for men and 6.04 hours for women. This is because it featured a larger than typical negative impact on female-dominated service sectors and increased child care needs due to school and daycare closures. See Alon et al. [2020] for a thorough analysis of gender differences during the pandemic recession. Overall, less educated workers and households with children were hit the hardest.

3.2 Time Substitution Rates Across American Households

To estimate the extent with which foregone work hours are reallocated towards home production (hp) and leisure (l), we apply the identification strategy from Aguiar et al. [2013] to ATUS data, doing so separately for each household type.

The causal effect of recession-induced market time losses on time spent in other activities cannot be identified from the simple comparison of time use before and during the Great Recession – which is in our sample. The reason for this is the presence of long run trends in home production (leisure) hours the influence of which cannot be separated from recessionary effects. One would like to remove the low frequency trends from time use data using standard statistical methods, but the short span of the dataset renders this approach infeasible.

The approach taken in Aguiar et al. [2013] takes advantage of the fact that the timing and size of recession-induced employment losses differ across states mainly due to the variation in the sectoral composition of their economies. If one assumes a common trend in home production (leisure) hours across states, then the effect of work hours on home production (leisure) hours can be obtained from cross-state variation

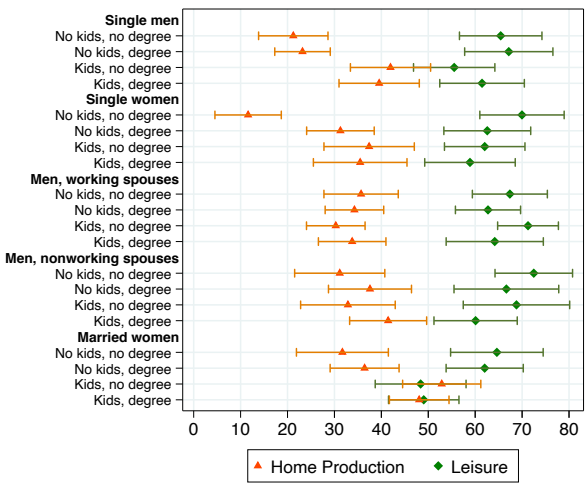
of changes in time use. Intuitively, states in periods characterized by very small changes in market hours would be identifying the change in home production hours due to the common trend.

Importantly, we allow for differential trends and differential effects across household types. Formally, we estimate the following equation for each time use category $k \in \{hp, l\}$ and each type of household j:

$$\Delta h_{st}^{k,j} = \alpha^{k,j} - \beta^{k,j} \Delta h_{st}^{j} + \varepsilon_{st}^{k,j}, \tag{2}$$

where $\Delta h_{st}^{k,j}$ is the change in average weekly hours spent on activity k by type j households in state s between period $t-1$ and period t, and Δh_{st}^{j} is the change in average weekly hours spent on market work by type j households in state s between period $t-1$ and period t. $\beta^{k,j}$ measures the substitution rate of home production (leisure) hours for lost market hours, for households of type j.[11] Our estimation sample includes 50 states and the District of Columbia ($s = 1, 2, ..., 51$) and eight two-year time periods, 2003-2004, 2005-2006, ... , 2017-2018 ($t = 1, 2, ..., 8$). Averaging over two years, as in Aguiar et al. [2013], increases the size of state-level samples.

Figure 2: Substitution Rates of Home Production/Leisure for Lost Market Hours, $\{\hat{\beta}^{k,j}\}$



Notes: The figure illustrates the estimated substitution rates of home production hours (in red) and leisure hours (in green) for lost market hours, along with 95% confidence interval bands.
Source: American Time Use Survey, authors' calculations.

The estimated substitution rates $\{\hat{\beta}^{k,j}\}$ are illustrated in Figure 2 and reported in Table 1. Depending on the type of household considered, we find that home production activities absorb anywhere from 12% to 53% of lost market hours. The smallest effect is experienced by single women without children and without

[11] We include controls for race and time period dummies in each estimation.

a college degree (12%). The groups experiencing the highest absorption rates are married women with children without a college degree (53%), married women with children and a college degree (48%), single men with children and without a college degree (42%), and college-educated married men with children and a stay-home wife (41%).

Table 1: Estimated Time Substitution Rates

Household Type	Home Production				Leisure			
	$\hat{\beta}$	S.E.	$\hat{\beta}_I$	S.E.	$\hat{\beta}$	S.E.	$\hat{\beta}_I$	S.E.
	(1)		(2)		(3)		(4)	
Single men								
No kids, no college degree	21.23	(3.77)	24.90	(3.59)	65.44	(4.49)	67.12	(4.11)
No kids, college degree	23.20	(3.02)	26.37	(3.43)	67.16	(4.80)	69.42	(4.62)
Kids, no college degree	41.95	(4.36)	34.81	(5.07)	55.53	(4.42)	66.93	(5.08)
Kids, college degree	39.53	(4.37)	42.30	(4.20)	61.46	(4.60)	59.23	(4.46)
Single women								
No kids, no college degree	11.60	(3.61)	16.21	(4.85)	69.97	(4.58)	62.07	(3.90)
No kids, college degree	31.28	(3.67)	31.40	(3.82)	62.58	(4.72)	62.49	(4.30)
Kids, no college degree	37.40	(4.91)	34.52	(3.93)	62.03	(4.38)	66.91	(4.52)
Kids, college degree	35.49	(5.09)	34.19	(4.75)	58.89	(4.92)	60.40	(4.50)
Married men with working spouse								
No kids, no college degree	35.68	(4.04)	42.33	(4.66)	67.39	(4.08)	63.00	(4.03)
No kids, college degree	34.26	(3.18)	38.40	(3.89)	62.73	(3.54)	58.89	(3.78)
Kids, no college degree	30.29	(3.19)	30.68	(3.95)	71.26	(3.30)	70.32	(4.03)
Kids, college degree	33.78	(3.67)	33.70	(3.25)	64.17	(5.28)	64.98	(4.66)
Married men with non-working spouse								
No kids, no college degree	31.13	(4.90)	40.40	(5.43)	72.49	(4.22)	61.93	(4.93)
No kids, college degree	37.58	(4.51)	28.41	(5.00)	66.65	(5.69)	75.75	(6.47)
Kids, no college degree	32.88	(5.14)	34.11	(4.41)	68.80	(5.79)	68.79	(5.12)
Kids, college degree	41.45	(4.19)	41.27	(4.47)	60.09	(4.53)	60.64	(4.90)
Married women								
No kids, no college degree	31.70	(5.00)	36.81	(4.49)	64.63	(5.03)	58.87	(5.20)
No kids, college degree	36.43	(3.75)	33.88	(3.42)	62.02	(4.19)	65.15	(4.21)
Kids, no college degree	52.87	(4.25)	48.52	(4.18)	48.37	(4.94)	50.11	(4.38)
Kids, college degree	48.07	(3.24)	40.88	(3.59)	49.03	(3.83)	53.98	(4.14)

Notes: Columns 1 and 3 report weighted least squares estimates of the regression model (2) for time use category $k \in \{hp, l\}$. All coefficients are multiplied by 100. Standard errors, clustered at the state level, are in parentheses. Each specification includes controls for race and time dummies, omitted from the table. Each observation is weighted by the state's population. Columns 2, 4 report weighted least squares estimates of the same model, reestimated on the sample of the employed.
Sources: American Time Use Survey, authors' calculations.

For most groups, the majority of forgone market hours are reallocated towards sleep and leisure activities such as watching TV, socializing and exercising. Leisure absorption rates are high, ranging from 48% to

72%, and correlate negatively with home production absorption rates. For almost all households, about 90% of lost work hours are reallocated towards either home production or leisure activities. However, single men without children and less educated single women without children respond notably less in terms of home production, reallocating as much as 23% of their lost work hours to other time use categories, such as education and other income-generating activities.

3.3 Impact of Lost Work on Home Production and Leisure Across American Households

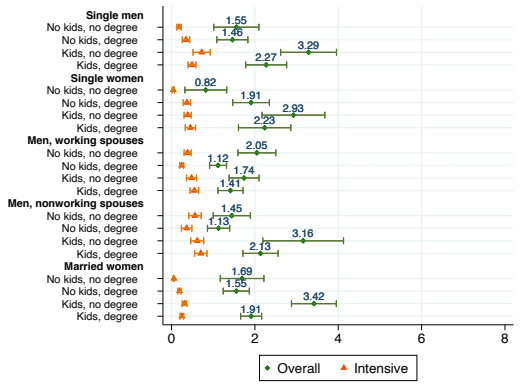
With the estimated substitution rates $\{\hat{\beta}^{k,j}\}$ and the monthly changes in market hours $\{\Delta h^j\}$ in hand, we compute the implied monthly changes in home production hours (and leisure) as the product $\{\hat{\beta}^{k,j}\Delta h^j\}$.

Figure 3 (panels a and b) reports the estimated cumulative changes in home production and leisure between February and April. Home production hours increased anywhere from 1 to 4 hours per week, with the largest impacts seen by married individuals and those with children. The two groups predicted to increase their home production hours the most—less-educated married women with children and less-educated single men with children—do so for very different reasons: the former because they substituted home production for lost work more than any other group (a 53% substitution rate) and the latter because they lost more market hours than almost any other group (a 8 hour loss). Meanwhile, while single individuals fared worse than married individuals in terms of employment, they exhibit a moderate change in home production hours due to their low substitution rates. Panel b reveals a larger response of leisure (due to greater substitution rates) across all household groups, especially single individuals.

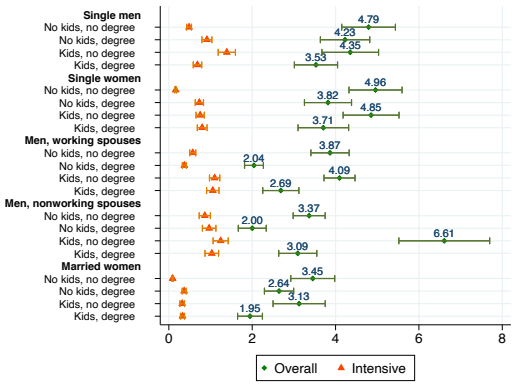
We also decomposed the predicted change in home production (leisure) hours into the part due to individuals that stayed employed, i.e. the intensive margin $\hat{\beta}_I^{k,j}\Delta I_t^j$, and the part due to individuals who lost their employment, i.e. the extensive margin $\hat{\beta}_E^{k,j}\Delta E_t^j$. With ΔI_t^j and ΔE_t^j measured according to (1), it remains to find $\hat{\beta}_I^{k,j}$ and $\hat{\beta}_E^{k,j}$. We first compute the substitution rates for the employed households $\{\hat{\beta}_I^{k,j}\}$ by re-estimating the regression model in (2) on the sample of employed workers. The resulting estimates are included in Table 1. This allows us to predict time allocation shifts along the intensive margin. The extensive margin is computed as the residual satisfying the proposed identity: $\beta^{k,j}\Delta h_t^j = \beta_I^{k,j}\Delta I_t^j + \beta_E^{k,j}\Delta E_t^j$. Figure 3 reveals that the intensive margin accounts for a very small part of the total impact on home production and leisure hours, for nearly all household types, implying that it is the loss of employment that drives the total rise in home production and leisure. The intensive margin is relatively larger for college-educated married men. These groups fared better in terms of employment. For example, for the college educated married men

Figure 3: Estimated Impact of Lost Work on Time Use

(a) Impact on Home Production, by Household, $\{\hat{\beta}^{hp,j}\Delta h^j\}$



(b) Impact on Leisure, by Household Type, $\{\hat{\beta}^{l,j}\Delta h^j\}$



Notes: This figure illustrates the predicted change in home production and leisure hours for each household type between February and April, 2020. "Overall" labels refer to the total change. "Intensive" labels refer to the change implied by reduced hours of the employed. The brackets mark 95% confidence intervals.
Sources: American Time Use Survey, Current Population Survey, authors' calculations.

with children and a working wife, we have $\Delta I \approx \Delta E$ and $\hat{\beta}^{hp}_E \approx \hat{\beta}^{hp}_I$, and so the two margins are equally important.

The response in leisure is much greater, ranging between 2 hours to 7 hours a week. The high point estimate is for the less educated married men with children and nonworking spouses. These men exhibit one of the largest substitution rates between market work and leisure (68.8%) and they lost the most market hours (a 9.6 hour loss).

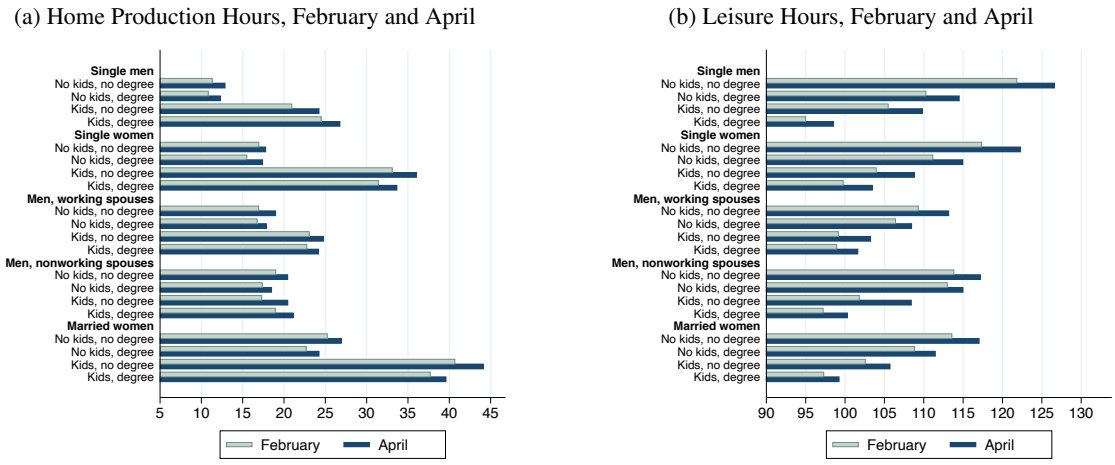
To impute the monthly level of home production (leisure) for each household type, we first proxy its January time allocation based on the 2018-2019 ATUS data (21.83 hours per week for home production and 109.3 hours per week for leisure).[12] We then impute the February home production hours by adding on the estimated increase $\hat{\beta}^{k,j}\Delta h^j_t$ where Δh^j_t measures the January-February change in market hours, and so on. Figure 4 helps visualize average weekly hours spent on home production (leisure) in February and April of 2020. It is clear that larger impacts were seen by groups that were already highly vested in that activity.

3.4 Implied Aggregate Impact of Lost Work on Home Production and Leisure

We impute the aggregate time allocation trends by aggregating over home production (leisure) hours for each group in each month. We do so using appropriate population shares. The implied aggregate monthly changes are shown in Figure 5 (panels a and b). Starting at 21.83 hours per week in January, home production

[12] 5.07 of the 21.83 home production hours are spent on child care.

Figure 4: Time Use Estimates Based on Lost Market Hours, $\{\hat{h}_t^{k,j}\}$



Notes: This figure illustrates predicted weekly home production hours (panel a) and leisure hours (panel b), for each type of household. The "February" bars refer to predicted weekly hours in February 2020. The "April" bars refer to predicted weekly hours in April 2020.
Sources: American Time Use Survey, Current Population Survey, authors' calculations.

hours remained approximately unchanged between January and February, rose by 0.36 between February and March and by nearly 1.5 between March and April, totaling a 1.9 hour increase between February and April. Only about 20 minutes of the 1.9 hours increase is accounted for by workers who maintained their employment, implying the bulk of the increase is driven by the loss of employment. Starting at 109.3 hours per week in January, leisure hours increased by 3.8 hours, also mostly along the extensive margin.

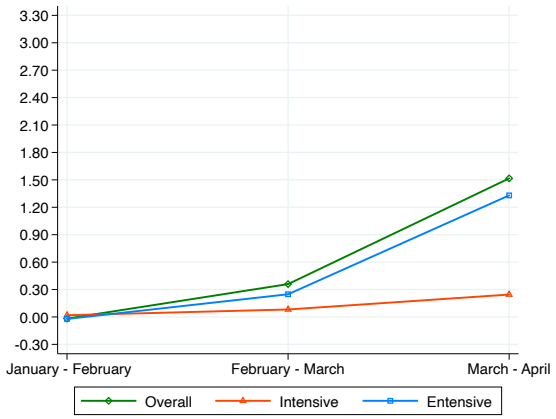
While the 1.9 hour increase in home production hours may not seem like a lot, it comprises about 30% of the 6.25 hour decline in weekly market hours. This estimate represents a lower bound of the actual change in home production hours because it is based on time substitution rates identified from pre-pandemic data. The pandemic, however, severely limited options for leisure activities, increased telecommuting prevalence and raised the need for parent-provided child care. All of these factors would have further increased home production hours.

We estimate the additional contribution of telecommuting in Section 4 and childcare/school closures in Section 5.

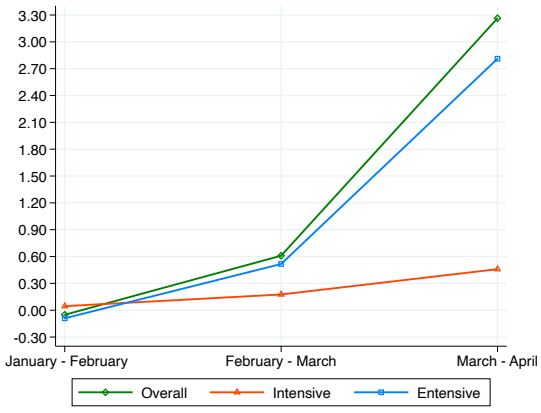
To put the increase in home production hours in perspective, it is useful to estimate the actual gain in the value of home production. Following a methodology similar to the one described in Bridgman [2016], we estimate the value of an hour of home production as the average wage (w) among private workers employed in sectors that Mazzolari and Ragusa [2013] identify as substitutes for home production (e.g.,

Figure 5: Estimated Impact of Lost Work on Time Use

(a) Monthly Changes in Average Home Production Hours



(b) Monthly Changes in Average Leisure Hours



Notes: This figure illustrates the estimated monthly changes in average weekly home production hours (panel a) and leisure hours (panel b) between January and April, 2020. "Overall" labels refer to the total change. "Intensive" labels refer to the change implied by reduced hours of the employed. "Extensive" labels refer to the change implied by job losses. The (small) residual part is due to very small changes in population shares.
Sources: American Time Use Survey, Current Population Survey, authors' calculations.

cooks, cleaners, child care workers). Using CPS data for January, we find that such workers made $17.35 an hour on average. We then calculate the value of total home production in a given month as the product $(4.3)wh_t^{hp}N_t$, where h_t^{hp} measures weekly time in home production, N_t is the working age U.S. population in month t, and 4.3 proxies the number of weeks per month.

We find that the value of monthly home production increased by $28.10 billion between February and April. This gain is equivalent to about 9.60% of the estimated $292.61 billion concurrent drop in monthly GDP.[13]

Even though our focus is on the strict lockdown period, we also report changes in CPS work hours and our estimates of their impact on home production hours for each remaining month in 2020. These are reported in Tables 4 and 6 in the appendix. As market hours bottomed out in April on aggregate and for nearly all household types, we see the largest impact on home production during the month of April. October was the best post-pandemic month for labor markets in 2020, with average weekly hours measuring at 1.45 hours below their February level and ranging between 0.07 (for married men with non-working spouses, no kids and no college degree) and 3.26 (for college-educated single men with kids). Hence, the smallest aggregate impact on home production hours is also seen in October, measuring at 0.42 hours per week. With

[13] Official GDP numbers are only given at annual and quarterly rates; here, we rely on seasonally adjusted monthly GDP estimates from Macroeconomic Advisers.

many schools reopened and labor markets picked up by the end of the year, we also see much less inequality in market hours (and home production estimates) across groups differentiated by education and the presence of children.

4 Contribution of Remote Work to Home Production Hours

The pandemic recession also witnessed a remarkable increase in telecommuting between the months of March and April. Working from home saves time and allows for a more flexible schedule. It makes it easier to engage in household-related tasks throughout the day. In this section, we estimate the additional contribution of the rise in remote work to the rise in home production. We do so by combining changes in remote work with our estimates of remote work effects on home production hours.

We measure the pre-pandemic group-specific telecommuting fractions, $\{fr^{tele}_{pre,j}\}^{20}_{j=1}$, in the latest available 2018- 2019 waves of ATUS as fractions of hours of the employed that are worked from home. These are reported in the first column of Table 2. We assume these fractions remained fixed through January, February and March. The weighted-average across groups is 12.9%, which is consistent with the pre-pandemic fraction of work days worked remotely (about 14%) obtained in a private survey conducted by Bick et al. [2021].

Our first step is to measure telecommuting rates for the employed in April. The question regarding telecommuting due to the pandemic was first introduced in CPS in May. Each month, the currently employed respondents were asked whether or not they worked from home – specifically due to the pandemic – at any point during the four-week reference period whose last week includes the 12th day of that month. The interviewers were specifically instructed to record a negative response if the respondent worked from home prior to the pandemic.[14] Thus, this question allows us to measure the increments in the telecommuting fractions relative to their pre-pandemic levels. We denote the month m telecommuting increment (relative to its pre-pandemic level) for group j by $fr^{tele}_{m,j}$. We use May CPS to proxy telecommuting increments in April, we use June CPS to proxy their May value, and so forth.[15]

Ideally, we would like the telecommuting rate to reflect the fraction of total work hours that are worked

[14] See page 2 of www2.census.gov/programs-surveys/cps/techdocs/Covid19_TechDoc.pdf.

[15] The backward looking nature of the reference period makes this a reasonable choice. One potential concern is that the reference period used to proxy the April telecommuting increment does not contain the first two weeks of the month, thus possibly overstating the result. However, the survey conducted by Brynjolfsson et al. [2020] makes it clear that those who switched to working from home did so by the first week of April.

from home. It may be concerning that the CPS only inquired about telecommuting incidence rather than asking for precise hours. However, telecommuting policies were implemented in response to the pandemic and meant that those who could work from home did so entirely. Indeed, Bick et al. [2021] found that the surge in remote work was driven almost completely by the rise in the share of workers that worked entirely from home. To the extent that overall hours are similar between commuters and telecommuters, our approach should yield a good proxy for the fraction of total work hours that are worked from home. For overlapping periods of study, aggregate measures of telecommuting in CPS are highly comparable to those reported in Brynjolfsson et al. [2020] and Bick et al. [2021] and somewhat smaller to those measured in Barrero et al. [2020]. These three studies use different privately run surveys to track commuting during the pandemic and report slightly different measures of remote work.

We find that about 36% of the employed switched from commuting to remote work in April. The group-specific telecommuting increments for April, $\{fr^{tele}_{April,j}\}$, are reported in column 2 of Table 2 and the remaining months of 2020 are summarized in Table 5 in the appendix. Clearly, not everyone faced the same opportunity to switch to remote work, with the less educated households more likely to hold service jobs tied to specific locations. Indeed, we see that telecommuting increments for college-educated groups are very high, ranging between 52% for single men with children and 64% for single women without children. By contrast, these rates vary between 9.8% (for singles men with children) to 27% (married women with or without children) for groups without a college degree.

The second step is to estimate the effect of remote work on home production hours. We use the 2010-2019 ATUS waves to estimate the following model on the sample of employed respondents:

$$h_i^{hp} = \rho(1 - fr_i^{tele})h_i + \phi h_i + \sum_{j=1}^{20} \gamma^j \mathbb{I}_{type^i=j} + \varepsilon_i, \tag{3}$$

where h_i^{hp} denotes respondent i's home production hours, h_i denotes respondent i's market hours, fr_i^{tele} is the fraction of market hours worked from home, $\mathbb{I}_{type^i=j}$ indicates that the respondent is of type j, and $\rho, \phi, \{\gamma^j\}$ are model parameters.

In addition to the standard (negative) impact of market work on home production hours, this formulation allows for a separate effect of those hours that are worked away from home. This additional term captures all the time costs that increase only with hours worked away from home, thereby taking away from the time available for home production. The most obvious time cost is commute-related. Others include additional

Table 2: Remote Work and the Implied Rise in Home Production

Household Type	Pre-pandemic fraction working remotely (1)	Pandemic fraction working remotely (2)	Change in total hours worked away from home (3)	Effect of remote work on home production hours (4)
Single men				
No kids, no college degree	0.061	0.111	-4.474	0.234
No kids, college degree	0.156	0.569	-23.536	1.231
Kids, no college degree	0.053	0.098	-5.873	0.307
Kids, college degree	0.240	0.515	-22.690	1.187
Single women				
No kids, no college degree	0.077	0.206	-7.445	0.389
No kids, college degree	0.162	0.635	-25.285	1.322
Kids, no college degree	0.063	0.223	-8.951	0.468
Kids, college degree	0.193	0.580	-23.726	1.241
Married men with working spouse				
No kids, no college degree	0.103	0.185	-8.740	0.457
No kids, college degree	0.213	0.597	-25.734	1.346
Kids, no college degree	0.078	0.165	-7.980	0.417
Kids, college degree	0.203	0.634	-27.520	1.439
Married men with non-working spouse				
No kids, no college degree	0.087	0.148	-8.094	0.423
No kids, college degree	0.207	0.539	-23.105	1.208
Kids, no college degree	0.067	0.115	-6.112	0.320
Kids, college degree	0.206	0.591	-25.853	1.352
Married women				
No kids, no college degree	0.127	0.270	-10.440	0.546
No kids, college degree	0.234	0.595	-23.524	1.230
Kids, no college degree	0.110	0.271	-10.271	0.537
Kids, college degree	0.252	0.625	-23.391	1.223

Notes: Column 1 presents the pre-pandemic prevalence of remote work, for each household type. These rates are computed from the latest available 2018- 2019 waves of ATUS as fractions of hours of the employed worked remotely, and assumed to remain stabled through January, February and March. Column 2 reports the pandemic-caused telecommuting rate increments for April of 2020, for each household type. Column 3 reports the implied change in hours worked away from home between March and April. Column 4 reports the implied effects on weekly home production hours between March and April.
Source: American Time Use Survey, Current Population Survey, authors' calculations.

grooming, socializing with coworkers over drinks after work, going out for lunch while at work.[16] It is also meant to capture lower schedule flexibility typically associated with office jobs and therefore missed opportunities for school pickups and cooked dinners. The estimation results are given in Table 3.[17]

We proxy the added contribution of the rise in remote work to home production hours of the employed type j households as

$$\Delta h^{hp,j} = -\hat{\rho}\Delta h_j^{away}, \tag{4}$$

where the implied change in weekly hours worked away from home for the employed individuals, between March and April, is computed as $\Delta h_j^{away} = (1 - fr_{April,j}^{tele} - fr_{pre,j}^{tele})h_{April,j}^{emp} - (1 - fr_{pre,j}^{tele})h_{March,j}^{emp}$. The first term represents hours worked away from home in April – we assume that, in addition to workers that began

[16] These categories are classified as leisure activities.

[17] We estimate this model on post- Great Recession data in order to avoid recession-related trends. Our results are largely unaffected if we include year dummies in our specification: the estimate of the coefficient on hours worked away from home changes from -0.0523 to -0.0525 (see Table 3).

Table 3: Estimated Effects of Remote Work

	Home production hours (1)		Home production hours (2)	
$(1-fr^{tele})h$	-0.0523***	(0.005)	-0.0525***	(0.005)
h	-0.253***	(0.007)	-0.253***	(0.007)
Group Dummies				
Single men				
No kids, no college degree	0	(.)	0	(.)
No kids, college degree	0.768*	(0.354)	0.769*	(0.355)
Kids, no college degree	7.731***	(0.638)	7.739***	(0.638)
Kids, college degree	9.304***	(1.329)	9.343***	(1.332)
Single women				
No kids, no college degree	1.481***	(0.349)	1.496***	(0.349)
No kids, college degree	2.126***	(0.361)	2.115***	(0.361)
Kids, no college degree	13.34***	(0.507)	13.35***	(0.508)
Kids, college degree	14.25***	(0.682)	14.25***	(0.682)
Married men with working spouse				
No kids, no college degree	2.797***	(0.414)	2.819***	(0.414)
No kids, college degree	2.917***	(0.443)	2.927***	(0.443)
Kids, no college degree	7.957***	(0.402)	7.944***	(0.403)
Kids, college degree	9.839***	(0.365)	9.860***	(0.365)
Married men with non-working spouse				
No kids, no college degree	1.642**	(0.550)	1.638**	(0.550)
No kids, college degree	1.236	(0.651)	1.212	(0.651)
Kids, no college degree	5.534***	(0.455)	5.534***	(0.455)
Kids, college degree	6.930***	(0.469)	6.928***	(0.468)
Married women				
No kids, no college degree	6.012***	(0.411)	6.004***	(0.411)
No kids, college degree	4.927***	(0.445)	4.936***	(0.445)
Kids, no college degree	15.47***	(0.479)	15.46***	(0.480)
Kids, college degree	16.98***	(0.385)	17.00***	(0.384)
Year Dummies				
2010			0.797*	(0.383)
2011			0.755*	(0.382)
2012			0.216	(0.371)
2013			0.371	(0.386)
2014			-0.141	(0.368)
2015			0.177	(0.377)
2016			0.493	(0.387)
2017			0.0761	(0.391)
2018			0.300	(0.398)
2019			0	(.)
Constant	24.54***	(0.381)	24.22***	(0.477)
Observations	31270		31270	
R^2	0.3381		0.3385	

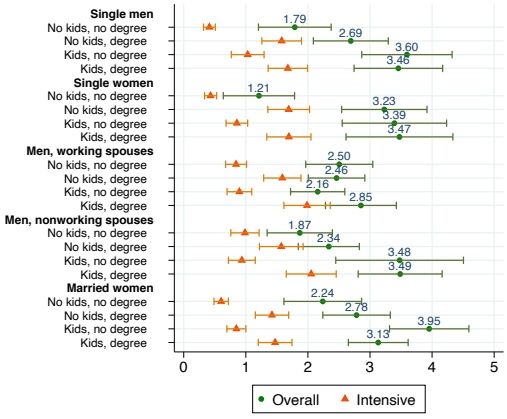
Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Notes: Column 1 presents weighted least squares estimates of the regression model (3), estimated on the sample of the employed in 2010-2019 ATUS data. Regressors include weekly market hours worked from home, weekly market hours, and household type dummies. Each observation is weighted with the sampling weight. Columns 2 presents the estimates for the specification that also includes the year dummies. Robust standard errors associated with the estimated coefficients are in parentheses.
Sources: American Time Use Survey, authors' calculations.

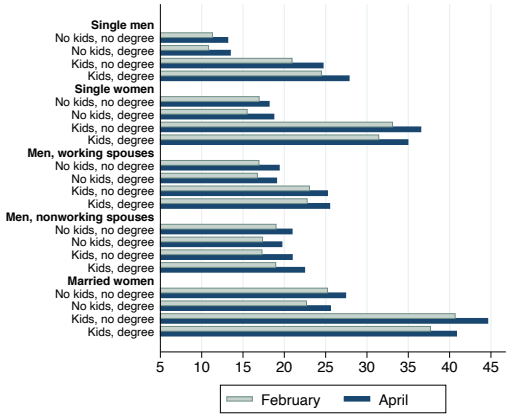
telecommuting due to the pandemic, those who telecommuted prior to the pandemic continued to do so. Column 3 of Table 2 reports Δh_j^{away} for each type. This is the total effect due to the change in hours worked away from home among the employed. On the one hand, the prevalence of telecommuting increased, but, on the other hand, total hours worked slightly declined even for the employed, which mitigated the impact of the rise in telecommunication. Column 4 of Table 2 reports the total effects on home production, $\Delta h^{hp,j}$. They range from 0.23 to 1.44 hours, with the college-educated workers affected the most as they switched to remote work in greater numbers.

Figure 6: Estimated Impact on Home Production Augmented with Remote Work Effects

(a) Augmented Impact on Home Production, by Group



(b) Augmented Home Production Estimates, Feb-April

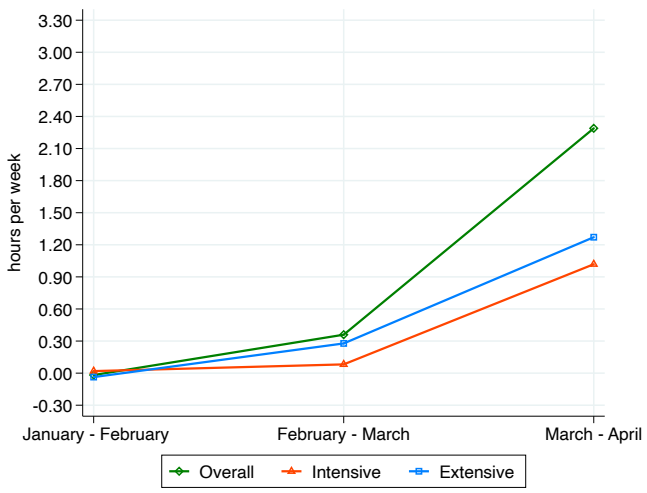


Notes: This figure summarizes our home production estimates augmented with remote work effects. Panel a reports predicted changes in home production hours for each type of household between February and April, 2020. The green marks entitled "Overall" refer to the total predicted change. The "Intensive" labels refer to the change implied by reduced hours of the employed and the rise in work-from-home arrangements. The "Extensive" labels refer to the change implied by the loss of jobs. The brackets mark 95% confidence intervals. Panel b illustrates predicted weekly home production hours, updated with remote work effects. The "February" bars refer to predicted weekly hours in February 2020. The "April" bars refer to predicted weekly hours in April 2020.
Sources: American Time Use Survey, Current Population Survey, authors' calculations.

We augment our earlier estimates of home production changes along the intensive margin, given in Figure 3 panel a, with $\{\Delta h^{hp,j}\}$ given in equation (4). The updated estimates are reported in Figure 6 panel a. The overall change is updated by the same amount, as it sums over the intensive and the extensive margins, the latter not affected by telecommuting. The updated predicted changes in home production hours between February and April now range from 1.21 to 3.95. Panel b helps visualize the actual hours spent on home production in February and April of 2020. It is clear that larger impacts were seen by groups that were already highly vested in that activity.

The aggregate impact on home production hours, updated with remote work effects, is reported in Fig-

Figure 7: Augmented Changes in Average Home Production Hours



Notes: This figure illustrates the estimated monthly aggregate changes in home production hours augmented with remote work effects. The remote work effect augments the intensive margin between March and April 2020. The green marks entitled "Overall" refer to the total predicted change. The "Intensive" labels refer to the change implied by reduced hours of the employed and the rise in work-from-home arrangements. The "Extensive" labels refer to the change implied by the loss of jobs.
Source: American Time Use Survey, Current Population Survey, authors' calculations.

ure 7. Compared to our earlier estimates illustrated in Figure 5 panel a, weekly home production hours among the employed (the intensive margin) increased by an additional 0.77 hours between March and April, bringing the cumulative increase between February and April to 2.65 hours. Because the remote work effect applies to the employed only, the intensive margin becomes more prevalent, now accounting for a 42% of the total predicted rise in home production hours.

The increase in the value of monthly home production between February and April updates to $39.65 billion – a $11.55 billion gain in value and a 13.55% of the estimated $292.61 billion drop in monthly GDP.

We also report the CPS changes in telecommuting rates for each remaining month in 2020 in Table 5 in the appendix. While the labor market picked up substantially by the end of 2020, work from home remained prevalent throughout the year. Even as late as in December, the telecommuting rate increments (relative to February) ranged from 35% to 45% among the college educated groups. As a result, the relative contribution of telecommuting to home production, when compared to market hours, increased throughout the rest of the year. We report our estimates of home production hours augmented with remote work effects, for each remaining month in 2020, in Table 7 in the appendix. Indeed, the college-educated groups for whom work from home arrangements persisted are predicted to bank at least half an hour more in terms of weekly home production hours, when compared to their counterparts without the college degree.

5 Childcare during the Lockdown Period

We made adjustments to our home production estimates to account for the rise in telecommuting. However, our estimates of home production are still understated for household types with small children, because of school and daycare closures during the lockdown. In this section, we make an additional adjustment for those types of households.

There are several private surveys that were conducted during the lockdown in various countries and differed in focus. Several asked the respondents to proxy hours spent on childcare and homeschooling (e.g. Adams-Prassl et al. [2020] for the U.S., U.K. and Germany, Oreffice and Quintana-Domeque [2020] for the U.K., and Farré et al. [2020] for Spain). None of these surveys are based on time diaries, which deems them less accurate. It also makes it impossible to distinguish between primary and secondary activities. However, we decided to report how our estimates would change with an added effect of school closures estimated in Farré et al. [2020]. We chose this paper because its results are based on a panel survey and the regression specification includes controls consistent with those used in our analysis (e.g. the effects of job losses are already accounted for). Table 3 in Farré et al. [2020] shows that the lockdown triggered a 3.81 hour increase in weekly childcare time for all adults with children and an additional 2.935 hour increase for women with children. Thus, we added on 3.81 hours to home production estimates for male types with children and 6.745 hours to female types with children.

Compared to our earlier estimates with remote work effects added on, weekly home production hours increased by an additional 2.27 hours between March and April, bringing the cumulative increase between February and April to 4.92 hours, or 79% of the 6.25 hour drop in market hours.[18] The increase in the value of monthly home production between February and April updates to $73.57 billion – a 25.14% of the estimated $292.61 billion drop in monthly GDP.

While we have adjusted our estimates of home production during the lockdown with childcare-related time, we have not done so for the home production estimates for the remaining months in 2020 (reported in Table 7). This is because the regression in Farré et al. [2020] was estimated on time use data during the strict lockdown period, and therefore applying its estimates would likely cause us to overstate home production hours for the months outside of the strict lockdown period. One should interpret the May through December estimates reported in Table 7 as representing the lower bound on home production hours.

[18] Note that the increased need in childcare, if we believe the estimates in Farré et al. [2020], would necessarily offset most of the implied increase in leisure due to the direct effect of lost market hours.

6 Conclusions

We documented the loss of employment and reduction of total market hours for different types of households for each month in 2020. We focused on the period between February and April which saw the largest drop in market hours and during which the ATUS was suspended. Hardest hit were the less educated workers and households with children. In contrast to other recessions, men and women experienced similar drops in hours. We estimated that home production activity increased by 1.9 hours a week (or 30% of the 6.25 hour drop in market hours), as a direct result of lost market hours. Although market hours declined the most for single, less educated individuals, the lost market hours were absorbed into home production the most by married individuals with children.

With remote work effects added on, which mainly impacted college-educated households, our estimate for the increase in home production activity rose to 2.65 hours a week, or 42.4% of lost market hours. Evaluating this change at wage rates paid in sectors that substitute for home production, we estimated that the monthly value of home production increased by $39.65 billion – that is 13.55% of the concurrent $292.61 billion drop in monthly GDP. Finally, adding on the impact of school closures on childcare hours, we found that weekly home production hours increased by an additional 2.27 hours between March and April, bringing the cumulative increase between February and April to 4.92 hours. The increase in the value of monthly home production between February and April updates to $73.57 billion – a 25.14% of the estimated $292.61 billion drop in monthly GDP.

We also reported the estimated changes in home production hours, as predicted by the evolution of market hours and prevalence of telecommuting, for the remaining months of 2020.

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Table 4: Market Hours during 2020

Household Type	Level	Change in Market Hours Relative to February									
	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Single men											
No kids, no college degree	23.60	-1.63	-7.32	-5.62	-3.37	-2.27	-1.73	-1.71	-1.07	-1.93	-2.09
	37.52	*-0.47*	*-0.72*	*-0.57*	*-0.07*	*0.05*	*0.41*	*0.27*	*0.13*	*-0.14*	*-0.04*
No kids, college degree	34.47	-1.10	-6.30	-4.86	-5.04	-4.80	-3.66	-3.40	-2.26	-2.55	-2.36
	41.51	*-0.55*	*-1.32*	*-0.94*	*-0.94*	*-0.62*	*-0.51*	*-0.64*	*-0.77*	*-0.70*	*-0.31*
Kids, no college degree	29.82	-0.69	-7.84	-5.01	-2.04	-0.68	-0.30	-0.69	-0.15	0.16	0.13
	41.09	*-0.61*	*-2.08*	*-1.14*	*-0.35*	*0.27*	*0.43*	*0.35*	*0.27*	*0.21*	*0.35*
Kids, college degree	35.91	-0.94	-5.74	-1.40	-2.72	-2.39	-3.12	-2.24	-3.26	-2.47	-0.01
	42.79	*0.32*	*-1.16*	*-0.03*	*-1.22*	*-0.23*	*-0.39*	*-0.18*	*0.04*	*-0.68*	*0.42*
Single women											
No kids, no college degree	19.89	-1.08	-7.09	-5.36	-3.11	-2.47	-2.35	-2.38	-1.85	-1.96	-1.69
	34.02	*0.01*	*-0.27*	*-0.15*	*-0.05*	*0.10*	*0.28*	*0.02*	*-0.25*	*-0.16*	*0.17*
No kids, college degree	32.64	-1.76	-6.10	-6.12	-5.51	-7.04	-5.17	-3.40	-1.86	-2.71	-1.83
	39.82	*-0.32*	*-1.17*	*-1.27*	*-0.76*	*-1.17*	*-0.85*	*-0.67*	*-0.48*	*-0.99*	*-0.43*
Kids, no college degree	24.26	-1.23	-7.82	-6.40	-5.10	-4.92	-3.30	-3.22	-2.21	-1.48	-1.92
	36.95	*-0.44*	*-1.12*	*-1.00*	*-0.50*	*-0.88*	*-0.43*	*-0.34*	*-0.24*	*-0.03*	*0.02*
Kids, college degree	33.72	-0.54	-6.29	-6.08	-5.64	-5.54	-3.88	-2.22	-2.28	-3.50	-2.88
	39.90	*0.20*	*-1.33*	*-1.14*	*-0.98*	*-1.01*	*-0.18*	*-0.24*	*-0.29*	*-0.84*	*0.00*
Married men with working spouse											
No kids, no college degree	34.18	-0.27	-5.74	-3.52	-2.48	-0.86	-0.46	-0.79	-0.38	-1.48	-1.32
	42.11	*0.09*	*-0.91*	*-0.43*	*-0.13*	*0.49*	*0.82*	*0.50*	*0.17*	*-0.58*	*-0.29*
No kids, college degree	39.01	0.25	-3.26	-2.81	-4.10	-3.43	-3.10	-1.98	-0.68	-1.35	-0.67
	42.82	*0.04*	*-0.63*	*-0.58*	*-1.27*	*-0.96*	*-0.84*	*-0.45*	*-0.04*	*-0.36*	*-0.10*
Kids, no college degree	37.53	-0.66	-5.75	-4.00	-2.72	-2.30	-1.62	-1.53	-1.43	-2.00	-1.84
	43.00	*-0.50*	*-1.56*	*-0.95*	*-0.55*	*-0.39*	*-0.19*	*-0.22*	*-0.25*	*-0.64*	*-0.53*
Kids, college degree	40.87	-0.80	-4.19	-2.78	-2.85	-3.06	-1.69	-1.36	-1.29	-1.35	-1.29
	43.33	*-0.31*	*-1.62*	*-1.26*	*-1.01*	*-0.94*	*-0.31*	*-0.26*	*-0.20*	*-0.54*	*-0.44*
Married men with non-working spouse											
No kids, no college degree	24.06	-0.85	-4.64	-3.33	-2.03	-1.69	-1.19	-0.63	-0.07	-0.98	-1.76
	41.67	*-0.05*	*-1.39*	*-0.89*	*-0.34*	*-0.13*	*0.15*	*0.03*	*-0.09*	*-0.17*	*-0.34*
No kids, college degree	29.11	-1.04	-3.00	-3.25	-2.57	-3.59	-1.26	-0.96	-0.75	-1.37	-2.20
	43.37	*-0.64*	*-1.28*	*-1.28*	*-0.58*	*-1.32*	*-0.66*	*-0.72*	*-0.78*	*-1.70*	*-0.51*
Kids, no college degree	35.13	-2.37	-9.61	-7.11	-4.66	-4.30	-3.83	-2.34	-2.72	-2.71	-3.63
	42.58	*-0.67*	*-1.81*	*-1.40*	*-1.05*	*-0.25*	*-0.61*	*-0.57*	*-0.52*	*-0.63*	*-0.58*
Kids, college degree	39.57	-1.78	-5.15	-3.98	-2.44	-5.30	-3.74	-1.80	-1.76	-1.66	-1.59
	44.68	*-1.04*	*-1.70*	*-1.55*	*-0.99*	*-1.36*	*-1.54*	*-1.42*	*-1.30*	*-1.34*	*-1.33*
Married women											
No kids, no college degree	21.49	-0.46	-5.34	-4.81	-3.18	-3.12	-2.07	-1.68	-1.32	-1.54	-1.66
	36.54	*0.23*	*-0.16*	*-0.28*	*0.04*	*0.18*	*0.26*	*0.19*	*0.11*	*-0.27*	*0.05*
No kids, college degree	28.66	-0.54	-4.26	-2.78	-4.35	-5.51	-3.01	-1.38	-1.10	-0.90	-0.16
	39.24	*0.00*	*-0.56*	*-0.55*	*-0.60*	*-0.98*	*-0.51*	*-0.29*	*-0.07*	*-0.27*	*0.37*
Kids, no college degree	21.19	-1.26	-6.46	-4.96	-3.26	-3.22	-2.57	-1.82	-1.16	-1.22	-0.87
	36.10	*-0.20*	*-0.64*	*-0.47*	*-0.36*	*-0.32*	*-0.13*	*-0.08*	*-0.03*	*-0.23*	*0.18*
Kids, college degree	27.92	-0.62	-3.97	-2.78	-4.38	-5.94	-3.56	-1.53	-1.18	-0.81	-0.14
	37.23	*0.03*	*-0.61*	*-0.29*	*-0.40*	*-0.49*	*-0.34*	*-0.09*	*0.17*	*0.27*	*0.80*
Aggregate	27.96	-1.05	-6.25	-4.77	-3.63	-3.58	-2.52	-1.97	-1.45	-1.73	-1.57
	39.19	*-0.21*	*-0.74*	*-0.54*	*-0.32*	*-0.26*	*-0.02*	*-0.06*	*-0.11*	*-0.30*	*0.00*

Notes: February average weekly market hours for each group are reported in Column 1. Columns 2-11 contain changes in market hours relative to February, for each month in 2020. Gray slanted numbers indicate level/changes in the average hours of the employed (the "intensive margin").
Source: Current Population Survey, authors' calculations.

Table 5: Telecommuting during 2020

Household Type	Level	Change in Fraction of Working Remotely Relative to February									
	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Single men											
No kids, no college degree	0.06	.	0.11	0.10	0.09	0.08	0.07	0.06	0.07	0.07	0.07
No kids, college degree	0.16	.	0.57	0.52	0.47	0.45	0.42	0.40	0.39	0.43	0.42
Kids, no college degree	0.05	.	0.10	0.08	0.09	0.06	0.06	0.05	0.05	0.06	0.06
Kids, college degree	0.24	.	0.52	0.49	0.43	0.39	0.37	0.34	0.34	0.36	0.35
Single women											
No kids, no college degree	0.08	.	0.21	0.16	0.15	0.13	0.13	0.11	0.11	0.12	0.11
No kids, college degree	0.16	.	0.64	0.57	0.48	0.46	0.44	0.43	0.44	0.45	0.45
Kids, no college degree	0.06	.	0.22	0.18	0.15	0.13	0.13	0.12	0.12	0.13	0.12
Kids, college degree	0.19	.	0.58	0.54	0.43	0.39	0.41	0.39	0.38	0.43	0.41
Married men with working spouse											
No kids, no college degree	0.10	.	0.19	0.14	0.13	0.11	0.08	0.08	0.08	0.10	0.10
No kids, college degree	0.21	.	0.60	0.54	0.46	0.43	0.38	0.41	0.42	0.44	0.45
Kids, no college degree	0.08	.	0.17	0.13	0.11	0.10	0.09	0.08	0.09	0.10	0.09
Kids, college degree	0.20	.	0.63	0.55	0.51	0.47	0.44	0.42	0.42	0.43	0.45
Married men with non-working spouse											
No kids, no college degree	0.09	.	0.15	0.13	0.12	0.12	0.08	0.09	0.11	0.10	0.10
No kids, college degree	0.21	.	0.54	0.51	0.45	0.41	0.41	0.39	0.38	0.41	0.41
Kids, no college degree	0.07	.	0.12	0.12	0.10	0.08	0.07	0.06	0.06	0.08	0.07
Kids, college degree	0.21	.	0.59	0.55	0.50	0.47	0.45	0.43	0.42	0.47	0.45
Married women											
No kids, no college degree	0.13	.	0.27	0.24	0.20	0.17	0.15	0.14	0.16	0.17	0.16
No kids, college degree	0.23	.	0.60	0.55	0.46	0.42	0.39	0.38	0.39	0.43	0.43
Kids, no college degree	0.11	.	0.27	0.25	0.18	0.16	0.15	0.15	0.15	0.16	0.15
Kids, college degree	0.25	.	0.63	0.55	0.44	0.43	0.42	0.39	0.40	0.43	0.41
Aggregate	0.129	.	0.360	0.327	0.274	0.247	0.233	0.220	0.224	0.240	0.236

Notes: Column 1 presents the pre-pandemic (February) prevalence of remote work, for each group. These rates are computed as fractions of hours of the employed worked remotely, and based on the 2018-2019 waves of ATUS. Columns 2-11 contain gains in this measure of remote work prevalence relative to February, for each month in 2020. The question regarding telecommuting due to the pandemic was first introduced in CPS in May. Each month, the telecommuting question refers to the four week period whose last week includes the 12th day of that month. We use May CPS to proxy telecommuting in April, June CPS to proxy telecommuting in May and so forth.
Source: American Time Use Survey, Current Population Survey, authors' calculations.

Table 6: Home Production in 2020: Estimates Based on Changing Market Hours

Household Type	Level Feb.	Change in Home Production Relative to February									
		Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Single men											
No kids, no college degree	11.31	0.35	1.56	1.19	0.72	0.48	0.37	0.36	0.23	0.41	0.44
		(0.06)	(0.28)	(0.21)	(0.13)	(0.09)	(0.07)	(0.06)	(0.04)	(0.07)	(0.08)
No kids, college degree	10.83	0.25	1.46	1.13	1.17	1.11	0.85	0.79	0.52	0.59	0.55
		(0.03)	(0.19)	(0.15)	(0.15)	(0.15)	(0.11)	(0.10)	(0.07)	(0.08)	(0.07)
Kids, no college degree	20.94	0.29	3.29	2.10	0.85	0.29	0.13	0.29	0.06	-0.07	-0.06
		(0.03)	(0.34)	(0.22)	(0.09)	(0.03)	(0.01)	(0.03)	(0.01)	(0.01)	(0.01)
Kids, college degree	24.49	0.37	2.27	0.55	1.07	0.94	1.23	0.88	1.29	0.98	0.00
		(0.04)	(0.25)	(0.06)	(0.12)	(0.10)	(0.14)	(0.10)	(0.14)	(0.11)	(0.00)
Single women											
No kids, no college degree	16.96	0.13	0.82	0.62	0.36	0.29	0.27	0.28	0.21	0.23	0.20
		(0.04)	(0.26)	(0.19)	(0.11)	(0.09)	(0.09)	(0.09)	(0.07)	(0.07)	(0.06)
No kids, college degree	15.50	0.55	1.91	1.92	1.73	2.20	1.62	1.06	0.58	0.85	0.57
		(0.07)	(0.22)	(0.23)	(0.20)	(0.26)	(0.19)	(0.13)	(0.07)	(0.10)	(0.07)
Kids, no college degree	33.10	0.46	2.93	2.39	1.91	1.84	1.23	1.21	0.83	0.55	0.72
		(0.06)	(0.38)	(0.31)	(0.25)	(0.24)	(0.16)	(0.16)	(0.11)	(0.07)	(0.09)
Kids, college degree	31.43	0.19	2.23	2.16	2.00	1.97	1.38	0.79	0.81	1.24	1.02
		(0.03)	(0.32)	(0.31)	(0.29)	(0.28)	(0.20)	(0.11)	(0.12)	(0.18)	(0.15)
Married men with working spouse											
No kids, no college degree	16.94	0.10	2.05	1.26	0.89	0.31	0.16	0.28	0.14	0.53	0.47
		(0.01)	(0.23)	(0.14)	(0.10)	(0.04)	(0.02)	(0.03)	(0.02)	(0.06)	(0.05)
No kids, college degree	16.74	-0.09	1.12	0.96	1.41	1.18	1.06	0.68	0.23	0.46	0.23
		(-0.01)	(0.10)	(0.09)	(0.13)	(0.11)	(0.10)	(0.06)	(0.02)	(0.04)	(0.02)
Kids, no college degree	23.04	0.20	1.74	1.21	0.82	0.70	0.49	0.46	0.43	0.60	0.56
		(0.02)	(0.18)	(0.13)	(0.09)	(0.07)	(0.05)	(0.05)	(0.05)	(0.06)	(0.06)
Kids, college degree	22.76	0.27	1.41	0.94	0.96	1.03	0.57	0.46	0.44	0.46	0.44
		(0.03)	(0.15)	(0.10)	(0.11)	(0.11)	(0.06)	(0.05)	(0.05)	(0.05)	(0.05)
Married men with non-working spouse											
No kids, no college degree	19.00	0.26	1.45	1.04	0.63	0.53	0.37	0.20	0.02	0.30	0.55
		(0.04)	(0.23)	(0.16)	(0.10)	(0.08)	(0.06)	(0.03)	(0.00)	(0.05)	(0.09)
No kids, college degree	17.37	0.39	1.13	1.22	0.97	1.35	0.48	0.36	0.28	0.51	0.83
		(0.05)	(0.14)	(0.15)	(0.12)	(0.16)	(0.06)	(0.04)	(0.03)	(0.06)	(0.10)
Kids, no college degree	17.30	0.78	3.16	2.34	1.53	1.41	1.26	0.77	0.90	0.89	1.19
		(0.12)	(0.49)	(0.37)	(0.24)	(0.22)	(0.20)	(0.12)	(0.14)	(0.14)	(0.19)
Kids, college degree	18.96	0.74	2.13	1.65	1.01	2.20	1.55	0.75	0.73	0.69	0.66
		(0.08)	(0.22)	(0.17)	(0.10)	(0.22)	(0.16)	(0.08)	(0.07)	(0.07)	(0.07)
Married women											
No kids, no college degree	25.23	0.15	1.69	1.53	1.01	0.99	0.66	0.53	0.42	0.49	0.53
		(0.02)	(0.27)	(0.24)	(0.16)	(0.16)	(0.10)	(0.08)	(0.07)	(0.08)	(0.08)
No kids, college degree	22.69	0.20	1.55	1.01	1.58	2.01	1.10	0.50	0.40	0.33	0.06
		(0.02)	(0.16)	(0.10)	(0.16)	(0.21)	(0.11)	(0.05)	(0.04)	(0.03)	(0.01)
Kids, no college degree	40.67	0.66	3.42	2.62	1.72	1.70	1.36	0.96	0.62	0.64	0.46
		(0.05)	(0.28)	(0.21)	(0.14)	(0.14)	(0.11)	(0.08)	(0.05)	(0.05)	(0.04)
Kids, college degree	37.69	0.30	1.91	1.34	2.11	2.86	1.71	0.73	0.57	0.39	0.07
		(0.02)	(0.13)	(0.09)	(0.14)	(0.19)	(0.12)	(0.05)	(0.04)	(0.03)	(0.01)
Aggregate	21.81	0.36	1.88	1.42	1.14	1.19	0.78	0.55	0.42	0.47	0.46
		(0.04)	(0.24)	(0.18)	(0.15)	(0.15)	(0.10)	(0.08)	(0.06)	(0.07)	(0.06)

Notes: In Column 1, we report our pre-pandemic (February) estimate of weekly home production hours. Columns 2-11 contain the estimated change in home production hours relative to February, as predicted by market hours alone (Section 3.3).
Sources: American Time Use Survey, Current Population Survey, authors' calculations.

Table 7: Home Production in 2020: Estimates Based on Changing Market Hours and Remote Work

Household Type	Level Feb.	Change in Home Production (with Working Remotely) Relative to February									
		Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Single men											
No kids, no college degree	11.31	0.35	1.79	1.39	0.85	0.58	0.42	0.41	0.30	0.52	0.53
		(0.06)	(0.30)	(0.23)	(0.14)	(0.10)	(0.07)	(0.07)	(0.05)	(0.08)	(0.09)
No kids, college degree	10.83	0.25	2.69	2.25	2.19	2.07	1.75	1.63	1.35	1.51	1.43
		(0.03)	(0.31)	(0.25)	(0.25)	(0.24)	(0.20)	(0.18)	(0.15)	(0.16)	(0.16)
Kids, no college degree	20.94	0.29	3.60	2.30	1.02	0.34	0.17	0.32	0.11	0.01	0.00
		(0.03)	(0.37)	(0.24)	(0.10)	(0.04)	(0.02)	(0.03)	(0.01)	(0.00)	(0.00)
Kids, college degree	24.49	0.37	3.46	1.66	2.07	1.83	2.09	1.67	2.05	1.82	0.78
		(0.04)	(0.36)	(0.17)	(0.21)	(0.19)	(0.22)	(0.17)	(0.22)	(0.19)	(0.07)
Single women											
No kids, no college degree	16.96	0.13	1.21	0.92	0.63	0.50	0.47	0.46	0.42	0.45	0.38
		(0.04)	(0.29)	(0.22)	(0.14)	(0.11)	(0.10)	(0.10)	(0.09)	(0.09)	(0.08)
No kids, college degree	15.50	0.55	3.23	3.12	2.73	3.16	2.53	1.95	1.49	1.79	1.51
		(0.07)	(0.35)	(0.34)	(0.30)	(0.35)	(0.28)	(0.21)	(0.15)	(0.19)	(0.16)
Kids, no college degree	33.10	0.46	3.39	2.76	2.19	2.11	1.48	1.42	1.04	0.77	0.92
		(0.06)	(0.43)	(0.35)	(0.28)	(0.27)	(0.19)	(0.18)	(0.13)	(0.09)	(0.11)
Kids, college degree	31.43	0.19	3.47	3.32	2.93	2.82	2.23	1.61	1.62	2.18	1.88
		(0.03)	(0.44)	(0.42)	(0.38)	(0.36)	(0.28)	(0.19)	(0.19)	(0.27)	(0.23)
Married men with working spouse											
No kids, no college degree	16.94	0.10	2.51	1.58	1.17	0.52	0.31	0.43	0.31	0.78	0.71
		(0.01)	(0.28)	(0.17)	(0.13)	(0.05)	(0.03)	(0.05)	(0.03)	(0.08)	(0.08)
No kids, college degree	16.74	-0.09	2.46	2.19	2.46	2.16	1.95	1.60	1.17	1.46	1.23
		(-0.01)	(0.23)	(0.21)	(0.23)	(0.20)	(0.18)	(0.15)	(0.11)	(0.14)	(0.12)
Kids, no college degree	23.04	0.20	2.16	1.52	1.06	0.91	0.68	0.62	0.63	0.83	0.76
		(0.02)	(0.22)	(0.16)	(0.11)	(0.09)	(0.07)	(0.06)	(0.06)	(0.09)	(0.08)
Kids, college degree	22.76	0.27	2.85	2.20	2.13	2.10	1.55	1.39	1.38	1.44	1.45
		(0.03)	(0.29)	(0.22)	(0.22)	(0.21)	(0.16)	(0.14)	(0.14)	(0.14)	(0.14)
Married men with non-working spouse											
No kids, no college degree	19.00	0.26	1.87	1.38	0.90	0.79	0.52	0.39	0.25	0.52	0.79
		(0.04)	(0.27)	(0.20)	(0.13)	(0.11)	(0.07)	(0.05)	(0.03)	(0.07)	(0.11)
No kids, college degree	17.37	0.39	2.34	2.36	1.95	2.28	1.39	1.22	1.13	1.46	1.73
		(0.05)	(0.25)	(0.26)	(0.21)	(0.25)	(0.14)	(0.13)	(0.11)	(0.15)	(0.19)
Kids, no college degree	17.30	0.78	3.48	2.64	1.78	1.56	1.42	0.90	1.03	1.05	1.35
		(0.12)	(0.52)	(0.40)	(0.26)	(0.24)	(0.21)	(0.13)	(0.15)	(0.15)	(0.20)
Kids, college degree	18.96	0.74	3.49	2.91	2.14	3.27	2.58	1.73	1.70	1.77	1.68
		(0.08)	(0.34)	(0.29)	(0.21)	(0.32)	(0.25)	(0.17)	(0.17)	(0.17)	(0.16)
Married women											
No kids, no college degree	25.23	0.15	2.24	2.02	1.41	1.32	0.94	0.80	0.73	0.85	0.84
		(0.02)	(0.32)	(0.29)	(0.20)	(0.19)	(0.13)	(0.11)	(0.10)	(0.11)	(0.11)
No kids, college degree	22.69	0.20	2.78	2.14	2.54	2.90	1.92	1.28	1.20	1.22	0.94
		(0.02)	(0.28)	(0.21)	(0.25)	(0.29)	(0.19)	(0.13)	(0.12)	(0.12)	(0.09)
Kids, no college degree	40.67	0.66	3.95	3.11	2.06	2.02	1.63	1.22	0.89	0.95	0.72
		(0.05)	(0.33)	(0.26)	(0.17)	(0.17)	(0.13)	(0.10)	(0.08)	(0.08)	(0.06)
Kids, college degree	37.69	0.30	3.13	2.42	2.98	3.70	2.53	1.50	1.34	1.21	0.84
		(0.02)	(0.25)	(0.19)	(0.23)	(0.27)	(0.19)	(0.12)	(0.11)	(0.10)	(0.08)
Aggregate	28.21	0.36	2.65	2.10	1.71	1.71	1.26	1.00	0.89	0.99	0.95
		(0.04)	(0.32)	(0.25)	(0.20)	(0.20)	(0.15)	(0.12)	(0.11)	(0.12)	(0.11)

Notes: In Column 1, we report our pre-pandemic (February) estimate of weekly home production hours. Columns 2-11 contain the estimated change in home production hours relative to February, as predicted by market hours and remote work (Section 4).
Source: American Time Use Survey, Current Population Survey, authors' calculations.