# Work from Home After the COVID-19 Outbreak

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## Abstract

Based on rich novel survey data on almost 5,000 working age adults, we document that 35.2 percent of the workforce worked entirely from home in May 2020, up from 8.2 percent in February 2020. Highly educated, high-income and white individuals were much more likely to shift to remote work and to maintain employment following the virus outbreak. Using available estimates of the potential number of home-based workers suggests that a large majority (71.7 percent) of US workers that could work from home, effectively did so in May. We provide some evidence indicating that apart from the potential for home-based work, industry business conditions and labor demand also mattered for employment outcomes following the virus outbreak.

**Keywords:** COVID-19, working from home, telecommuting, social distancing, employment

**JEL Classifications**: J1, J2, J22, I18, R4

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# 1 Introduction

The global COVID-19 pandemic has led to widespread physical distancing to contain the spread of the virus. Many businesses scaled back or ceased operations in the regular workplace because of government-mandated closures and stay-at-home orders, concerns for the health of their employees, or a lack of customers. Some workers were able to transition to remote work relatively easily. In many jobs, however, performing regular work activities from home is impossible, forcing many workers to become inactive or look for a new job. Quantifying both the potential and effective home-based work behavior of workers is important for evaluating the costs and benefits of virus containment policies, and for formulating optimal reopening strategies.[1]

In this paper, we present evidence on how many US workers shifted to remote work in the months after the pandemic outbreak. This evidence is based on survey questions about commuting behavior in the Real-Time Population Survey (RPS).[2] The RPS is a novel bi-weekly online survey with around 2000 respondents selected to be representative of the US population. The survey is designed to correspond closely to the basic module of the Current Population Survey (CPS), such that the indicators of labor market status are directly comparable to those of the Bureau of Labor Statistics (BLS). Our baseline results combine the results of two survey weeks in May (starting May 10 and May 26). Since we also ask the respondents the same questions about their spouse or partner if they live in the same household as the respondent, we have information on nearly 5,000 working age adults. Retrospective questions about February allow us trace these individuals' labor market status and commuting behavior since the start of the pandemic.

Our main findings based on the RPS are the following:

- Of all those employed in May, 35.2 percent worked entirely from home, whereas 8.2 percent reported doing so in February.

- Of all workers commuting daily in February, only 43.7 percent continued doing so in May, while 28.6 percent report working from home at least once per week and 27.7 percent were no longer employed in May. Among workers who switched from daily commuting in February to working from home, almost 70 percent did not commute to work at all in May. The increase in telecommuting among those employed in May explains just over half (52.7%) of the overall reduction in commuting volume, with reductions in labor supply explaining the remainder.

- Workers that were already telecommuting before the pandemic transitioned to non-employment at almost the same rate as those that were commuting daily. Many home-

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[1]Examples of analyses in which the scope for home-based work matters include Jones, Philippon, and Venkateswaran (2020), Baqaee et al. (2020), and Leibovici and Santacreu (2020).

[2]The RPS was initially designed by Bick and Blandin (2020), and is conducted in collaboration with the Federal Reserve Bank of Dallas.

based workers lost employment in contact-sensitive sectors that were hard-hit by social distancing, which indicates that industry business conditions and labor demand also shaped employment losses following the virus outbreak.

- Whether workers switched to telecommuting or became inactive varies greatly across different socioeconomic groups and in line with predictions on the potential for home-based work: Switching to remote work was much more prevalent among highly educated, high income, and white workers, and much less among minorities, workers with lower incomes, and high school degrees.

- Using estimates by Dingel and Neiman (2020) of the number of potential home-based workers, we find that the ratio of effective to potential home-based workers was 71.7 percent in May. This suggests that the majority of US workers that could work from home did so in May. However, this leaves an additional 28.3 percent of potential home-based workers who could switch to telecommuting to help contain the virus, with the education, information, and finance sectors among the industries with the greatest further potential for additional home-based work.

The rest of the paper is structured as follows: Section 2 first provides some evidence on telecommuting before the pandemic. Section 3 documents the basic facts regarding changes in commuting behavior and transitions into non-employment from February to May. Section 4 describes how the impact of COVID-19 on remote work and employment status varies among different socioeconomic groups. Section 5 compares the effective number of home-based workers to the number of potential telecomuters.

## 2  Work from Home Before COVID-19

How many US workers were working remotely before the pandemic? Table 1 summarizes the evidence from the Real-Time Population Survey as well as a number of other surveys.[3]

The RPS for the weeks of May 10-16 and May 24-30 contains retrospective questions asking those employed in February how many days per week they usually worked in February.[4] The survey asks the same question about days commuting to work. Based on sample of 3587 individuals aged 18-64 and employed in February, 75.4 percent report that they commuted to work every day, and 16.4 percent on some days. The fraction of workers working exclusively from home – i.e., every day they worked in February, they worked at home – was 8.2 percent.

The RPS evidence on pre-COVID home-based work can be compared to evidence from several other surveys. For example, the Work Schedule Topical Module in the Survey of Income and Program Participation (SIPP) contains information on work from home. Mateyka, Rapino,

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[3]Appendix A provides more details on the RPS

[4]Bick and Blandin (2020) document that the retrospective questions about employment and hours worked yield aggregate employment rates and average hours worked that are close to those from the February CPS.

| | | RPS Feb 2020 | SIPP 2010 | ATUS 2017/18 |
|---|---|---|---|---|
| a. | Commuting to Work Every Day (%) | 75.4 | 91.0 | 87.0 |
| | Commuting on Some Days (%) | 16.4 | 2.8 | 10.2 |
| | Working from Home Every Day (%) | 8.2 | 6.6 | 2.8 |
| b. | Avg. Days Worked per Week | 4.8 | | 4.7 |
| | Fraction of Work Days Commuting (%) | 85.0 | | 84.2 |

| | | NHTS 2017 | ACS 2018 | Brynjolfsson et al. (2020) |
|---|---|---|---|---|
| c. | (Usually) Working from Home (%) | 11.9 | 5.0 | 14.6 |
| | Option of Working from Home (%) | 16.3 | | |

*Notes*: RPS, Real-Time Population Survey. SIPP, Survey of Income and Program Participation. ATUS, American Time Use Survey. NHTS, National Household Travel Survey. RPS results are for the May 10-16 and May 24-30 reference weeks and for adults aged 18-64.

and Landivar (2012) use this module to estimate the prevalence of work from home in 2010. They calculate that 6.6 percent of all workers worked exclusively from home, which is roughly in line with the RPS estimate, in particular after allowing for a likely upward trend in remote work. They calculate that 2.8 percent were mixed workers, defined as those who worked at home at least 1 full day a week but also worked other days in a location outside of their home. This number is considerably lower than the fraction of RPS respondents that report commuting on some days.

The American Time Use Survey (ATUS) is another source of data on work from home. There are two sources of information within the ATUS survey. The first is the Leave and Job Flexibilities Module, which asks workers a series of questions about how often they usually work from home. Based on the usual number of days worked and the question "How often do you work from home", we calculate the fraction of workers that commute daily, on some days, or never. The results are shown in panel (a) of Table 1, and indicate that 2.8 percent of all workers report working from home every day, and 10.2 percent on some days (at least once a month). Collectively, these results indicate that work from home behavior is less common in the Leave and Job Flexibilities Module of ATUS than in the February RPS.

The second source of data on work from home is the ATUS time diary. Panel (b) in Table 1 presents estimates from the regular time diary on the fraction of work days actually commuted by ATUS respondents. Workers aged 18-64 worked an average of 4.7 days per week in the February 2017-2018 ATUS, versus 4.8 days in the RPS for February 2020. They commuted

84.2 percent of work days in the ATUS versus 85.0 percent of work days in the RPS. Also using ATUS time diary data, Hensvik, Le Barbanchon, and Rathelot (2020) find that around 15 percent of working hours are performed at home in the US from 2011 to 2018. Overall, the commuting patterns in the time diary of the ATUS look much more similar to those in the RPS than those in the Leave and Job Flexibilities Module.

Panel (c) in Table 1 provides some additional pieces of evidence based on survey questions about usual commuting behavior. The first piece is from the Department of Transportation's National Household Travel Survey (NHTS). In the most recent NHTS survey for 2017, 11.9 percent of respondents say they usually work from home, while 16.3 percent report having the option of working from home. These numbers appear broadly consistent with the evidence in the RPS. The second is from the American Community Survey (ACS), which also contains some information about commuting behavior. Based on 2018 ACS data, we find that 5.0 percent of the U.S. workforce aged 18-64 reports usually working from home, which appears somewhat less than suggested by the RPS estimates. Finally, in a recent survey Brynjolfsson et al. (2020) finds that 14.6 percent of workers report that they were already working from home just before the COVID-19 outbreak. Their survey question implies working from home all the time. However, given the precise meaning of questions can be unclear to survey respondents, we consider their estimate of 14.6 percent as largely consistent with the RPS.

Overall, we view the RPS estimates of how many people work remotely before the pandemic appears as broadly consistent with the evidence of existing surveys.

## 3 Commuting Following the COVID-19 Outbreak

In mid-March, the coronavirus outbreak triggered broad-based sheltering-in-place and the closures of many non-essential businesses. One of the consequences of the social distancing was a sharp reduction in commuting to work. Google mobility metrics, for example, show a decrease of approximately 40 percent in workplace visits in May compared to the Feb 10 - Mar 8 baseline.[5] Mobility metrics derived from geolocation data, however, do not reveal to what extent commuting declined because people switched to remote work or because they stopped working.

Table 2 provides insights into the causes of the overall reduction in commuting based on evidence in the RPS. According to the RPS, the total number of weekly commuting trips in May declined by 51.9 percent, or 73.2 log points, compared to February, which is somewhat more than suggested by the Google mobility metrics. The total number of weekly commuting trips is the product of the number of workers, the average number of days worked per worker, and the average fraction of work days commuting. The rows in Table 2 show how each of these components changed between February and May, and the last column provides the log points contribution to the total decline in weekly commuting trips.

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[5]See https://www.google.com/covid19/mobility/.

| | February | May | Change in Log Points |
|---|---|---|---|
| Employment Rate (%) | 73.2 | 54.0 | -30.3 |
| Avg. Days Worked per Week | 4.8 | 4.6 | -4.3 |
| Fraction of Work Days Commuting (%) | 85.0 | 56.9 | -38.6 |
| Log Points Change in Weekly Commuting Trips: | | | -73.2 |

*Notes:* RPS results are for the May 10-16 and May 24-30 reference weeks and for adults aged 18-64.

In the aggregate, employment fell by 30.3 log points from February to May from 73.2 percent of the population to 54.0 percent. Those individuals that remained employed worked fewer days per week in May (4.6 days on average), than in February (4.8 on average), a reduction by 4.3 log points. Workers only commuted on 56.9 percent of work days in May, compared with 85.0 percent in February, a decline by 38.6 log points.

Overall, the average increase in home-based work accounts for slightly more than half (38.6/73.2 or 52.7 percent) of the overall decline in weekly commuting trips. The remainder is accounted for by reductions in labor supply, the bulk of which through reductions in employment.

The average increase in the number of days worked from home is not necessarily entirely driven by workers switching to working from home, but could also be in part due to changes in the composition of the workforce. If workers telecommuting in February were much more likely to remain employed in May, then the reduction in the fraction of work days commuted could partly reflect a selection effect. We find, however, that this is not the case.

Table 3 provides additional information about the nature of the adjustments to the work environment at the individual level. Panel (a) shows the commuting behavior of those employed in February. The first column shows the composition for all workers regardless of labor market status in May. As shown earlier in Table 1, 75.4 percent of all workers commuted to work every day and 8.2 percent worked entirely from home. The second and third columns in Panel (a) of Table 3 show that these shares were virtually the same among those who remained employed in May (75.4 percent and 8.5 percent) and among those that were no longer employed in May (76.7 percent and 7.8 percent). This suggests that selection plays very little role in the average increase in frequency of telecommuting, which seems instead to be predominantly driven by commuting workers switching to working from home. This is consistent with evidence by Kahn, Lange, and Wiczer (2020) on job postings, which dropped by a similar amount for jobs that

can be done from home as for those that cannot.

Panel (b) in Table 3 shows that, among all those employed, the share commuting to work on a daily basis declined from 75.4 percent in February to 51.1 percent in May. At the same time, the share working entirely from home increased from 8.2 percent in February to 35.2 percent in May. These numbers combine RPS survey results for two different reference weeks. In the survey for the week of May 10-16, the share working entirely from home was 35.7 percent, for the week of May 24-30, the share was 34.2 percent. This suggests that, even with the partial reopening in several U.S. states, workers that are able to work from home largely continued to do so in May. This is also consistent with Google's mobility metric for workplace visits, which has remained flat in May. Unsurprisingly, the shares for those who were already employed in February are very similar (second column in panel (b)), since almost all of those employed in May were also employed in February.

Panel (c) in Table 3 shows in more detail how workers' commuting status transitioned from February to May. Among workers who were commuting daily in February, less than half (43.7 percent) commuted daily in May. A large fraction, 27.7 percent, are no longer employed, likely including many whose jobs cannot be done remotely. The remainder, 28.6 percent, of daily commuters are now working from home with 69.2 percent (19.8/28.6) of them doing so on a daily basis.

Panel (c) of Table 3 also confirms that commuting status before the pandemic is not strongly related to employment status in May. The bottom row of the Table shows that transition rates into non-employment are similar regardless of whether workers were commuting or working from home. Specifically, individuals who already worked from home every day in February lost employment at essentially the same rate (26.5 percent) as commuters (27.7 and 28.8 percent). Our analysis below by worker and industry characteristics suggests that what matters more for employment status in May is the potential for working at home, rather than whether individuals were already working from home. Moreover, the fact that many pre-COVID home-based workers lost employment in May points to labor demand playing a role as well.

To our knowledge, there is little other evidence so far on how many workers switched to home-based work since the start of the health crisis. One exception is Brynjolfsson et al. (2020), who report results from a survey question asked through Google Consumer Surveys in the week of April 1-5, 2020. They find that, of those employed four weeks earlier, 37.6 percent report they continued to commute, 34.1 percent used to commute but are now working from home, while 11.8 percent report being laid-off or furloughed. Compared to the RPS, the fraction reporting they continued to commute appears roughly similar. However, the percentage that switched to working from home is smaller in our survey (19.8 percent for daily commuters, and 25.2 percent for mixed commuters). Apart from sampling error, the difference in timing

| | All Employed | Employed in May & Feb | Non-Employed in May |
|---|---|---|---|
| **a. Commuting Behavior in February** | | | |
| Commuting to Work Every Day | 75.4 | 75.4 | 75.2 |
| Commuting on Some Days | 16.4 | 16.1 | 17.0 |
| Working from Home Every Day | 8.2 | 8.5 | 7.8 |
| Nobs | 3587 | 2612 | 976 |
| **b. Commuting Behavior Week in May** | | | |
| Commuting to Work Every Day | 51.1 | 50.9 | |
| Commuting on Some Days | 13.7 | 13.8 | |
| Working from Home Every Day | 35.2 | 35.3 | |
| Nobs | 2565 | 2527 | |

| **c. February-May Transition Rates** | *In February:* | | |
|---|---|---|---|
| *In May:* | Commuting Every Day | Commuting Some Days | Working from Home |
| Commuting to Work Every Day | 43.7 | 14.9 | 2.4 |
| Commuting on Some Days | 8.8 | 31.1 | 5.7 |
| Working from Home Every Day | 19.8 | 25.2 | 65.4 |
| No Longer Employed | 27.7 | 28.8 | 26.5 |
| Nobs 3587 | | | |

*Source*: Real-Time Population Survey, adults aged 18-64, combined statistics for the May 10-16 and May 24-30 reference weeks.

between the surveys may be partially responsible: by the time of the May RPS surveys, many more workers had probably transitioned into non-employment than in April, and perhaps even some workers had already returned to commuting. In addition to providing evidence later into the crisis, one of the key contributions of our paper relative to Brynjolfsson et al. (2020) is that we can document the heterogeneity in work from home and employment outcomes across a rich set of worker and industry characteristics.

# 4    Heterogeneity in Switching to Remote Work

Recent jobs reports released by the BLS show disproportionate increases in unemployment among minorities, women, and low-skill workers. One likely reason is that the feasibility of switching to telecommuting varies greatly across the various occupations held by different de-

mographic groups. Given measures of the varying need for physical proximity to the workplace or to customers within different occupations, Mongey, Pilossoph, and Weinberg (2020) find that low-education and low-income workers are more likely to be forced to become inactive as a result of social distancing. Because of the large impact on service occupations with high female employment shares, Alon et al. (2020) also predict relatively larger job losses among women.

In this section we provide evidence showing that the impact of COVID-19 on actual outcomes in terms of remote work indeed varies importantly among different subgroups. Moreover, the heterogeneity in the rate of job loss appears consistent with the predictions based on the potential for home-based work. Table 4 provides results from the RPS by sex, race, education, income and the presence of (young) children in the household. The first two columns list the fraction of workers telecommuting in February and in May. The last three columns break down the May commuting status of all workers that were commuting on a daily basis in February.

The first column in Table 4 shows that there was already some heterogeneity in home-based work prior to the virus outbreak. Specifically, the fraction of workers telecommuting from home on a daily basis was somewhat larger among women (8.7 percent versus 7.8 percent for men), white workers (9.7 percent versus 6.8 percent for Black and 5.2 percent for Hispanics), high-income workers (9.6 percent versus 7.6 percent for low-income and 6.8 percent for mid-income workers), and adults without children at home (9.7 percent versus 5.6 percent for adults with children and 5.2 percent for adults with young children). On the other hand, there was little difference in telecommuting by education level in February.

The second column in Table 4 shows that the fraction of full-time home-based workers rose for every category in May. However, the increase in telecommuting was far more pronounced for some groups than for others. Whereas there was no notable difference in remote work by education level in February, more than half (50.2 percent) of all workers with a college degree or more (high education) were working from home on a daily basis in May. In contrast only 14.6 percent of workers with a high school degree or less (low education) were working from home in May. Similarly, the share of high income remote workers rose to 45.5 percent, whereas the share of low income workers rose only to 18.4 percent. Interestingly, the fraction of women telecommuting increased more than the fraction of men, to 38.6 percent (up from 8.7 percent) compared to 32.2 percent (up from 7.8 percent) for men. Many more white workers became daily telecommuters (39.4 percent) than Black or Hispanic workers (24.5 and 23.5 percent, respectively). Finally, whereas adults without children were more likely to work from home in February, there was basically no difference with adults without children in May. Given the widespread closures of schools, it is clear that social distancing forced many adults to balance home-based work and parenting.

The last three columns in Table 4 describe the May commuting status of those workers that

TABLE 4: WORK FROM HOME, BY WORKER CHARACTERICS

| | % of Employed Working At Home Every Day in | | % of Daily Commuters to Work in February that are, in May, | | |
| --- | --- | --- | --- | --- | --- |
| | February | May | Commuting Some Days | Working Home Every Day | No Longer Employed |
| All | 8.2 | 35.2 | 8.8 | 19.8 | 27.7 |
| Male | 7.8 | 32.2 | 8.6 | 18.1 | 25.6 |
| Female | 8.7 | 38.6 | 8.9 | 21.5 | 30.2 |
| White | 9.7 | 39.4 | 8.9 | 22.9 | 22.5 |
| Black | 6.8 | 24.5 | 8.3 | 13.6 | 33.9 |
| Hispanic | 5.2 | 23.4 | 8.7 | 12.3 | 34.0 |
| Low Education | 8.2 | 14.6 | 6.6 | 4.9 | 33.9 |
| Mid Education | 8.4 | 25.2 | 8.9 | 10.7 | 33.7 |
| High Education | 8.2 | 50.2 | 10.2 | 34.8 | 20.2 |
| Low Income | 7.6 | 18.4 | 7.6 | 7.5 | 39.9 |
| Mid Income | 6.8 | 30.7 | 7.4 | 18.1 | 28.1 |
| High Income | 9.6 | 45.5 | 10.6 | 29.2 | 19.4 |
| Children | 5.6 | 34.1 | 9.4 | 21.2 | 27.8 |
| Youngest Child under 13y | 5.2 | 33.2 | 11.0 | 20.6 | 27.9 |
| No Children | 9.7 | 35.7 | 8.5 | 19.0 | 27.7 |

*Source*: Real-Time Population Survey, adults aged 18-64, combined statistics for the May 10-16 and May 24-30 reference weeks. Low education: high school or less; Mid Education: some college; High Education:college degree or higher. Low Income: household income last year less than $50k; Mid Income: household income last year between $50k and $100k; High income: household income last year higher than $100k.

were commuting every day before the pandemic in February. The variation in the proportion of commuting workers switching to telecommuting echoes the changes in the overall percentage working remotely described above. Women, whites, the highly-educated, and high-income commuters all switched to telecommuting at relatively higher rates. Commuting women transitioned out of employment at a higher rate (30.2 percent) than men (25.6 percent), which seems consistent with the prediction in Alon et al. (2020). Even larger gaps arise in the fractions of commuters that became non-employed between: whites (22.5 percent) and minorities (33.9 percent and 34.0 percent for Blacks and Hispanics, respectively); between highly educated workers (20.2 percent) and lower skilled workers (33.9 percent for workers with high school degree or less, 33.7 percent for workers with some college experience); and between high- and low-income workers (19.4 percent versus 39.9 percent). There was no meaningful difference according to parental status.

Overall, our results on actual work from home behavior after the virus outbreak are consistent with workers in low-work-from-home or contact-intensive jobs being economically vulnerable, as predicted by Mongey, Pilossoph, and Weinberg (2020). A recent study by Adams-Prassl et al. (2020) offers additional evidence on the link between the scope for telecommuting and job loss from a labor market survey of households across several countries, including the US. Their survey asks about the share of tasks that respondents say could be done from home. The authors find that the probability of job loss is higher among individuals who said that a small share of tasks could be done from home. They also find that women and workers without a college degree are for this reason significantly more likely to have lost their jobs, which is consistent with the RPS evidence in Table 4.

## 5 Was Everyone Who Can Work from Home Doing So?

Remote work reduces face-to-face interactions. Therefore, expanding the number of workers that are home-based can help reduce the number infections at an economic cost that is lower than many other containment policies.[6] In this section, we assess the extent to which potential home workers effectively did so in May.

A number of recent papers have developed measures of the scope for working remotely across different occupations and industries. Dingel and Neiman (2020) use O*NET data to classify the feasibility of working at home for all major occupations. Based on this classification, they conclude that 37 percent of jobs in the United States could be performed entirely at home.[7] Using a similar strategy, Su (2020) calculates that 39 percent of jobs can be done remotely, at least in the short term.[8]

Earlier in Table 3, we documented that 35.2 percent of all workers report working from home every day in May according to the RPS. This is very close to the upper bound of 37 percent calculated by Dingel and Neiman (2020) – or the upper bound of 39 percent in Su (2020) – on the basis of O*NET data. Taking the 37 percent number of Dingel and Neiman (2020), this suggests that about 90.2 percent of workers that could work from home were doing so in May.

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[6]Baqaee et al. (2020) offer a quantitative assessment of reopening strategies involving prolonged home-based work versus others that do not.

[7]Gottlieb, Grobovšek, and Poschke (2020) use the measures in Dingel and Neiman (2020) to quantify the feasibility of working from home across countries.

[8]Alon et al. (2020) instead rely on survey questions in the Leave and Job Flexibilities Models of ATUS to assess the scope for remote work. They conclude that that 28 percent of male workers and 22 percent of female workers are employed in highly telecommutable occupations. Papanikolaou and Schmidt (2020) also use the Leave and Job Flexibilities Models of ATUS to calculate the fraction of workers by industry who said "there are days they are working only at home" and show that this measure is highly correlated with employment changes between March and April in the CPS. Leibovici, Santacreu, and Famiglietti (2020) propose an index of occupations scoring the reliance on physical proximity, and calculate that about one-fourth of total employment is in low-contact intensive occupations.

However, the 90.2 percent estimate is an upper bound for the ratio of effective to potential home workers in May because the potential for home-based work calculated by Dingel and Neiman (2020) is based on pre-COVID workforce composition statistics. The changes in employment caused by the pandemic in May relative to February are large, and as a result the composition of the workforce has changed markedly in recent months. An alternative calculation for the ratio of effective to potential home workers is the ratio of May home workers to February employment. In the RPS, 26.0 percent ($35.2 \times 54.0/73.2$) of those employed in February worked from home every day in May. Taking the Dingel and Neiman (2020) estimates of the potential for home-based work, this suggests that 70.3 percent of the pre-COVID workforce who could work entirely from home did so in May.

In practice, the 70.3 percent estimate of the ratio of effective to potential home workers in May is likely a lower bound. The reason is that, as documented earlier in Table 3, 26.5 percent of all remote workers in February were no longer employed in May. Our preferred estimate of the ratio of effective to potential home workers subtracts these from the number of potential home workers, yielding a ratio of 71.7 percent ($35.2 \times 54.0/(73.2 \times (100 - 8.2 \times 26.5/100)$). Based on the evidence in the RPS and taking the calculations by Dingel and Neiman (2020) at face value, our best estimate is therefore that 28.3 percent more workers could have worked from home in May.

Table 5 reports results from the RPS for 18 major industries. The first column provides employment shares across the industries in February.[9] The second column lists the percent change in employment from February to May. Consistent with the CPS, the job losses were widespread across sectors, and they were particularly large in contact-intensive service sectors such as arts, entertainment and recreation, accommodation and food, and retail trade. The last two columns show the share of workers working completely from home in February and May by industry. The industries with the largest increase in telecommuters are information, finance/insurance, and professional and business services. Some industries saw both large employment losses and large increases in the share of workers telecommuting. As result, the occupational mix within these sectors shifted strongly towards jobs that can be done from home, even though the fraction of jobs that is telecommutable in these sectors is relatively small.

The increase in home-based work across industries aligns well with the estimates of the potential for telecommuting by Dingel and Neiman (2020). Figure 1a plots the share of home-based workers in May against the potential shares calculated by Dingel and Neiman (2020). The regression line lies above but is relatively close to the 45 degree line, and the associated R squared is 0.78.

As explained earlier, a better metric for ratio of effective to potential home-based workers

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[9]The distribution of employment is very similar to the February CPS, see Bick and Blandin 2020.

TABLE 5: WORKING FROM HOME BEHAVIOR, BY INDUSTRY

| | % of Feb Employ-ment | Feb-May % Change in Employment | % of Employed Working At Home Every Day in | |
| --- | --- | --- | --- | --- |
| | | | February | May |
| Agriculture | 2.2 | -16.2 | 10.6 | 17.2 |
| Mining | 1.4 | -30.4 | 4.0 | 21.2 |
| Utilities | 1.7 | -29.3 | 5.8 | 27.5 |
| Construction | 6.9 | -28.8 | 4.9 | 12.0 |
| Manufacturing | 7.5 | -19.7 | 5.1 | 22.3 |
| Wholesale Trade | 2.0 | -25.4 | 16.2 | 40.1 |
| Retail Trade | 8.9 | -34.0 | 6.7 | 19.7 |
| Transp/Warehousing | 4.3 | -29.7 | 6.5 | 8.7 |
| Information | 3.2 | -9.6 | 9.8 | 47.8 |
| Finance/Insurance | 5.9 | -10.5 | 10.9 | 60.6 |
| Real Estate/Rental | 1.5 | -23.8 | 9.3 | 25.8 |
| Prof/Bus. Services | 10.1 | -11.5 | 13.1 | 60.0 |
| Education | 10.2 | -29.3 | 4.6 | 58.9 |
| Health Care | 9.8 | -17.5 | 4.8 | 23.9 |
| Arts/Entert/Recr | 3.2 | -54.1 | 13.1 | 52.2 |
| Accom/Food | 4.5 | -52.0 | 7.6 | 10.0 |
| Other Services | 13.1 | -29.4 | 10.1 | 31.2 |
| Public Sector | 3.8 | -9.4 | 7.8 | 40.5 |

*Source*: Real-Time Population Survey, adults aged 18-64, combined statistics for the May 10-16 and May 24-30 reference weeks.

is in terms of February employment. Figure 1b plots the share of telecommuters as a share of industry employment against the Dingel and Neiman (2020) potential shares. The associated R squared is 0.83, and the regression line lies now more clearly above the 45 degree line. To the extent the Dingel and Neiman (2020) estimates measure the true potential for home-based work, Figure 1b suggest that the education, information, and finance sectors are among the industries with some further scope for workers to switch to working from home. At the same time, an alternative possible interpretation is that there are additional constraints to home-based work that are not captured by the Dingel and Neiman (2020) estimates.

Table 6 provides the transitions in commuting status by industry, as estimated from the RPS data. The first three columns contain the outcomes in May for workers that were commuting daily in February. Consistent with the overall industry employment changes in Table 5, many more daily commuters transitioned out of employment in non-essential/contact-intensive service sectors, such as arts, entertainment and recreation (64.9 percent), accommodation and food (52.6 percent), and retail trade (37.8). Unsurprisingly, the highly telecommutable sectors saw many more commuters switch to remote work, e.g. information (37.3 percent), finance/in-

## Figure 1: Potential and Effective Remote Work By Industry

(a) Share of May Employment        (b) Share of February Employment
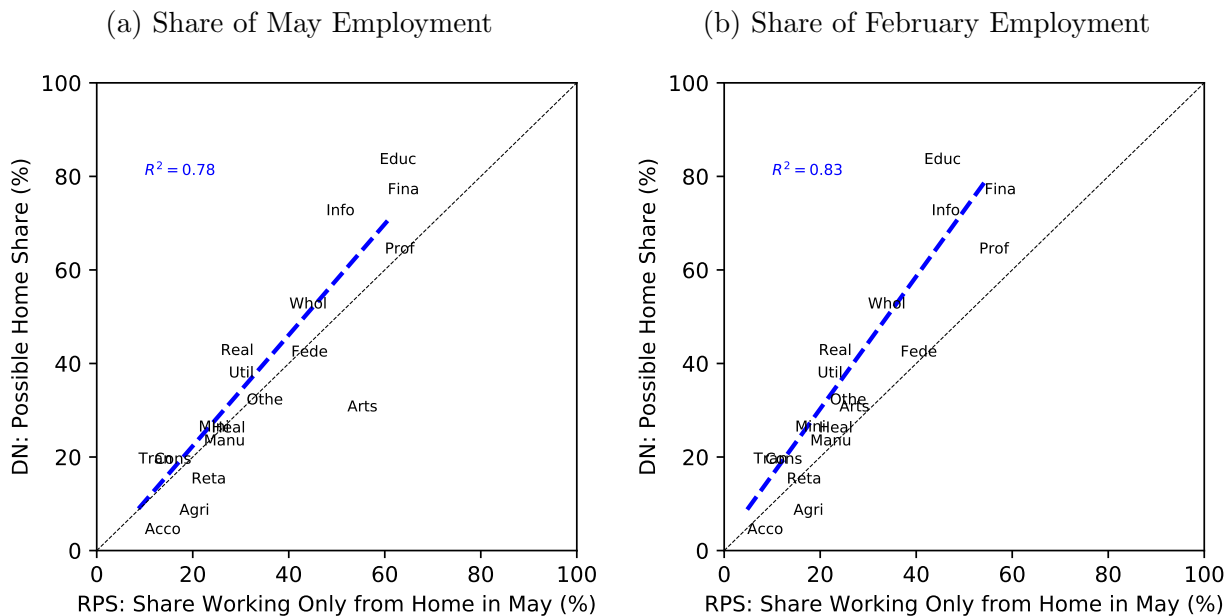


*Source: Dingel and Neiman (2020), Real-Time Population Survey.* Broken lines are regression lines. Full lines are the 45% degree lines.

surance (45.2 percent), professional and business services (44.8 percent).

The last three columns in Table 6 describe the May outcomes by industry for those workers that were already working from home every day in February. In most industries the majority of home-based workers continued to telecommute in May. However, in several industries a substantial fraction of home-based workers transitioned out of employment. This is consistent with our earlier finding in Section 3 that workers that were already telecommuting before the pandemic transitioned to non-employment at almost the same rate as those that were commuting daily. Given the relatively small fraction of home-based workers in February, the number of observations in each of the industry bins is relatively small. Nevertheless, it is relatively clear that home-based workers mostly lost employment in sectors that were hard-hit by social distancing, such as the accommodation and food and retail trade sectors. In sectors that were relatively less affected, such as the information or finance/insurance sectors, very few home-based workers became non-employed in May. This further indicates that, apart from the potential for home-based work, industry business conditions and labor demand are also important determinants of employment outcomes following the virus outbreak.

## 6 Concluding Remarks

The outbreak of the COVID-19 pandemic and social distancing have led to unprecedented employment losses, as well as severe disruptions to work and commuting habits. To the best of our knowledge, this paper is the first to provide extensive empirical evidence on home-based

TABLE 6: COMMUTING TRANSITIONS, BY INDUSTRY

| | % of Daily Commuters to Work in February that are, in May, | | | % of Employed Working at Home Every Day in February that are, in the Week of May 10, | | |
|---|---|---|---|---|---|---|
| | Commuting Some Days | Working Home Every Day | No Longer Employed | Commuting Some Days | Working Home Every Day | No Longer Employed |
| Agriculture | 12.5 | 5.5 | 14.1 | 9.7 | 83.0 | 7.3 |
| Mining | 11.2 | 2.6 | 18.3 | 0 | 54.1 | 45.9 |
| Utilities | 5.3 | 22.2 | 24.3 | 26.4 | 39.3 | 34.3 |
| Construction | 12.4 | 4.4 | 29.8 | 5.0 | 70.9 | 11.4 |
| Manufacturing | 6.3 | 12.9 | 21.0 | 0 | 82.5 | 17.5 |
| Wholesale Trade | 15.8 | 21.1 | 30.1 | 0 | 76.8 | 5.7 |
| Retail Trade | 6.1 | 9.2 | 37.8 | 0 | 64.6 | 31.9 |
| Transp/Warehousing | 3.7 | 2.8 | 26.8 | 6.7 | 52.6 | 40.7 |
| Information | 20.5 | 37.3 | 15.5 | 20.9 | 79.1 | 0 |
| Finance/Insurance | 9.8 | 45.2 | 16.2 | 6.4 | 90.4 | 3.1 |
| Real Estate/Rental | 14.4 | 7.3 | 24.4 | 44.8 | 55.2 | 0 |
| Prof/Bus. Services | 7.1 | 44.8 | 15.6 | 0 | 84.3 | 14.3 |
| Education | 13.9 | 42.8 | 24.9 | 18.2 | 56.5 | 25.3 |
| Health Care | 7.1 | 15.2 | 16.7 | 0 | 91.4 | 4.1 |
| Arts/Entert/Recr | 6.2 | 8.7 | 64.9 | 0 | 76.5 | 23.5 |
| Accom/Food | 3.8 | 1.6 | 52.6 | 0 | 46.4 | 38.7 |
| Other Services | 7.0 | 15.0 | 28.7 | 8.4 | 60.1 | 31.4 |
| Public Sector | 15.0 | 34.3 | 3.1 | 0 | 41.3 | 58.7 |

*Source*: Real-Time Population Survey, adults aged 18-64, combined statistics for the May 10-16 and May 24-30 reference weeks.

work and job loss since the start of the crisis. We find that whether workers actually worked from home prior to the virus outbreak shows little relationship with employment outcomes. Based on information on actual work-from-home behavior, we find instead that the potential for home-based appears is closely related to employment outcomes, consistent with predictions by Dingel and Neiman (2020), Mongey, Pilossoph, and Weinberg (2020) and others. Taking the estimates of Dingel and Neiman (2020) of the number of potential home-based workers at face value, we estimate that the ratio of effective to potential home-based workers in May is 71.7 percent. However, the fact that many home-based workers in hard-hit industries became unemployed suggests labor-demand plays also matters for employment losses since February. The evidence in this paper on home-based work following the recent virus outbreak should be useful to inform quantitative analysis of containment policies and reopening strategies, such as those of Baqaee et al. (2020), Jones, Philippon, and Venkateswaran (2020), and others.

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# A  Real-Time Population Survey Background Information

The RPS is administered online to respondents of the Qualtrics panel. The first survey wave was collected in the week of April 6, and a new wave has been collected every other week since then. Wave one consisted of 1,118 respondents; beginning in the second wave the sample size increased to about 2,000 respondents. The questions about commuting behavior appear first in the survey for the week of May 10. The sample of respondents was selected to be representative of the US population (ages 18-64 in wave 1, ages 18+ from wave 2-on) along several characteristics (age, gender, race/ethnicity, education, marital status, presence of children, geographic region, and household income in 2019).

The RPS asks respondents a host of questions related to demographic background and labor market outcomes. The labor market questions closely follow the the basic module of the Consumer Population Survey (CPS) in asking about work experiences last week. This allows us to assign individuals to one of four basic labor force categories: employed and at work, employed and absent from work, unemployed, and not in the labor force. Employed respondents are asked about type of employer, employer tenure, industry, hours of work, commuting behavior, hourly or salaried pay status, and earnings. Non-employed respondents are asked about layoff status, availability for work, and search behavior. In addition to asking about work experiences last week, we ask individuals about work experiences in February, which provides a retrospective panel component to the survey. Since the full CPS sequence of questions for labor market status can be time consuming, the RPS only ask a subset of questions for February.

If the respondent cohabits with a spouse or partner, the RPS asks most of these questions of the spouse/partner as well. When respondents cohabit with a spouse/partner we assign each of them a weight of 0.5; respondents not living with a spouse/partner receive a weight of 1. We also assign weights based on age, relationship status and household income last year to match the joint distribution of these variables in the February CPS.

For additional details on the survey design and sample, see Bick and Blandin (2020). Table A.I provides key labor market statistics based on combining RPS results for for the weeks of May 10-16 and May 24-30.

TABLE A.I: KEY LABOR MARKET STATISTICS FOR MAY

|  | All | Men | Women | White | Black | Hispanic |
|---|---|---|---|---|---|---|
| **Employment Rate** | | | | | | |
| February | 73.2 | 76.8 | 69.6 | 72.9 | 73.7 | 72.4 |
| May | 54.0 | 58.6 | 49.6 | 57.6 | 50.3 | 48.7 |
| **Feb-May Job Flows** | | | | | | |
| E to E Job Stayer | 66.1 | 68.1 | 64.1 | 72.5 | 56.0 | 58.5 |
| E to E Job Transition | 6.6 | 7.4 | 5.7 | 5.3 | 11.8 | 6.7 |
| E to N | 27.4 | 24.6 | 30.2 | 22.2 | 32.2 | 34.8 |
| N to E | 3.3 | 3.2 | 3.3 | 2.9 | 2.2 | 5.5 |
| N to N | 96.7 | 96.8 | 96.7 | 97.1 | 97.8 | 94.5 |
| Nobs | 4845 | 2378 | 2460 | 2942 | 639 | 798 |

|  | Low Education | Mid Education | High Education | Low Income | Mid Income | High Income |
|---|---|---|---|---|---|---|
| **Employment Rate** | | | | | | |
| February | 62.0 | 70.8 | 84.3 | 60.4 | 78.0 | 80.9 |
| May | 41.4 | 47.7 | 69.4 | 36.9 | 56.7 | 67.2 |
| **Feb-May Job Flows** | | | | | | |
| E to E Job Stayer | 58.0 | 59.1 | 75.4 | 50.5 | 64.3 | 77.5 |
| E to E Job Transition | 7.1 | 7.3 | 5.9 | 8.5 | 7.6 | 4.7 |
| E to N | 35.1 | 33.6 | 18.7 | 41.0 | 28.1 | 18.0 |
| N to E | 3.1 | 1.8 | 5.7 | 2.8 | 3.4 | 4.0 |
| N to N | 96.9 | 98.2 | 94.3 | 97.2 | 96.6 | 96.0 |
| Nobs | 1560 | 1389 | 1896 | 1533 | 1521 | 1791 |

*Notes:* Authors' calculations based on the Real-Time Population Survey for the weeks of May 10-16 and May 24-30.