Why Working From Home Will Stick

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December 10th 2020

Abstract: We survey 15,000 Americans over several waves to investigate whether, how, and why working from home will stick after COVID-19. The pandemic drove a mass social experiment in which half of all paid hours were provided from home between May and October 2020. Our survey evidence says that about 25 percent of all full work days will be supplied from home after the pandemic ends, compared with just 5 percent before. We provide evidence on five mechanisms behind this persistent shift to working from home: diminished stigma, better-than-expected experiences working from home, investments in physical and human capital enabling working from home, reluctance to return to pre-pandemic activities, and innovation supporting working from home. We also examine some implications of a persistent shift in working arrangements: First, high-income workers, especially, will enjoy the perks of working from home. Second, we forecast that the post-pandemic shift to working from home will lower worker spending in major city centers by 5 to 10 percent. Third, many workers report being more productive at home than on business premises, so post-pandemic work from home plans offer the potential to raise productivity as much as 2.4 percent.

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JEL No. D13, D23, E24, J22, G18, M54, R3

Keywords: COVID, working-from-home

Acknowledgements: We thank Stanford University, the University of Chicago Booth School of Business, ITAM, the Stanford Institute for Human-Centered Artificial Intelligence and Toulouse Network for Information Technology for financial support. We are grateful to comments from presentations in HAI, LSE, Maryland, Munich, Rice, Ridge, Princeton, Stanford and the World Bank. We thank Corinne Stephenson for help generating our WFH media data.

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1) Introduction

Working from home (also called remote work or telecommuting, but hereafter referred to as "WFH") was already growing before the COVID-19 pandemic. In the United States the proportion of employees who *primarily* worked from home had grown from 0.75% in 1980 to 2.4% in 2010 (Mateyka *et al.* 2012) and 4.0% in 2018[1]. At the same time, the wage discount (after controlling for observables) from *primarily* working at home had fallen from 30% in 1980 to zero by 2000 (Oettinger, 2011). But the COVID-19 pandemic produced a step-increase in WFH. In independently conducted surveys, Bick, Blandin, and Mertens (2020) and Brynjolfsson et al. (2020) find that about half of all employed persons worked entirely or partly from home in May 2020. By our own estimates, about half of all paid hours were provided from home between May and October 2020, about a ten fold-increase compared to pre-pandemic numbers.

This mass experiment in working from home has, understandably, attracted tremendous interest. The frequency of newspaper articles that mention working from home in the Newsbank archive of around 2,000 daily US newspapers rose 120-fold (12,000%) in March relative to January 2020. This explosion in interest reflects the many questions raised by a massive shift in working arrangements and where work happens during the COVID-19 pandemic.

There appears to be less consensus, however, about how well working from home has worked, whether it will stick after the pandemic ends, and why or why not. This lack of consensus is evident in the wide range of views, from extremely negative to extremely positive, prominent executives have expressed about working from home. At one end of the spectrum, Netflix CEO Reed Hastings, recently said, "*I don't see any positives. Not being able to get together in person, particularly internationally, is a pure negative*" (Cutter, 2020). At the other extreme, Heyward Donigan, CEO of retailer Rite Aid, reported, "*We have adapted to work-from-home unbelievably well… We've learned that we can work remote, and we can now hire and manage a company remotely*" (Cutter, 2020). Others have expressed intermediate views, for example Apple CEO Tim Cook: "*In all candor, it's not like being together physically….[But] I don't believe that we'll return to the way we were because we've found that there are some things that actually work really well virtually*" (Cutter 2020).

[1] Defined as those working 3+ full paid days a week from home in Bureau of Labor Studies (2018).

Our goal in this paper is to move past these anecdotal accounts and gather systematic evidence about whether, how, and why working from home will stick after the COVID-19 pandemic. We survey 17,500 working-age Americans over several waves between May and November 2020, asking about their working status during the pandemic, their views about working from home, as well as their employers' plans with regards to working from home after the pandemic. Other survey questions help us examine what persistently high levels of working from home mean for workers, for dense cities like New York and San Francisco, and for productivity. We have also talked to dozens of managers and CEOs across the US to supplement this with richer discussion data.

Our analysis first describes the state of working from home during the COVID-19 pandemic. The left panel of Figure 1 shows 42 percent of working age persons were working from home in May 2020 at the height of pandemic lockdowns, or 62 percent among those who were working for pay. These numbers are comparable to other estimates from early on in the pandemic, including Bick et al. (2020) and Brynjolfsson et al. (2020). In October, our most recent survey wave, 32 percent of respondents, or 40 percent of persons working for pay, were still working from home. While lower than in May, these numbers imply that the share of full paid working days spent working from home was still eight times larger than before the pandemic, based on data from the 2017-2018 American Time Use Survey (see the Bureau of Labor Statistics (2018)).

After the pandemic, workers report their employers are planning for them to spend about 23 percent of all paid days working from home. This arises from the approximately 50% of employees that can work from home being allowed to work from home two days a week post-pandemic. Employers mention concerns around innovation, culture and motivation as key reasons to have all employees come onto the business premises three days per week, but are happy for employees to spend the other two days per week working from home.

This 23 percent of days post pandemic WFH figure implies less working from home than during the pandemic, but almost three-quarters of this drop due to a reduction in the intensive margin. That is, workers that during the pandemic are working from home full time will move to working from home for two to three days a week post pandemic. This 23 percent figure is almost five times larger than in the pre-pandemic time use data, but still half as large as what workers want in a post-pandemic world.

We then turn to the question of *why* working from home will stick. Our survey evidence points to five key channels. Our findings are complementary to other analyses, including research by

Jerbashian and Vilalta-Bufi's (2020) on how the prices of information and communication technologies impact working from home. First, reduced stigma. A large majority of respondents report perceptions about working from home have improved since the start of the pandemic among people they know. With fewer people viewing working from home as "shirking from home," workers and their employers will be more willing to engage in it.

Second, the pandemic forced workers and firms to experiment with working from home en masse, giving them a chance to learn how well it actually works. The ubiquity of the pandemic facilitated this experimentation by allowing firms to evaluate working from home while their clients and suppliers also worked from home. Our survey reveals that the experience has been positive and better than expected for the majority of firms and workers, consistent with survey responses of US hiring managers in Ozimek (2020). Thus, the pandemic has helped workers and organizations overcome inertia related to the costs of experimentation, as well as inertia stemming from biased expectations about working from home. In this regard, our evidence relates to the classic multi-armed bandit problem in that COVID-19 compelled firms to experiment with a new production mode – working from home – and led them to acquire information that leads some of them to stick with the new mode after the forcing event ends.

Third, our survey reveals that the average worker has invested over 13 hours and about $660 dollars in equipment and infrastructure at home to facilitate working from home. We estimate these investments amount to 1.2 percent of GDP. In addition, firms have made sizable investments in back-end information technologies and equipment to support working from home. Thus, after the pandemic, workers and firms will be positioned to work from home at lower marginal costs due to recent investments in tangible and intangible capital.

Fourth, about 70 percent of our survey respondents express a reluctance to return to some pre-pandemic activities even when a vaccine for COVID-19 becomes widely available, for example riding subways and crowded elevators, or dining indoors at restaurants. This persistent fear of proximity to others is likely to leave some residual demand for social distancing at workplaces and prop up demand for working from home in the coming years.

Fifth, the rate of innovation around technologies that facilitate working from home appears to have accelerated, as documented by Bloom, Davis, and Zhestkova (2020). Consistent with ideas in the literature on directed technical change (e.g., Acemoglu 2002), the massive expansion in working from home has boosted the market for working from equipment, software and

technologies, spurring a burst of research that supports working from home, in particular, and remote interactivity, more broadly.

We also argue that network effects are likely to amplify the impact of these five mechanisms. For example, coordination among several firms will facilitate doing business while their employees are working from home. When several firms are operating partially from home, it lowers the cost for other firms and workers to do the same, creating a positive feedback loop.

After examining evidence for why working from home will stick after the COVID-19 pandemic, we quantify some of the implications of the shift in working arrangements. Workers value working from home as a perk, with the average survey respondent valuing the opportunity to work from home at about 8% of earnings. But the benefits will accrue disproportionally better paid, more highly educated workers, because they value working from home more, and their employers are planning for them to work from home more often after the pandemic. Our survey evidence also seems to confirm widely held views that the shift to working from home will diminish the economic fortunes of dense cities like New York and San Francisco. We estimate that the post-pandemic shift to working from home (relative to the pre-pandemic situation) will lower post-COVID worker expenditures on meals, entertainment, and shopping in central business districts by 5 to 10 percent of taxable sales.

Finally, many workers report being more productive while working from home during the pandemic than they were on business premises before the pandemic. Taking these survey responses at face value, accounting for employer plans about who gets to work from home, and aggregating, we estimate that worker productivity will be 2.4 percent higher post-pandemic due to working from home. This number might be an underestimate, however, because our survey asks about productivity while working from home *during COVID*. Thus, it is subject to the negative effects of closed schools and pandemic-related stress, among other potentials drags on worker efficiency. Alternatively, these estimates might be an overestimate if workers fail to internalize externalities associated with face-to-face collaboration that raise firm-level productivity and which are stifled when employees work from home. Bartik et al. (2020) report that business owners and managers overwhelmingly perceive productivity to be lower during the pandemic.

While the literature on working from home was relatively short prior to the pandemic, our paper builds on several studies. First, the impact of working from home on firms. Bloom et al. (2015) finds a 13% productivity impact of working from home in randomized control trials of

Chinese call center workers, and Emanuel and Harrington (2020) report an 8% uplift in a natural experiment involving call-center workers in a large US firm. (However, Emmanuel and Harrington also find evidence of negative worker selection into working from home.) Choudhury et al. (2020) examine a natural experiment in the US Patent Office, finding additional 4% productivity benefits from shifting to work from anywhere (a geographically flexible version of work from home), consistent with the positive results of Angelici and Profeta (2020) on the advantages of smart working (flexible work location). Interestingly, Kunn, Seel and Zegners (2020) report worse performance among elite chess players competing from home during the COVID pandemic, as assessed by Chess Artificial Intelligence move assessment software. One explanation is that the home environment is less conducive to peak performance in cognitively demanding tasks.

A second strand of the literature looks at the impact on employees of working from home. Mas and Pallais (2017) report substantial gains in welfare from working from home, finding an 8% wage equivalent valuation of working from home by employees in a randomized job offering with varying wages and working conditions. However, under the pandemic working from home conditions have been far from ideal with children at home and shared working spaces, with Möhring et al. (2020) arguing this has reduced family satisfaction, particularly for mothers. DeFilippis et al. (2020) examine meeting and email data from thousands of firms across 16 major cities and find employees working from home attend more (but shorter) meetings per day, send and receive more emails, and experience an increase in the workday of almost an hour.

Third, this relates more broadly to the literature on the provision of workplace perks like working from home, job-sharing, part-time work and other alternative work arrangements. Katz and Krueger (2016) document a significant rise in alternative work arrangements between 2005 and 2015, while Mas and Pallais (2017 and 2020) document the wide variety of options and policy discussion around these, including to what extent governments should regulate to coerce firms into offering apparently more work-life balance friendly options.[2]

Finally, there is the rapidly growing literature on the impact of COVID on firms (e.g. Bartik et al. 2020a, Gourinchas et al. 2020 or Bloom et al. 2020) labor markets (e.g. Chetty et al. 2020,

[2] There is a separate ongoing debate as to whether this is in firms own interests to do this, with the evidence suggesting more productive and better managed firms offer a superior package of work-life-balance options, like WFH, but it is unclear whether these relationships are causal (Bloom, Kretschmer and Van Reenen 2009).

Kahn et al. 2020, Cajner et al. 2020 and Alon et al. 2020), and the influence of working from home on these (e.g. Mongey et al. 2020 and Papanikolaou and Schmidt 2020).

In what follows, we first provide details about our survey and methodology (Section 2). Then we describe the state of working from home during COVID and quantify the extent of working from home after the end of the pandemic (Section 3). Section 4 examines the evidence for why working from home will stick after the pandemic, and, finally, Section 5 describes the implications of a persistent shift towards working from home.

2) Survey data and methodology

Starting in May 2020, we have run six waves of our own working from home survey using two commercial survey providers, who recruit respondents and field each survey over the internet on our behalf. Each survey includes between 40 and 55 questions about respondent demographics, as well as various questions about working from home during and after the COVID-19 pandemic. For example, we ask them about their current working status, their employers' plans for working from home after the pandemic, and whether perceptions about working from home have changed among people they know since the start of the pandemic.[3]

Appendix B shows the survey questions for each wave, and Figure A.1 shows two sample question. The first concerns respondents' employers' plans about working from after the pandemic, while the second asks about changes in perceptions of working from home associated with the pandemic. Figure A.1 also shows how we use bold text and italics to highlight important parts of our questions. For example, the question about future employer plans highlights the period of time that we are referring to, "After COVID, in 2022 and later," and also highlights that we are specifically asking for employer plans rather than employee preferences.

The six survey waves we have run far were in the field on the following dates. (We refer to each wave by the month shown in parentheses):

- May 21 to 25, 2020 (May)
- June 30 to July 9, 2020 (July)

[3] Our survey does not collect personally identifiable private information and we have no direct contact with respondents, or any way to follow up with them. All interactions and survey responses are collected directly by our survey providers QuestionPro and Inc-Query. We pay a modest fee for each completed response.

- August 21 to 28, 2020 (August)
- September 29 to October 2, 2020 (September)
- October 28 to November 3, 2020 (October).
- November 17 to November 20, 2020 (November)

Each wave collected 2,500 responses, except in August, when we collected 5,000 by running parallel surveys across our two survey providers. While it is possible for a given respondent to answer more than one of our survey waves, we are currently unable to track whether this takes place. Thus, our combined dataset consists of six repeated cross sections. See Prescott, Bishara, and Starr (2016, 2020) and Bick and Blandin (2020) for a fuller discussion of how these online surveys work. We follow much of their approach and practices to obtain sensible responses.

Median time to completion is between 5 and 9 minutes depending on the survey wave. In particular, we've added questions in later surveys, so completion times are longest for the October wave (8 min, 44 sec) and shortest for May (3 min, 10 sec). We drop responses that take less than 2 minutes in May or less than 3 minutes in all of the other waves since these "speeders" are likely to be simply filling out as many surveys as possible without thinking about the questions carefully.

The target population for our surveys includes working age (i.e. 20 to 64 years old) US residents who earned at least $20,000 in 2019. We thus focus on individuals that are strongly attached to the labor market. Our survey providers recruit respondents from among a pool of verified individuals who have previously signed up to receive invitations to complete online surveys in exchange for some form of reward. No respondents sign up for our survey specifically. Our preferred provider also directs survey invitations so as to roughly match the distribution of individuals in Census data by age, income, gender, and race/ethnicity.

In practice, our providers recruit from leading marketing research aggregators who pool potential respondents from several sources that respondents sign up with, obtaining a heterogeneous sample of individuals. Part of the reason why aggregators obtain this heterogeneity is that respondents receive different forms of compensation depending on where they signed up to receive online surveys. Some (presumably higher income) respondents may receive airline miles in exchange for their response, for instance, while others receive cash or in-game credits enabling them to unlock valuable features of internet games. Aggregators provide access to both kinds of respondents and many more.

We are keenly aware that the quality of our estimates relies on obtaining a sample that is broadly representative of our target population. In pursuit of this goal we re-weight our raw survey responses to match the share of individuals in a given earnings-industry-state cell in a pooled sample of the 2010 to 2019 Current Population Survey (CPS) belonging to our target population (i.e. working age persons who earn more than $20,000 per year). Figure 2 shows the marginal distribution of our raw survey responses, as well as the reweighted distribution and the distribution in the CPS for six variables of interest. The top row shows the distributions along the three dimensions that are part of our reweighting scheme (earnings, industry of the current or most recent job, and geography). The bottom shows three additional variables of interest, namely education, age and sex. The top and bottom panels on the left show that our raw survey data materially over-samples high-earning, highly educated individuals, but the reweighted distribution is much closer to the CPS along these dimensions. The raw data look broadly similar to the CPS along the other dimensions and so do the reweighted distributions.

There is still a concern that our respondents may be differentially selected on unobservables. Based on conversations with our survey providers the most salient concern when collecting surveys like ours over the internet is that respondents might be differentially comfortable with technology. People who own smartphones and spend more time online may, intuitively, sign up to receive online surveys more often and respond differentially. Given near universal penetration of broadband internet, smartphones, and similar devices in 2020, this is perhaps less of a concern today than 10 to 15 years ago. However, we cannot fully rule out that our respondents might be different from the broader population after reweighting on observables. Specifically, concerns would be that persons who are disproportionately likely to work from home might be more likely to sign up for online surveys and thus more likely to complete our particular survey.

Table A.1 displays reweighted summary statistics (i.e., to match the share of the population in the CPS in a given earnings-industry-state cell) for many of our variables of interest. The median respondent is thus a 30 to 40-year old female, who earned between $40 and $50 thousand by working in 2019 and has completed a four-year college degree. Although we obtained 15,000 raw responses across the five survey waves we have run so far, after dropping “speeders” and cleaning up inconsistent responses we end up with a core sample of 13,746 survey responses. Some variables are based on questions that we did not ask in every wave. For example, we did not ask about employer plans about post-COVID working from home arrangements until the July wave,

so we end up with less than 13,746 observations for that variable. In other cases, we only asked a question from respondents who claimed to be working from home, or who worked from home at some point during COVID. Thus, we have fewer observations, around 6,500, for the number of hours spent learning how to work from home effectively, and similarly for the amount of money invested in equipment and infrastructure enabling work from home.

We supplement our own data collection efforts with published data from the Bureau of Labor Statistics American Time Use Survey (ATUS) Job Flexibilities and Work Schedules module. This survey was run continuously in 2017 and 2018 on about 10,000 respondents who were all wage and salary workers.[4] We use ATUS data primarily to quantify how many full paid days were spent working from home prior to the COVID-19 pandemic, for comparison with the amount of working from home reported in our own survey during and planned for after the end of the pandemic.

3) The state of working from home during COVID

We begin our analysis by examining the state of working from home during COVID, in comparison with before the pandemic.

We estimate the extent of working from home during the COVID-19 pandemic using the following question, which we fielded in each of our five survey waves:

Currently (this week) *what is your working status?*

- *Working on my business premises*
- *Working from home*
- *Still employed and paid, but not working*
- *Unemployed*
- *Not working and not looking for work*

Then, we classify the responses into three categories, namely "working on business premises", "working from home", and "not working," the last of which aggregates responses across the final three response options.

[4] See the full survey here https://www.bls.gov/news.release/flex2.nr0.htm

Our survey responses reveal the extent to which the COVID-19 pandemic forced a mass experiment in working from home. The left panel of Figure 1 compares the distribution of responses across those three categories for the first and last of the five survey waves we've fielded so far. In May, when lockdowns or stay-at-home orders covered almost 90 percent of all US counties (see Coibon et al. 2020), over 40 percent of respondents were working from home, more than were working on business premises or not working. In fact, work on business premises was the least frequent response, with just about 25 percent of respondents in that month. By late October, however, those working on business premises had become the largest group with nearly 45 percent of responses. The prevalence of working from home declines by about 10 percentage points but remains high in October at about 32 percent of respondents.[5] Our data also show the partial recovery in labor market conditions, with the share of responses classified under "not working" dropping from 33 to 23 percent.

The right panel of Figure 1 shows how the share of paid working days provided from home varies over time. We first estimate the amount of *pre-pandemic* working from home using publicly available tabulations from the 2017-2018 American Time Use Survey (ATUS).[6] Among all workers, just 14.7 percent spent any full days working from home before the pandemic. Among those who had any full paid days working from home, the frequency was the following:

- Less than once a month: 18.4
- Once a month: 13.5
- Once every two weeks: 13.1
- At least 1 day per week: 10.2
- 1 to 2 days per week: 17.4
- 3 to 4 days per week: 12.8
- 5 or more days per week: 14.5

[5] One question may be how does this align with the data from the Current Population Survey (CPS) showing a 22% share of employed individuals working from home in October 2020 (e.g. https://www.bls.gov/cps/effects-of-the-coronavirus-covid-19-pandemic.htm#data). There are several factors that collectively explain this. Firstly, the CPS looks at employees aged 16+, but if you focus on 20 to 64 the share WFH rises by 1%. Second, the CPS excludes peoples who "*whose telework was unrelated to the pandemic, such as those who worked entirely from home before the pandemic*" which would exclude about 4% based on the ATUS 2018 data. Third, the CPS includes part-time employees, and looking only at full-time employees increases WFH share by 2%. Finally, they look at all income levels while we focus on those earning $20,000+ in 2019, which likely would raise this maybe another 1% to 3% given the strong income-WFH relationship. Collectively these adjustments would add about 8% or 10% to their figure, bringing this to about 30% to 32%, very close to our 32% for October.

[6] The relevant tabulations and documentation are available at https://www.bls.gov/news.release/flex2.t03.htm

Thus, we estimate the share of full paid working from home days before the pandemic is 5.3 percent.[7] We plot this number as the starting point of the time series shows in the right panel of Figure 1.

Then, we estimate the share of paid days spent working from home during each of our survey waves, namely the share of respondents to our current working status question who choose "working from home" among those who were either "working from home" or "working on business premises." The right panel of Figure 1 plots our estimate for each wave along with its 95 percent confidence interval on the vertical axis, while showing the timing of each wave on the horizontal axis.

Looking at Figure 1 we can see how the extent of working from home during the COVID-19 pandemic dwarfs pre-pandemic work from home. On average across our five survey waves, 47.5 percent of all paid workingua days were provided from home, about 9 times as high as in the pre-pandemic time use data. As we might expect, working from home is most prevalent in May at over 62.1 percent of all paid working days (or just shy of 12 times the pre-pandemic figure) and declines gradually to 42.1 percent (or 8 times the pre-pandemic figure) in late October when our most recent wave was in the field.

Table 1 examines how the prevalence of working from home during the pandemic varies across demographics. Pooling across survey waves, 35.3 (0.4) percent of all respondents (including those not working) claim to be working from home on the week of the survey. Conscious of the pandemic's ever-changing state, since August we also ask our respondents "***During the COVID-19 pandemic*** *have you at any point worked primarily from home, for example, due to lockdowns or because it was unsafe or otherwise not possible to work on business premises?*" Table 1 reports on the top right that nearly 60 percent of respondents have indeed worked from home during the pandemic, even if they are not at the moment.

Table 1 also shows the prevalence of working from home is higher for men than women, revealing a 5.5 percentage point gender gap in the amount of working from home during COVID-19. We also find modest differences across ages, between respondents located in "Red"

[7] Specifically we use the following formula: $100 \times (0 * (1 - .147) + .147(0 * 0.184 + 0.05 * .135 + 0.1 * .131 + 0.2 * .102 + 0.3 * .174 + 0.7 * .174 + 1 * .145) = 5.3\%$

Republican-voting states versus "Blue" Democratic states,[8] between workers employed in goods versus service industries, and between those who have children in their household versus not. However, differentials are much larger when we compare respondents across by their earnings or education, consistent with the analyses by Bick, Blandin, and Mertens (2020) and Brynjolfsson et al., (2020), who focus on the early months of the pandemic, namely April and May. The share of respondents working from home is over four times as high among those with graduate degrees than among those who did not finish high school, and nearly twice as high among workers earning $150,000 per year than those earning between $20,000 and $50,000.

We find the comparisons across demographic groups from Table 1 interesting, but they do not show how working from home varies with a given trait, conditional on others. It may be, for example, that women work from home during the pandemic less than men because they tend to work at firms that provide in-person services as argued in Alon et al. (2020).

To get a handle on what factors predict working from home during COVID we therefore regress an indicator for whether a given respondent is working from home on individual characteristics collected from the survey and report the results in columns 1 to 7 of Table 2. We include date (i.e., survey wave) fixed effects in all regressions since we know from Figure 1 that the average amount of working from home varies substantially as the pandemic evolves. To make the coefficients easier to interpret, we use standardized (mean zero, unit standard deviation) versions of our continuous independent variables, namely years of education, log(earnings), internet quality, and the share of votes obtained by Joe Biden in the 2020 US Presidential election in each respondent's state of residence. Our survey collects data on earnings, education, and internet quality using discrete categories (see Appendix A for the relevant questions), so we assign numerical values for each response. For example, we assign 10 years of education to respondents who did not finish high school, 12 to those with high school degrees, and 16 to those with four-year bachelors' degrees.

Columns 1 to 7 of Table 2 show that education, earnings, and state-level politics are the strongest marginal predictors of whether a respondent is working from home during the COVID-19 pandemic. Respondents with one-standard-deviation higher education or earnings predict a

[8] We classify states as "Red" or "Blue" based on the Cook Political Report's Partisan Voting Index, calculated using data from the 2012 and 2016 presidential elections and published at https://cookpolitical.com/state-pvis. We classified the three states designated as "EVEN" in the index, namely New Hampshire, Pennsylvania, and Wisconsin, as "Blue" based on Joe Biden winning these states in the 2020.

marginal 5.5 and 7.2 percentage point higher likelihood that the respondent is working from home during the pandemic. So do the politics of the respondent's home state: a one-standard-deviation higher vote share for Joe Biden in the 2020 election is associated with a 2.2 percentage point higher likelihood of working from home. By contrast, other variables like gender or sex, whether there are children under 18 living in the household, or internet quality have smaller and statistically insignificant coefficients. Much of the narrative surrounding the economic impact of the pandemic has focused on comparisons across industries, with in-person services being particularly hit. Interestingly, however, adding industry fixed effects between columns 6 and 7 has a limited impact on the R-squared and only modestly lowers the coefficients on education, earnings, and politics.

Collecting the results from Figure 1 and Tables 1 to 2 we conclude that the COVID-19 pandemic has resulted in a mass experiment in working from home. Our data point to an eight-fold or more increase in the share of paid working days provided from home relative to pre-pandemic levels. The question, then, is how much of this shift towards working from home will stick after the end of the pandemic, and for what sorts of workers?

4) The future of working from home

Our survey includes two questions that we use to forecast the amount of working from home after the end of the COVID-19 pandemic. The first asks respondents for their preferences regarding working from home after the end of the pandemic:

> ***After COVID, in 2022 and later,*** *how often would you* ***like to*** *have paid workdays at home?*
>
> - *Never*
> - *About once or twice per month*
> - *1 day per week*
> - *2 days per week*
> - *3 days per week*
> - *4 days per week*
> - *5+ days per week*

The second question instead refers to their employer's plans for their working arrangements after the pandemic:

> ***After COVID, in 2022 and later,*** *how often* ***is your employer planning*** *for you to work full days at home?*
>
> - *Never*
> - *About once or twice per month*
> - *1 day per week*
> - *2 days per week*
> - *3 days per week*
> - *4 days per week*
> - *5+ days per week*
> - *My employer has not discussed this matter with me or announced a policy about it*
> - *I have no employer*

In earlier waves like May and July, the question's reference to "After COVID" specified 2021 instead of 2022, but we changed this as it became clear that the pandemic would not be over by early or perhaps even mid-2021.

Based on responses to these questions we construct discrete variables for the percent of full paid days spent working from home during the pandemic. We assign zeros to "Never" and "About once or twice per month" and assign 20 percent for each full paid day per week spent working from home. For example, 3 days per week working from home equals 60 percent of paid working days. When coding the number of employer planned work from home days, we also assign zeros for any respondents who say "My employer has not discussed this matter with me or announced a policy about it." We believe this to be the more conservative choice, in particular, if employers that are less likely to make plans about future working from home are more likely to be distressed during the pandemic, or more likely to be businesses that require labor to be provided on business premises.

Table 3 estimates, side-by-side, how much working from home employees desire and employers are planning for after the end of the pandemic. On average, employers are planning for employees to spend 21.5 (0.3) percent of paid days working from home—namely, about one day

per week. This estimate is somewhat higher but comparable to estimates from Barrero, Bloom, and Davis (2020) and Altig et al. (2020) who use a survey of firms conducted in May 2020 to estimate working from home will amount to about 18 percent of paid days after the pandemic. The average worker, by contrast, would *like to* work from home 44.0 (0.4) percent of the time, or about two full days per week.

The right panel of Figure 1 plots our estimate of post-pandemic employer planned working from home expressed as a fraction of all paid working days, for comparison with what we see before and during the pandemic. Employer plans for working from home after the pandemic are about half of what we actually see in late October based the most recent survey wave. However, it is still about four times higher than the pre-pandemic amount of working from home we estimate from the 2017-2018 American time use data, labeled "pre-COVID" in the right panel of Figure 1.

Most of the gap between actual working from home during the pandemic and employer plans for after comes from a reduction in the intensive margin (the number of days per week spent working from home) rather than the extensive margin (the number of workers spending at least one full paid day working from home). Indeed, the share of respondents whose employers are planning *at least* 1 full paid day of working from home per week is 33.8 (0.8) percent. Three-fifths of the gap between October 2020 and post-pandemic levels of working from home, then, comes from a reduction in the share of working from home days, not in the share of employees working from home regularly. This is consistent with our experience of directly discussing post-pandemic plans with managers in dozens of firms who reported plans to have employees currently working from home come back to the business premises for three or four days a week and remain working from home for the remaining one or two days a week.

In discussions with firms CEOs and managers mention the reason for requiring employees to be on the business premises three days per week is to support innovation, employee motivation and company culture. Managers believe physically interactions are important for these factors, but employees need only be on premises for about three days a week to achieve this. There is also a strong belief that employees should come to work on the same days – so for example, the entire team or company works on Monday, Tuesday and Thursday – to maximize physical overlap in the office.

The distribution of desired working from home days (among those who are able to work from home at least partially), shown in Figure 3, points to a similar conclusion. The median and

mean desired number of working from home days are 2 and 2.5, suggesting workers will go back to the office for part of the week after the pandemic, instead of making a binary decision as during COVID.

Employer plans for post-pandemic working from home are also lower than employees' desires, generating a sizable gap between both measures. Looking at Table 3 it appears that employee desires for post-pandemic working from home are broadly uniform across demographics. Men and women, old and young, high- and low-earning, college graduates and non-college workers, as well as workers in "blue" or "red" states all desire to work from home about 40 percent of working days. Employer plans show more heterogeneity across some of these demographics, in particular across sexes, education and earnings levels.

Higher earning workers, in particular, will work from home more often after COVID-19. Figure 4 shows how the gap between post-pandemic employee desired and employer planned working from home changes as we move up the income distribution. For each earnings category (e.g. $20,000 to $30,000 per year) we compute the average of both statistics and then plot them on the vertical axis against earnings on the horizontal. The black circles show employee desired working from home while the red triangles show employer plans, and the size of each marker corresponds to the proportion of respondents in each category after reweighting to the CPS (see Section 2 for details). For the lowest earners in our sample, the gap between employer plans and employee desires is as large as 1.5 working days per week. As we move up the earnings distribution, employee desires remain basically constant around 2 days per week (or 40 percent of working days) but employer plans increase and thus the gap narrows. The pattern in Figure 4 is the first piece of evidence to suggest that the implications of a persistent shift to working from home will differ across workers, which we examine in Section 6.

As with our analysis of who is working from home during COVID-19, Table 3 and Figure 4 do not show what respondent characteristics predict higher levels of desired or planned post-COVID working from home *on the margin*. Columns 8 and 9 of Table 2 examine this question by regressing each measure of post-COVID working from home on the same suite of characteristics we used to predict pandemic working from home. (As with columns 1 to 7, we report standardized coefficient for all non-binary independent variables.) Men, and particularly men who live with children under 18 would like to work from home less often. Internet quality is associated with more employee desired working from home days, but the magnitude of the coefficient is small,

and it is only statistically significant with 90 percent confidence. By contrast, education, earnings, and Joe Biden's vote share in the 2020 election do not seem to correlate strongly with respondents' working from home preferences.

Column 9 of Table 2 confirms the pattern from Figure 4 whereby higher earnings predict higher levels of employer planned working from home after COVID. Column 9 shows that this pattern still holds after controlling for education, gender, industry and a battery of characteristics. Education and the presence of children in the home also predict more planned post-COVID working from home, but the coefficients are smaller and only marginally statistically significant.

Altogether, what does the future of working from home look like? Our survey evidence indicates that firms will embrace working from home for part of the week, especially for higher earning workers, and workers seem to agree.

5) Mechanisms facilitating a persistent shift towards working from home

It appears that working from home will stick after the COVID-19 pandemic. In this section we discuss five mechanisms facilitating this persistent shift, supporting our arguments with our survey evidence.

a. Stigma associated with working from home has diminished during COVID

Working from home has historically appeared to have a negative reputation. In particular, the view is that employees "shirk" instead of work on days when they are not in the office. Emanuel and Harrington (2020) quantify this in their analysis of pre-COVID productivity in a large US call study, finding a 12% lower level of productivity in employees who selected to work from home.[9] So as we began collecting our survey data we included the following question to see whether perceptions about working from home changed as COVID-19 forced higher-than-ever working from home:

[9] To be clear working from home in their study finds an 8% positive *treatment effect* (the same employee is more productive at working at home than on the business premises), but a 12% negative selection effect (employees who chose to work from home pre-COVID were less productive working from the same location).

Before COVID-19, "working from home" was sometimes seen as "shirking from home." Since the COVID pandemic began, ***how have perceptions about working from home (WFH) changed among people you know?***

- *Hugely improved -- the perception of WFH has improved among almost all (90-100%) the people I know*
- *Substantially improved -- the perception of WFH has improved among most but not all of the people I know*
- *Slightly improved -- the perception of WFH has improved among some people I know but not most*
- *No change*
- *Slightly worsened -- the perception of WFH has worsened among some, but not most, people I know*
- *Substantially worsened -- the perception of WFH has worsened among most, but not all, people I know*
- *Hugely worsened -- the perception of WFH has worsened among almost all (90-100%) the people I know*

If perceptions of working from home have improved during the pandemic, with unprecedented numbers of workers are forced to stay home, both employers and employees will be more open to it after COVID. Employees will feel less ashamed of requesting it, and employers will be more prone to accept it.

Responses to this question indicate that two-thirds of Americans report perceptions of working from home have improved among people they know. Only a small number—6.5 percent—say perceptions have worsened. Figure 5 shows the full distribution of responses across the options given in the question. Altogether, these results leave little doubt that the stigma associated with working from home has diminished during COVID. Table A.7 in the appendix furthermore shows that employee preferences and employer plans for post-pandemic working from home are both higher among respondents who report more widespread improvements in perceptions of working from home.

Appendix Table A.2 additionally shows how net perceptions of working from home (i.e. the share of persons who say perceptions have improved minus the share who say they have worsened) and the gross share of positive perceptions varies across demographics. While the levels

of both statistics are high in the overall population, they increase with education and earnings. We already know from Tables 2 and 3 and Figure 4 that these groups have been more exposed to working from home during the pandemic, so it is perhaps not surprising that stigma has diminished more among them.

b. COVID-19 forced workers and firms to experiment with working from home, helping overcome inertia

We view the pandemic as a situation that forced firms and workers to experiment with working from home, a technology they had always had access to but not tried out due to inertia. This situation can be modeled as a close cousin of a multi-armed bandit problem. Prior to COVID-19, firms and workers primarily operated on business premises, with the payoffs of this strategy coming from a known distribution $F(\cdot)$. At the same time firms had access to a second technology—working from home—which they could try out at some fixed cost. The payoffs of working from home follow a second distribution $G_\nu(\cdot)$, with unknown mean ν, but firms have a prior over the value ν.

Once COVID-19 arrives, it forces firms to all pay the cost of trying out working from home and learn about their payoffs under $G_\nu(\cdot)$. The costs become sunk and thus the pandemic overcomes the inertial reluctance to experiment that are inherent to the multi-armed bandit setup. Indeed, this is summarized in the quote by James Gorman, CEO of Morgan Stanley: "*If you'd said three months ago that 90% of our employees will be working from home and the firm would be functioning fine, I'd say that is a test I'm not prepared to take because the downside of being wrong on that is massive*" (Cutter 2020).

Moreover, the pandemic provides a unique learning opportunity. It is different for a firm to conduct a small experiment with working from home with a few workers (similar to Bloom et al, 2015) than to experiment at the organizational level, while other firms are still operating on business premises. The pandemic, however, is a situation in which many firms coordinate and experiment with working from home at the same time, so they learn about the feasibility and payoffs of a world where a non-trivial share of the economy is working from home.

What has the pandemic experiment revealed about working from home? To answer this question, we asked the following to our survey participants who have worked from home during COVID:

Compared to your expectations ***before COVID (in 2019)*** *how has working from home turned out for you?*

- *Hugely better -- I am 20+% more productive than expected*
- *Substantially better -- I am to 10% to 19% more productive than I expected*
- *Better -- I am 1% to 9% more productive than I expected*
- *About the same*
- *Worse -- I am 1% to 9% less productive than I expected*
- *Substantially worse -- I am to 10% to 19% less productive than I expected*
- *Hugely worse -- I am 20%+ less productive than I expected*

Figure 6 shows the distribution of responses across the several options, and appendix Table A.3 breaks down the mean response across demographics. A majority—61 percent—claim that the experience has turned out better than expected and only 12.7 percent say it has turned out worse. On average, respondents who have worked from home during the pandemic report being 7.6 (0.2) more productive than they expected before the start of the pandemic. These numbers are consistent with evidence from a survey of hiring managers in Ozimek (2020).

The positive productivity surprise of working from home documented in Figure 6 has two separate effects that lead to a persistent shift to working from home. First, there is a variance effect, whereby firms and workers who learn they get payoffs from the right tail of $G_{\nu}(\cdot)$ when working from home will tend to stick with it after the end of the pandemic. Even if firms were correct on average in their ex ante expectations of working from home the fact that some firms had a positive surprised would lead to some persistence. The second effect arises because priors over the mean payoff from working from home $G_{\nu}(\cdot)$ appear to have been biased ex-ante. If the prior were unbiased, we would not see so many more respondents reporting positive rather than negative surprises in Figure 6.

Our discussion so far has centered on how learning about working from home during COVID might lead it to stick in the future, but there is still the question of whether workers and firms will change the behavior in light of what they have learned during the pandemic. In other settings, people do appear to react to forced experimentation, as documented in Larcom, Rauch, and Willems's (2017) study of how London commuters changed their commute routes after a strike

of London underground workers forced them to experiment with alternative routes. But there is also evidence in our survey data that people reacting to the results of the mass working from home experiment. Figure A.2 in the appendix shows a bin-scatter plot of employee preferences and employer plans for post-pandemic working from home on the vertical axis against our measure of the productivity surprise associated with working from home during COVID. Respondents who choose "Hugely better" desire to work from home about 1.5 days more than those who choose "Hugely worse." Similarly, employer plans for post-pandemic working from home are 10 to 15 percent higher among the former than the latter. Workers and firms, thus, appear to have absorbed the lessons learned from the pandemic's working from home experiment, and those lessons appear likely to impact future working arrangements.

c. Workers and firms have made investments (mostly sunk) enabling working from home that will remain after the pandemic

The sudden shift to working from home seen in 2020 spurred workers and firms to invest in physical and human capital to help them work from home effectively. Millions of people learned to use teleconferencing software and many others faced incentives to purchase desks, chairs, microphones, etc., to help them work from home more effectively. These investments will remain after the pandemic and will thus lower the marginal cost of working from home after the pandemic. Thus, they will enable the persistence of working from home.

We quantify these investments in human and physical capital by posing three survey questions to our respondents who report having worked from home during COVID:

> *How many hours have you invested in learning how to work from home effectively (e.g., learning how to use video-conferencing software) and creating a suitable space to work?*
>
> *How much money have you and your employer invested in equipment or infrastructure to help you work from home effectively -- computers, internet connection, furniture, etc.?*
>
> [For those reporting positive investment in the previous question:] *What percentage of this expenditure has been reimbursed or paid by your employer?*

The average respondent reports 13.7 (0.3) hours and $660 (17) worth of investment into working from home. Table A.4 in the appendix breaks down these figures across demographic groups. Moreover, the average worker had 60 percent of the monetary investments paid or reimbursed by their employer.

How large are these investments into working from home relative to the US economy? Aggregating the monetary investments reported by individuals in our survey and valuing their time at their hourly wage rate we estimate that the human and physical capital investments into working from home are as large as 1.2 (0.03) percent of 2020 GDP.

We believe our estimates likely understate the actual amounts invested into working from home. The reason is businesses have themselves made investments enabling working from home on business premises (e.g. buying new servers and improving virtual private networks) that are not included in our survey. The 2020 pandemic recession is unlike other post-war economic downturns in that it has been driven by large drops in consumption—of services in particular—rather than investment. US National Accounts do show drops in most categories of investment, but also a sharp increase on 7% versus 2019 in purchases of IT equipment, computers, and peripherals (Eberly 2020). [10] Much of the monetary investment that does show up in our survey is unlikely to be counted as part of those investments[11], suggesting total investment in working from home probably exceeds 1.2% of GDP in 2020.

d. Residual fear of proximity to others will remain after the pandemic

Since the start of the pandemic, the hope has been that a COVID-19 vaccine will be discovered and made widely available, so once the population achieves "herd immunity" we can safely return to activities that pose a risk of contracting the disease. As of late November 2020, those prospects are looking better with three vaccine candidates showing high efficacy in late state trials, but it is not obvious that habits will change automatically once vaccines become widespread.

We examine this issue in our survey data by asking our respondents the following:

[10] The US National Income and Product Accounts investment in "information processing equipment and software" growth rate jumped to 2.2% and 5.8% in 2020Q2 and 2020Q3 respectively (compared to an average of 1.1% over the 40 quarters 2010Q1 to 2019Q4 inclusive).

[11] Employee reimbursements usually show up as business expenses rather investments since employee purchased assets are not normally included in the asset register or included in the balance sheet.

If a COVID vaccine is discovered and made widely available, which of the following would best fit your views on social distancing?

- *Complete return to pre-COVID activities*
- *Substantial return to pre-COVID activities, but I would still be wary of things like riding the subway or getting into a crowded elevator*
- *Partial return to pre-COVID activities, but I would be wary of many activities like eating out or using ride-share taxis*
- *No return to pre-COVID activities, as I will continue to social distance*

Table 4 shows the distribution of responses across the four options.

Only 28 percent of respondents would return to their pre-COVID activities "completely," and as many as 12 percent would continue to social distance in the event a vaccine was made widely available.[12] There is no guarantee people's future actions will correspond to their survey responses, but this evidence bodes ill for hopes that a vaccine will work as an immediate silver bullet against the pandemic. Our results are also consistent with anecdotal reports of changing habits among the general public (Mims 2020), systematic evidence that COVID-19 caused a spike in reallocation with arguably persistent effects on the economy (Barrero, Bloom, and Davis 2020) and evidence that earlier major events like 9/11 had a long-run impact in lowering air-travel (Blunt, Clark and McGibany, 2006).

Intrigued about the reasons behind these responses, in recent waves we ask a follow-up question to respondents who did not say they would return to pre-COVID activities "completely." Among them, a majority cited concerns with the effectiveness, safety, or take-up of the vaccine, consistent with other evidence reported in various media outlets including Hopkins (2020) and Tyson, Johnson, and Funk, (2020). See appendix Table A.6 for details. It may be that Americans will turn out to be less risk averse in reality than in our survey question about returning to pre-pandemic habits. But their reasoning about vaccines is consistent and suggestive of a persistent preference for continued social distancing, likely including working from home.

[12] Table A.5 in the appendix shows how the share of persons who *would* return completely once a vaccine arrives changes with demographics. It is notably higher among men, those with post-graduate education, and those with annual earnings over $150,000.

e. Innovation to improve working from home

Technological advances and investments enabling working from home will enable workers and firms to shift to working from home and provide incentives for others to create and further adopt new technologies and conduct further investments. Bloom, Davis, and Zhestkova (2020) show the share of new patents that explicitly mention working from home or remote work rapidly increased post-pandemic, more than doubling by June 2020 alone. Implementation of these innovations leads to more working from home and more investment in the networks that support it, such as physical communication networks and common knowledge of popular collaboration platforms like Zoom and Microsoft Teams. Greater working from home in turn creates demand for new technologies and further investments. This is one example of the broader phenomena of directed technical change (e.g. Acemoglu 2002) whereby a dramatically – as in five to ten fold – increase in the market for working from home equipment and software during and after the pandemic has spurred innovation.

Overarching these five mechanisms network effects will amplify their impact to further facilitate a persistent shift to working from home. Our discussion previously outlined network effects related to firms' ability to learn about the payoffs of working from home. This learning is arguably more valuable when most firms coordinate on working from home, as during the pandemic. Coordination, thus, creates greater incentives for more firms to try out and learn how to work from home during the pandemic, generating a positive feedback loop. The same logic applies to diminishing stigma related to working from home, for instance, and to actually doing business with a non-trivial share of their employees working from home. As firms coordinate at an organizational level on holding meetings over video conferencing software, as do multiple firms that do business with each other, the payoffs of working from home increase and allow for it to persist

6) Implications of a persistent shift to working from home

A persistent and widespread shift to working from home carry broader implications. Here, we use our survey evidence to characterize some of the more salient implications, in particular for

workers, cities, and productivity. Other studies provide deeper analysis of the impact of working from home during and after COVID on other aspects of the economy, for example Cicala's (2020) analysis of residential electricity consumption. We agree with the assessment of Orrell and Leger (2020), that more research on the implications is needed to guide businesses and policymakers in their efforts to manage and handle a much more remote workforce.

a. Working from home is a perk, and one which higher earning, highly educated workers will enjoy disproportionately

Participants in our survey express a desire to work from home, as we see in Table 3, for example. On its face, that desire suggests they view working from home as a perk. We test that hypothesis more formally by asking them explicitly whether they value working from home and, if so, how much. The following two-part question appeared in our most recent survey waves (earlier waves included similar questions):[13]

> ***After COVID, in 2022 and later,*** *how would you feel about working from home 2 or 3 days a week?*
>
> - *Positive: I would view it as a benefit or extra pay*
> - *Neutral* [No follow-up question]
> - *Negative: I would view it as a cost or a pay cut*
>
> [Depending on the previous answer] *How much of a* ***pay raise [cut]*** *(as a percent of your current pay) would you value as much as the option to work from home 2 or 3 days a week?*
>
> - *Less than a 5% pay raise [cut]*
> - *A 5 to 10% pay raise [cut]*
> - *A 10 to 15% pay raise [cut]*
> - *A 15 to 25% pay raise [cut]*
> - *A 25 to 35% pay raise [cut]*
> - *More than a 35% pay raise*

[13] Previous versions of this question had less granular options for the second part, for example combining the "5 to 10%" and "10 to 15%" options. In the earliest waves we used a one question approach. See Appendix B for details.

Collecting responses to this two-part question, we confirm our hypothesis that the typical respondent views the option to work from home a couple days a week as a perk. Figure 7 shows the distribution of responses (consolidating some of the response options together). Nearly half of respondents value working from home part of the time as a modest raise of under 15 percent. A bit more than one in six view it as a substantial perk worth more than 15 percent and only about one out of twelve view it negatively.

Given our estimates of substantial post-COVID working from home, it appears employees stand to benefit as this perk becomes a persistent feature of many jobs. It is less clear how these benefits will be distributed across the population. To answer this question, we estimate how much of that perk value workers will *actually get* after the pandemic, based on their responses to the perk value question and employers' plans for them to work from home post-COVID. (See Section 4 for details about the underlying survey question about employer plans and Table 3 for summary statistics.) Thus, we translate the categorical responses from the two-part question above into numerical values by assigning them the midpoint of the interval chosen by the respondent. We assign zeros to workers who are "Neutral" about working from home, negative values when the respondent views working from home as a pay cut, and we use 40 percent for the "More than a 35% pay raise [cut]" option. Altogether, the average employee reports the value of working from home is worth 7.6% on average (Table 5) which is very close to the 8% value Mas and Pallais (2017) report in their experimental job-applications data.

Then, we adjust this "raw perk value" to account for how much each respondent's employer is planning for them to work from home. This adjustment is important because some groups, like higher earners and college and post-graduate degree holders will get to work from home more often than others, as we can see in Figure 4. So, we multiply the raw perk values by:

- Zero, if the respondent's employer is planning for them to work from home "Never" or "About once or twice per month."
- One-half, if their employer plans for them to work from home "One day per week," since our perk value questions correspond to working from home "2 or 3 days a week."
- One, if their employer plans for them to work from home more often than once a week. Thus, we assume there is no extra perk value in working from home more than the "2 or 3 days a week" specified in the question, in our view a conservative choice.

We refer to the resulting variable as the "value of planned post-COVID working from home," and use it as our primary measure of worker benefits.

The value of planned post-COVID working from home is unevenly distributed across the population. Figure 8 shows how the mean value changes with respondent earnings, and Table 5 estimates the mean value across demographic groups. (Table 5 also reports the "raw perk value," namely, without adjusting for employers' post-pandemic working from home plans). From the table and the figure, we find benefits increase with earnings and education. Men also appear likely to receive benefits worth nearly 80 percent more than women (3.4 percent for men versus 1.9 percent for women). These uneven benefits across groups arise partly because some groups value working from home by more, as we can see from the raw perk values in the second column of Table 5. But uneven benefits also arise because some groups will get to work from home more post-COVID, as we can see from employer plans in Table 3 and Figure 4. Higher earners and highly educated workers value working from home more, and they will *also* get to enjoy it more often post-COVID. Women, by contrast, value working from home as much as men (a 7.5 percent raise compared with 7.7 for men in Table 5). But since men report they will get to work from home much more (26 percent of working days for men versus 18 percent for women in Table 3), men appear likely to end up with higher benefits of planned working from home in Table 5.[14]

Altogether, the persistent shift to working from home will benefit workers across the board. All of our estimates of the mean benefit in Table 5, after incorporating employer plans, are positive. They are, however, larger among workers who have suffered less during the pandemic[15], and who have faced better conditions in recent decades. This result carries broader implications for economic welfare and for the design of policies affecting labor market conditions in years and decades to come.

b. Expenditure in major city centers may decrease by 5 to 10 percent

[14] In the appendix, we also estimate the subjective value of a respondent's commute time savings based on how much working from home they expect to have after COVID. We find similar results when we use commute time savings as a measure of the benefits of post-pandemic working from home, since commute times tend to be longer for workers who value working from home more, and who will get to enjoy more of it post-COVID.

[15] See, for example, Adams-Prassl et al. 2020, Alon et al. 2020, Mongey et al. 2020 among others for evidence of the worse pandemic impact of lower educated, women and those unable to work from home.

The shift to working from home raises questions about the future of dense cities like New York and San Francisco, whose recent prominence was built on the concentration of high-earning, highly educated workers and is associated with the development of amenities and in-person services like dining and entertainment, as well as retail. So far, there has been much speculation and anecdotal accounts in the media about potential effects and—as far as we know—less systematic evidence about future plans for working from home and their impact on dense cities.

We use our survey data to examine how a persistent shift to working from home might impact spending in Manhattan and San Francisco. To do so, we exploit questions in our survey about the location of respondents' job business premises in 2019, as well as questions on how much they used to spend on meals (i.e. lunch and coffee), shopping, and entertainment (e.g. bars and restaurants) near their workplace before COVID. (See Appendix B for the full questions.)

In our survey data, higher population density around a respondent's pre-pandemic workplace indeed predicts higher spending near work. The left panel of Figure 9 shows a bin-scatter plot with twenty quantiles of log(population density) across respondents' job locations on the horizontal axis and a consolidated measure of weekly spending near the workplace on the vertical axis. The figure shows a positive relationship between density and expenditures, which is confirmed by a positive and statistically significant coefficient of 23.08 (1.77).

We also find that density around a respondent's workplace predicts more employer planned working from home after COVID. The right panel of Figure 9 shows a bin-scatter plot, again with twenty quantiles of log(population density) on the horizontal and the percent share of employer planned working from home days on the vertical axis. Again, we find a positive relationship, with a coefficient of 1.95 (0.35). Together, the two relationships shown in Figure 9 seem to confirm the conventional wisdom and anecdotes reported in the media, namely that dense cities will likely see less retail and entertainment spending as their workers shift to working from home.

To make these results more concrete, we forecast the reduction in spending in Manhattan and San Francisco. Isolating respondents in our data who report working in Manhattan and San Francisco before COVID, we find they spend $319 and $185 around work each week, and plan to work from home 30 and 61 percent of the time after COVID. Aggregating these figures by the 2.3 million or 200 thousand workers who commute (on net) into Manhattan (see Moss et al. 2020) or

San Francisco,[16] we forecast spending reductions of $11 Billion or $1 Billion, respectively. Scaling these numbers by 2019 taxable sales in each location,[17] we obtain a reduction of 6 percent in San Francisco and 12 percent in Manhattan. Granted, some of this expenditure may be reallocated within the city, but even then the scale of pre-COVID expenditures, commuters, and working from home changes point to significant shifts in expenditures away from central business districts and perhaps towards suburban residential areas.

c. The shift to working from home may improve overall productivity

One of the largest questions regarding a persistent shift to working from home is whether workers are more productive than at the office. Bloom et al. (2015) show, using a field experiment, that call center workers are on average more productive when they work from home, but it is not obvious whether these findings will generalize to the broader population. It is also not obvious whether offices or homes have fewer distractions and more quiet time, with co-workers and water coolers in the former, and televisions, (potentially) children, and less supervision in the latter. So far, we have presented evidence that our respondents report being more efficient while working from home during COVID than they *expected*. But the question remains, are workers more productive at home than on business premises, or vice versa?

We assess the relative productivities of working from home and business premises based on responses to the following two-part question in our survey, directed at respondents who worked from home at some point during COVID:[18]

> *How does your efficiency working from home **during the COVID-19 pandemic** compare to your efficiency working on business premises **before the pandemic?***

---

[16] See Moss et al. (2012) for the Manhattan number, and https://www.vitalsigns.mtc.ca.gov/commute-patterns#:~:text=San%20Francisco%20leads%20the%20Bay,of%20120%2C000%20commuters%20each%20day for San Francisco.

[17] In San Francisco, 2019 sales tax receipts were $16.9 Billion (Source: https://www.cdtfa.ca.gov/dataportal/dataset.htm?url=TaxSalesByCounty). In New York City they were $182 Billion (Source: https://data.ny.gov/Government-Finance/Taxable-Sales-And-Purchases-Quarterly-Data-Beginni/ny73-2j3u/data.) Taxable sales are not separately reported for Manhattan, so we assume Manhattan accounts for half of all taxable sales, which seems reasonable given Manhattan attracts more businesses and tourists than the rest of the city but has a minority of the population.

[18] As with the question about the perk value of working from home, earlier versions of this question did not use a two-part approach or used a different level of disaggregation for the choices. For Figure 10, we focus on survey waves where the questions and choices were comparable. For our quantitative analysis of the relative productivity of working from home, we pool responses from all question versions and waves.

- *Better -- I am more efficient at home than I was working on business premises*
- *About the same -- I'm equally efficient in both places* [No follow-up question]
- *Worse -- I am less efficient at home than I was working on business premises*

[Depending on the previous answer] *How much **more efficient** have you been working from home **during the COVID-19 pandemic** than on business premises **before the COVID-19 pandemic?***

- *Under 5% more [less] efficient*
- *5 to 10% more [less] efficient*
- *10 to 15% more [less] efficient*
- *15 to 25% more [less] efficient*
- *25 to 35% more [less] efficient*
- *Over 35% more [less] efficient*

Figure 10 shows the distribution of responses. A plurality of workers, 43.5 percent, report being about as efficient at home during COVID than on business premises before COVID. But a similar number, 41.2 percent, report being more efficient at home than at the office and just 15.3 percent report being less efficient.

Taken at face value, these numbers suggest the economy has been more productive during COVID, and a persistent shift to working from home would be a boon to productivity. Our result coincides with findings by Riom and Valero (2020), who use a survey of UK businesses during COVID to show that firms have largely adopted new technologies, management practices, and more broadly adapted to increase employee productivity. To quantify these effects, we first translate the categorical survey responses into a quantitative variable by assigning zeros to respondents who chose "About the same" in the first question, assigning a value equal to the midpoint of each interval in the second question, and 40% to any "Over 35%" responses. We now have a quantitative measure of how much more productive each worker is at home during COVID relative to how productive they were on premises before COVID.

To estimate how much more efficient the US has been during COVID we need to adjust our quantitative measure for selection into working from home, since we only asked the underlying survey question to respondents who worked from home at some point during COVID. Thus, we

assign a relative efficiency of zero to any respondent who reported they were working on business premises during the pandemic, or who said they are unable to do their job from home. We then compute the earnings-weighted average of this selection-adjusted relative efficiency and find that it is 4.6 (0.2) percent higher during COVID than it would have been if workers had remained at the office.

We make a similar adjustment to our relative efficiency variable before forecasting the change in efficiency or productivity we will see after COVID. In addition to adjusting for selection into working from home, we scale the relative efficiency of each worker by the share of paid days they report their employer plans for them to *actually* work from home after the pandemic. Thus, a worker who claims to be 10 percent more efficient at home will only be 4 percent more efficient if their employer is planning for them to work from home two days per week (40 percent of the time). As before we compute the earnings-weighted mean of this variable and obtain a predicted increase in productivity of 2.4 (0.1) percent after COVID. There are good reasons to think this value is an underestimate, since our question specifically refers to efficiency *during* COVID, with children at home, pandemic related stress, and a sudden change in working arrangements. There are also questions about how firm managers perceive productivity while working from home during COVID, in particular whether they disagree with workers' assesments of productivity. Ozimek (2020) finds more managers report an increase than a decrease in productivity, but Bartik et al. (2020) find managers believe workers are less efficient while at home during the pandemic.

We consider a final adjustment to our data, where we assume workers who claim to be less efficient at home than on business premises are allowed to reoptimize and override their employer's plans, working on business premises all the time. This adjustment raises the post-pandemic productivity forecast to 2.9 (0.1) percent, illustrating the potential gains from this re-optimization, specifically by allowing employees to choose what working arrangements work best for them.

Our estimates of the efficiency impact of working from home are surely imperfect. However, this evidence along-side the prior literature on the potential productivity increases from working from home suggests the persistent shift to working from home will likely boost productivity.

7) Conclusion

We examine the massive experiment in working from home spurred by the COVID-19 pandemic and whether, how, and why working from home will stick. Based on 15,000 survey responses from working age Americans, carried out between May and October 2020, we estimate that one half of paid hours were provided from home during this period. After the pandemic, employers are planning for about 23 percent of paid days to be spent working from home, a four-fold increase relative to before the pandemic. This works out as roughly 2 days a week for the roughly 50% of employees than can work from home. Managers report the other three days per week employees need to work on the business premises to support innovation, employee motivation and company culture.

Our survey provides evidence for five channels facilitating this persistent shift to working from home. These channels are diminished stigma, learning and experimentation that overcome inertia and biased expectations about working from home, investments enabling working from home, residual fear of proximity other people (e.g. in elevators and subways), and innovation improving the ability to work from home. We also argue network effects will further amplify these individual channels.

Finally, we examine some implications of the shift to working from home. Working from home is a perk, but men, higher earners and highly educated workers will disproportionately get to enjoy it. Since high earners and the educated are particularly likely to work in city centers these areas will see steep drops in retail demand, with forecasted drops in spending of 5 to 10 percent in places like Manhattan and San Francisco. Finally, our survey respondents report being more efficient working from home during COVID than they were on business premises before COVID. So, we forecast the permanent shift to working from home will increase productivity by 2.4 percent in aggregate.

Our data collection efforts are ongoing, so we expect to continue to update these results in the coming months as the pandemic (hopefully) subsides, vaccines are rolled out, and plans about the future of working from home confront the post-pandemic reality.

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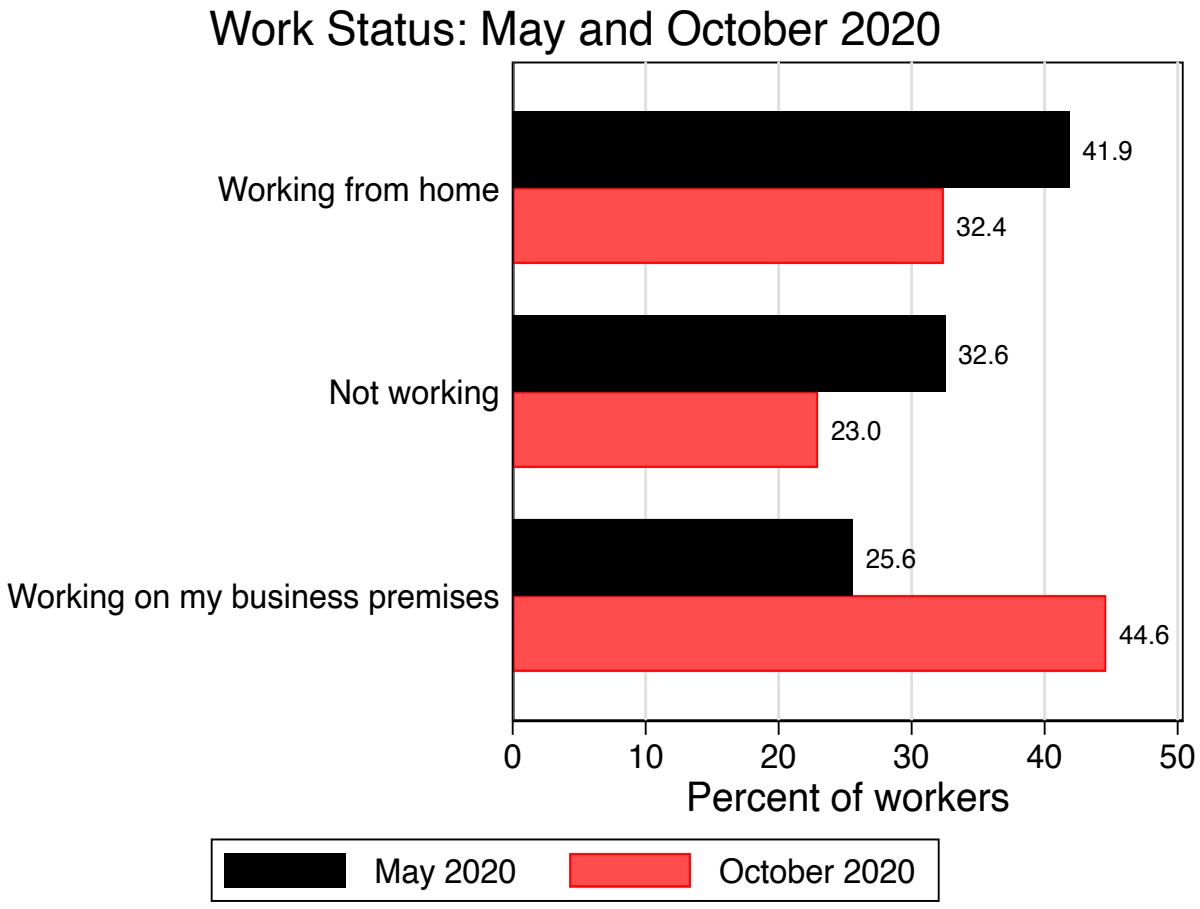
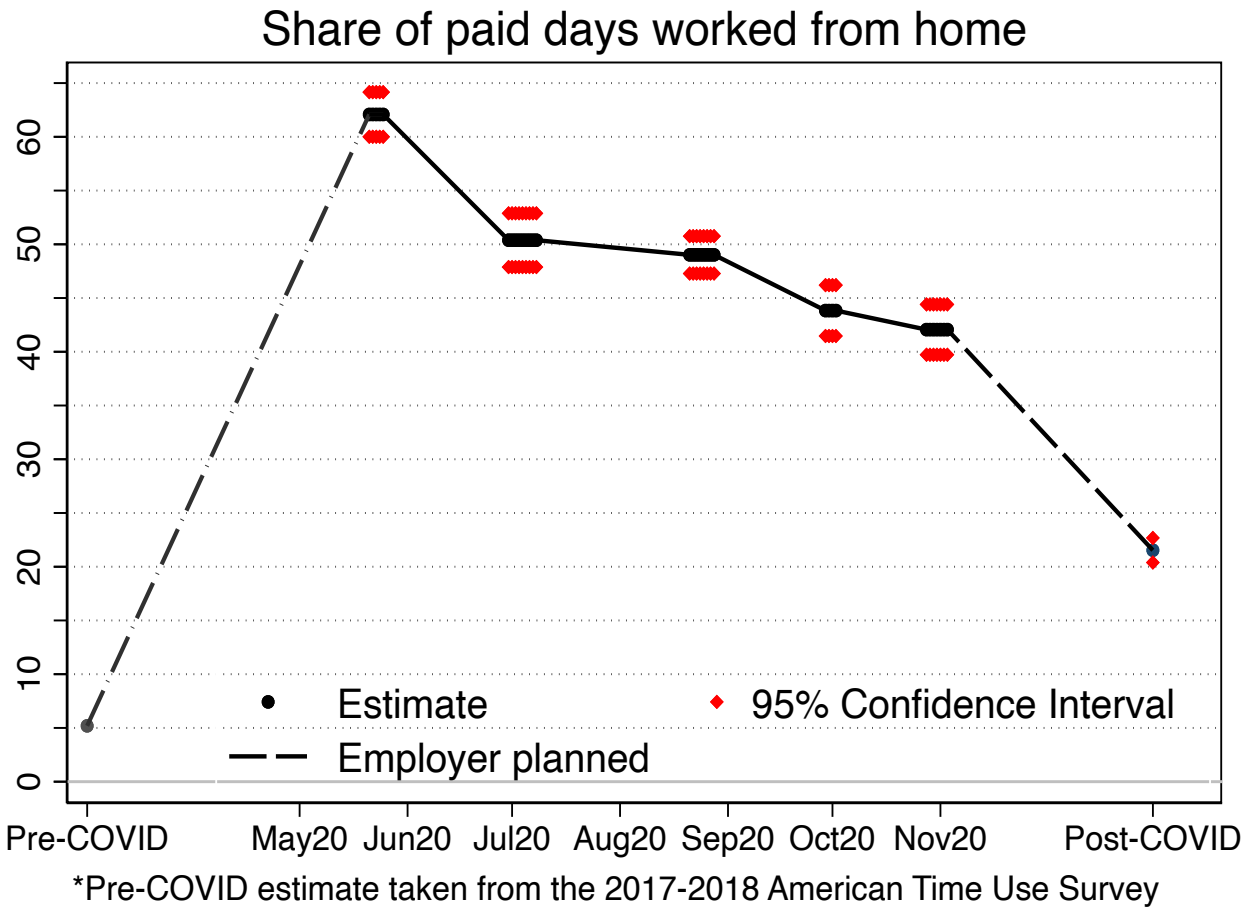
Figure 1: Extent of working from home during, before, and after COVID



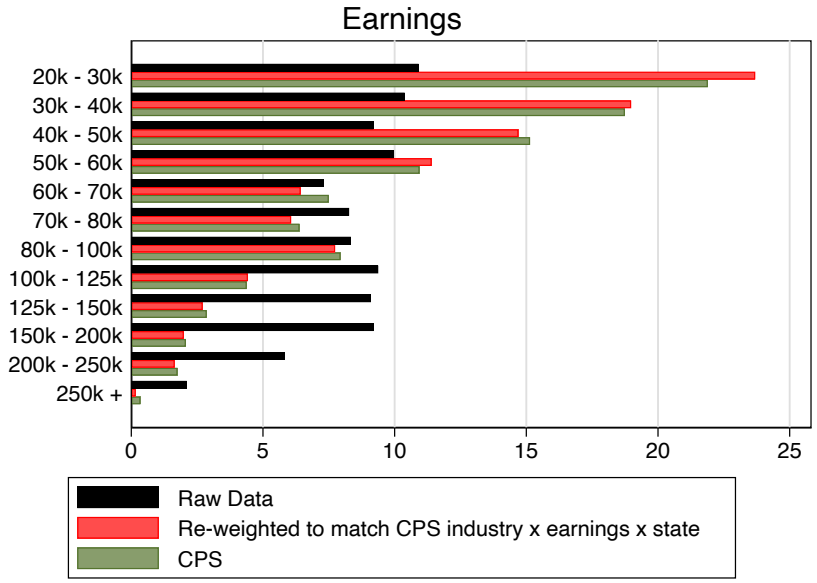


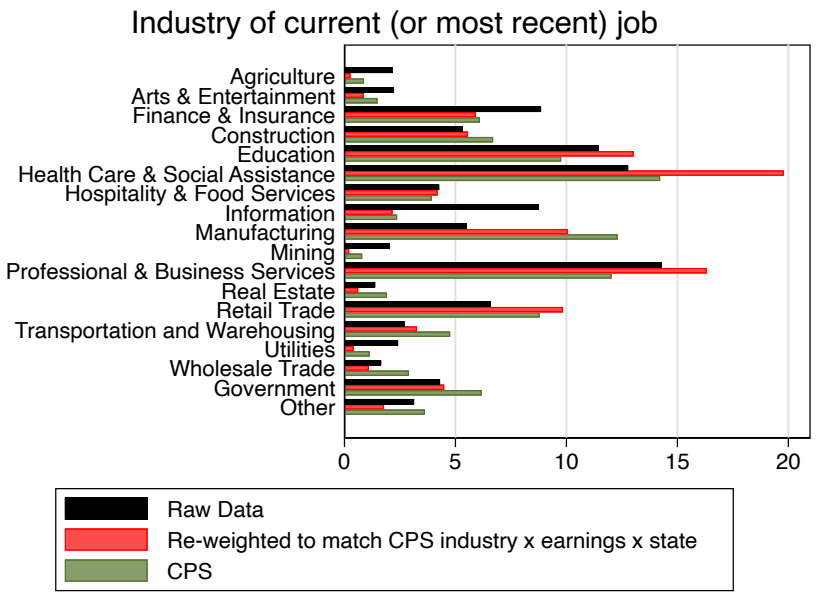
Source: Responses to the questions: *"**Currently (this week)** what is your work status?" and "**After COVID, in 2022 and later,** how often is your employer planning for you to work full days at home?"*

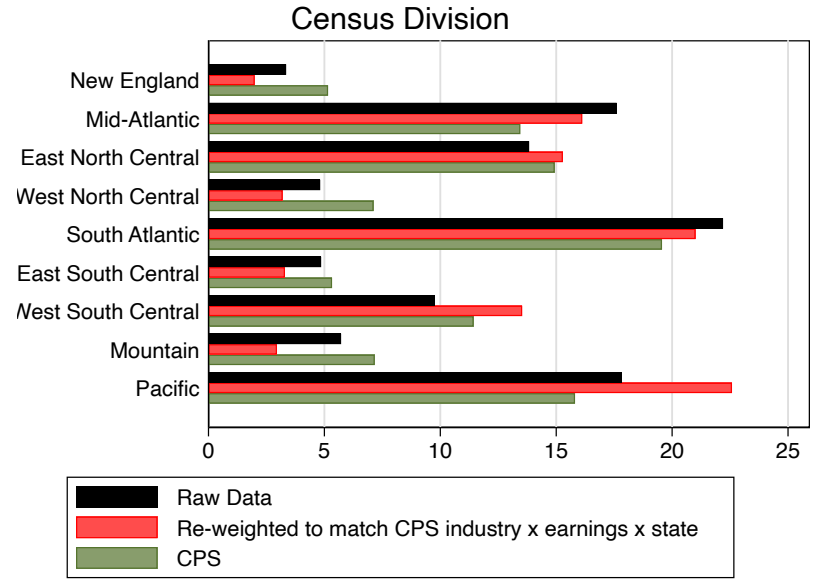
Notes: Data from 15,000 survey responses collected in May, July, August, September, and October 2020 by Inc-Query and QuestionPro. Each wave collected 2,500 responses, except the August wave which collected 5,000. We re-weight raw responses to match the share of working age respondents in the 2010-2019 CPS in each {industry x state x earnings} cell.

Figure 2: Survey Responses vs. CPS

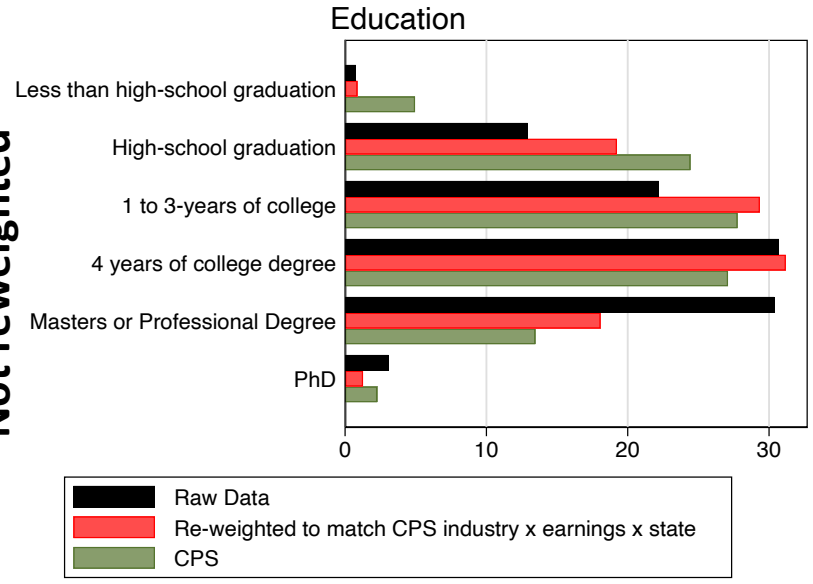
Reweighted

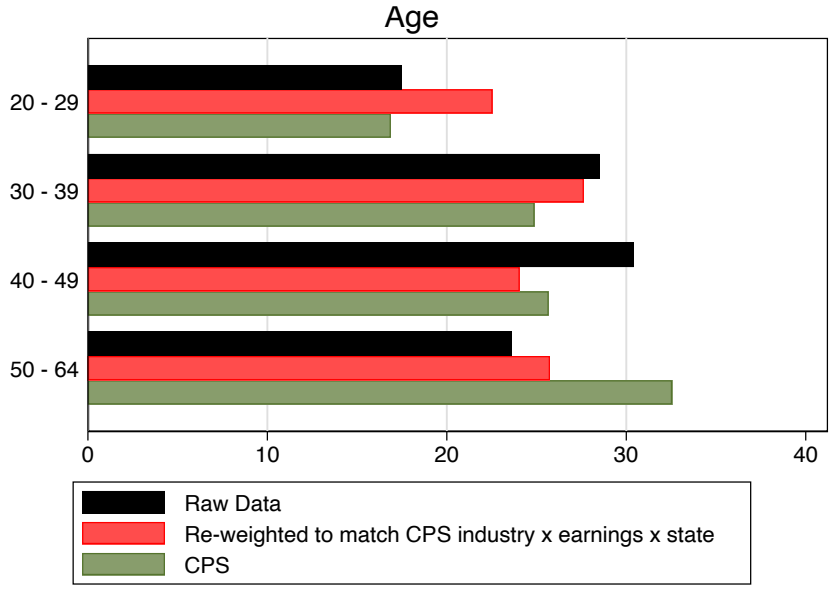


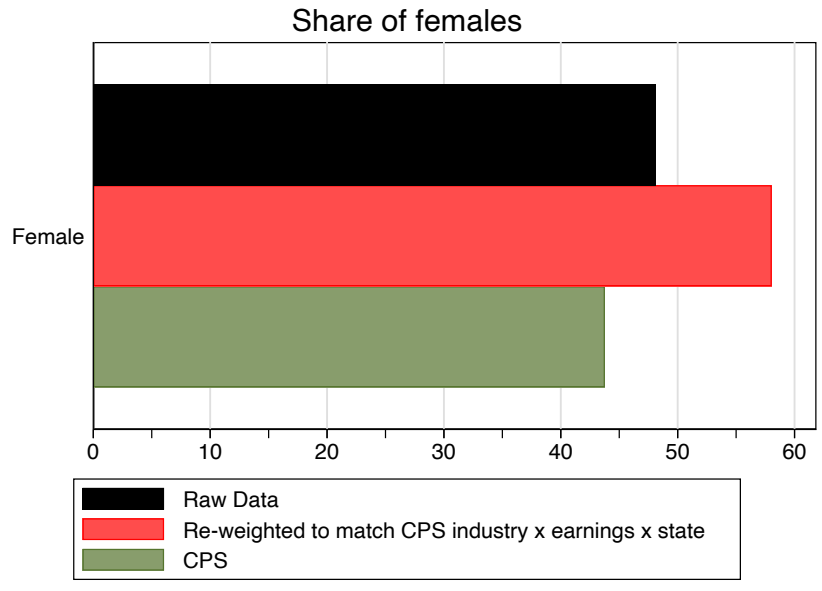




Not reweighted

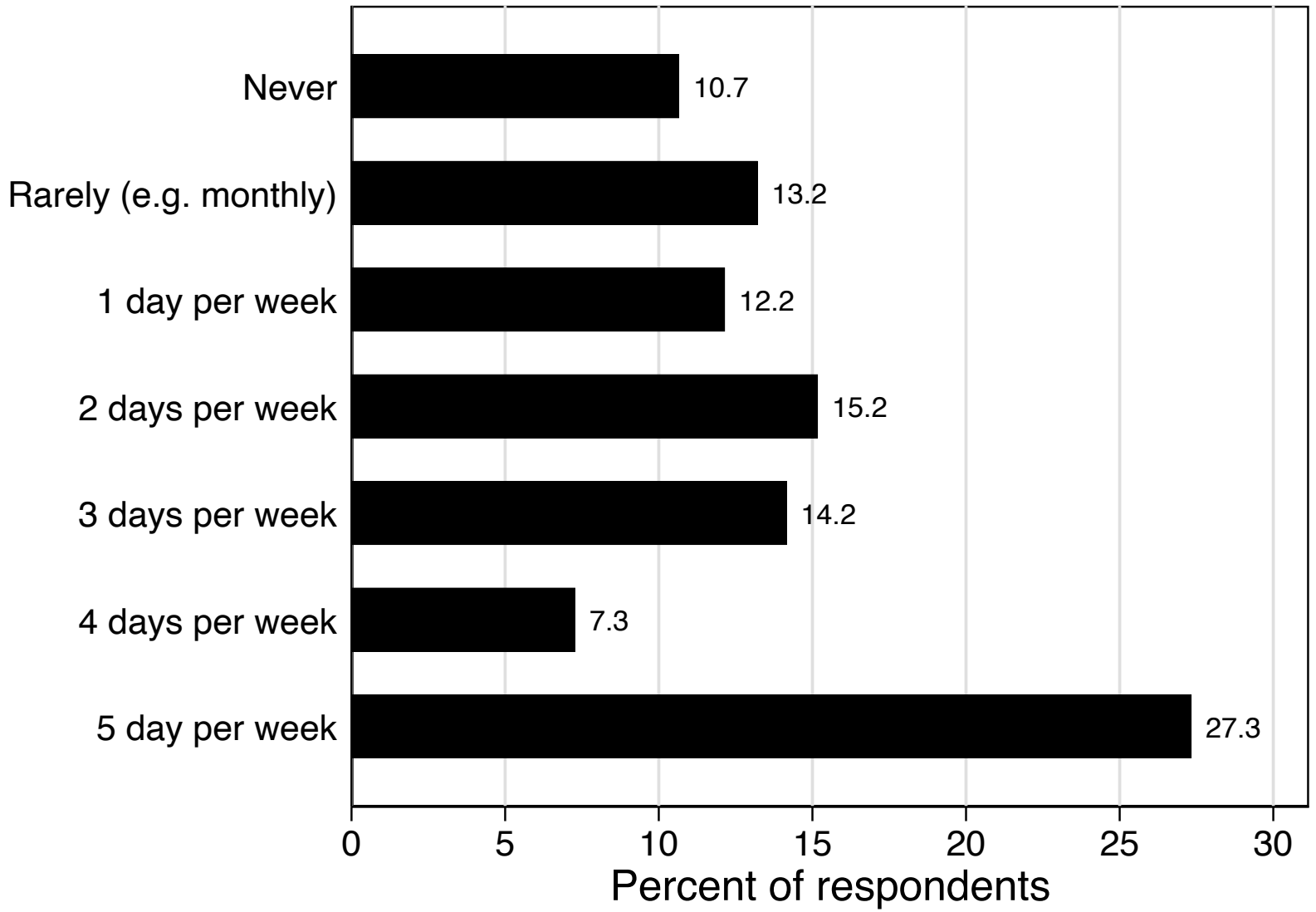






Notes: Each figure shows the distribution of raw survey responses, survey responses reweighted to match the share of persons in a given {earnings x industry x state} cell in the 2010 – 2019 CPS, and the distribution among persons earning more than $20,000 per year in the 2010 – 2019 CPS. Data are from 15,000 survey responses collected in May, July, August, September, and October 2020 by Inc-Query and QuestionPro. Each wave collected 2,500 responses, except the August wave which collected 5,000.

Figure 3: Desired amount of paid work from home days, among workers who can work from home



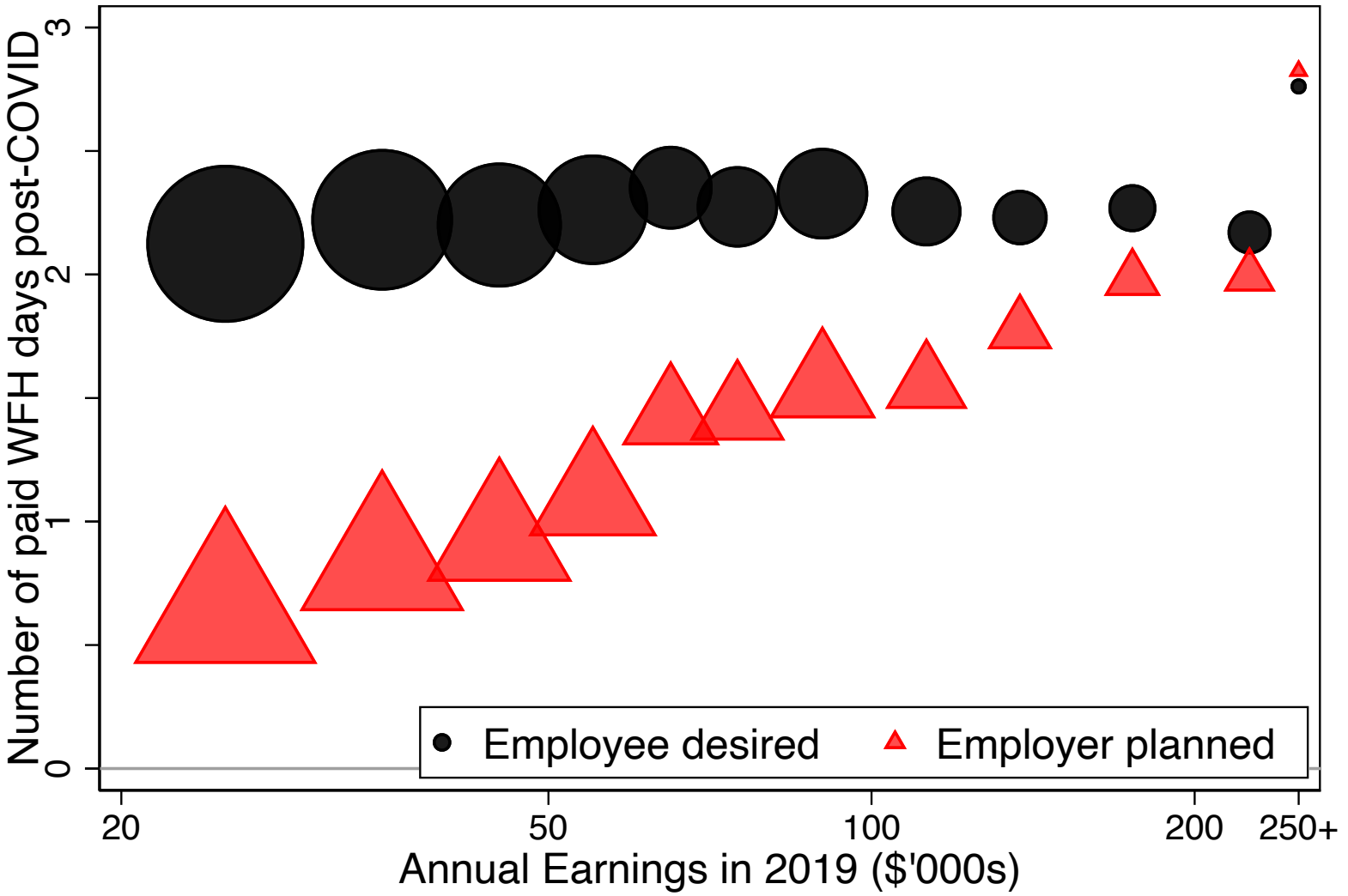
Source: Responses to the question:

In 2022+ (after COVID) *how often would you like to have paid work days at home?*

Notes: Data are from 15,000 survey responses collected in May, July, August, September, and October 2020 by Inc-Query and QuestionPro. Each wave collected 2,500 responses, except the August wave which collected 5,000.

*Sample: Respondents who report being able to WFH or did at some point during COVID

Figure 4: Worker-desired WFH is fairly uniform. Employer plans increase with earnings.



Note: Marker size is proportional to the number of respondents per income level.

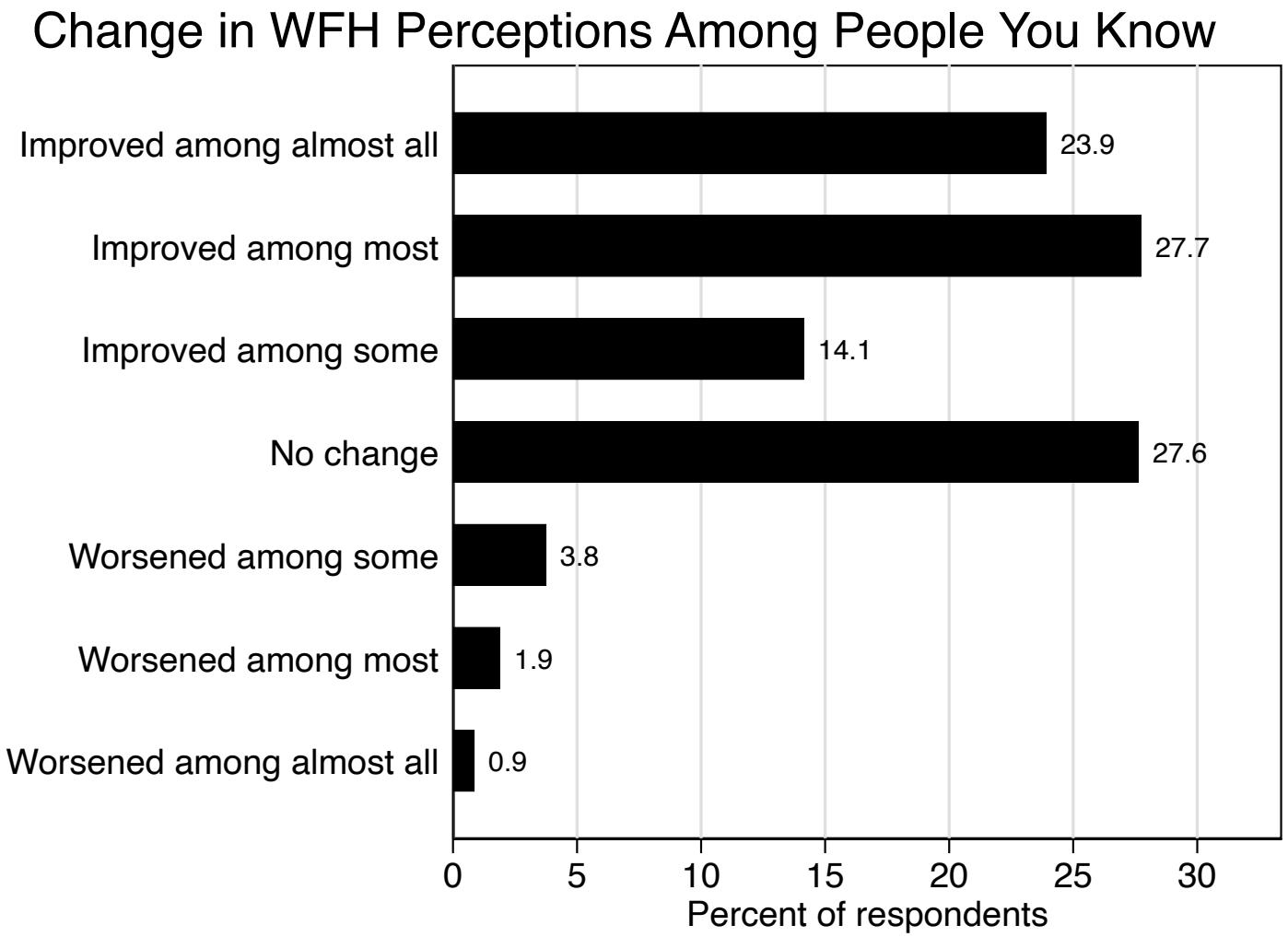
Source: Response to the questions:

After COVID, in 2022 and later, *how often would you like to have paid workdays at home?*

After COVID, in 2022 and later, *how often is your employer planning for you to work full days at home?*

Notes: Data are from 15,000 survey responses collected in May, July, August, September, and October 2020 by Inc-Query and QuestionPro. Each wave collected 2,500 responses, except the August wave which collected 5,000. We re-weight raw responses to match the share of working age respondents in the 2010-2019 CPS in each {industry x state x earnings} cell.

Figure 5: WFH stigma has diminished



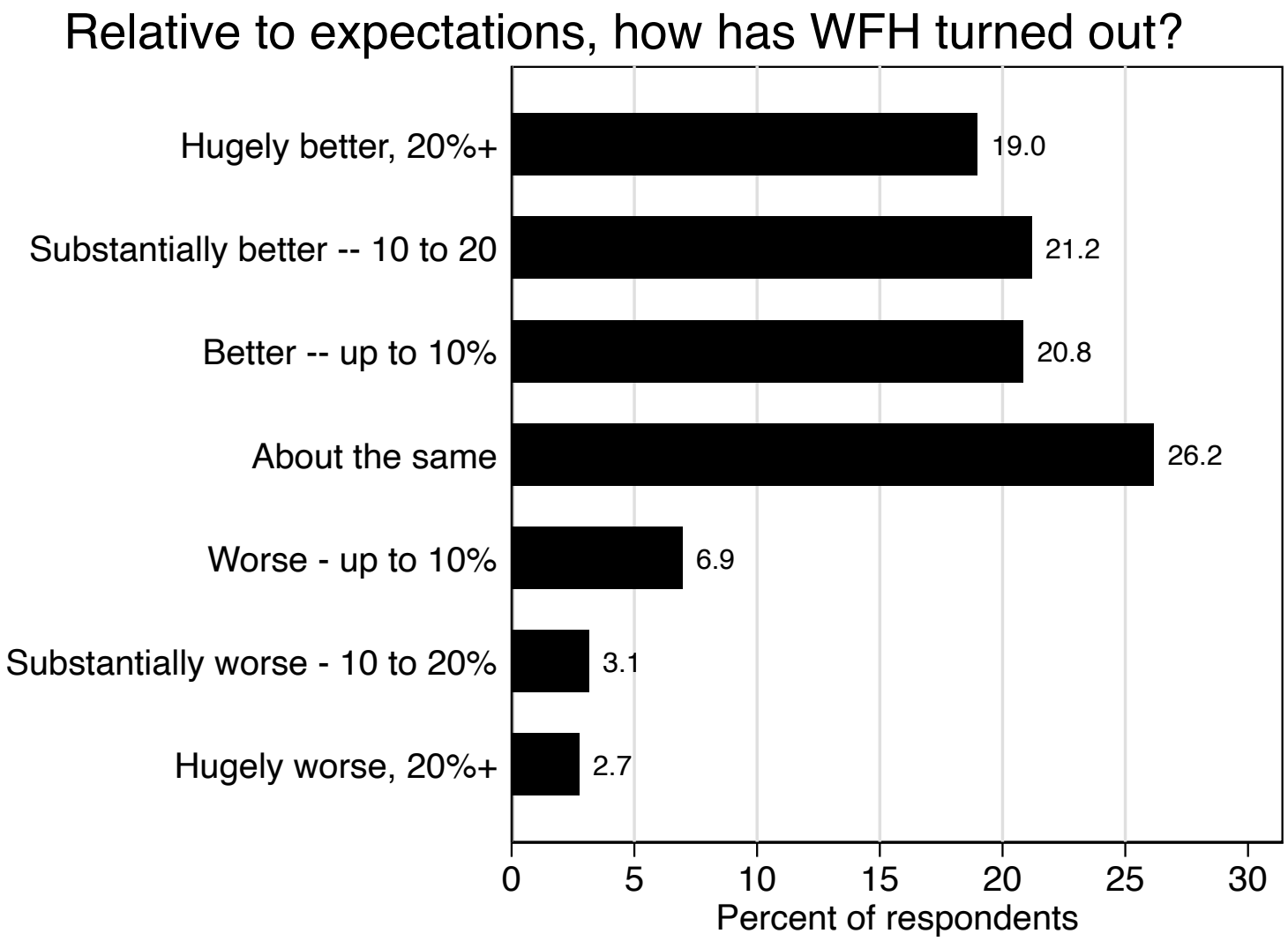
Source: Responses to the question:

Before COVID-19, "working from home" was sometimes seen as "shirking from home." Since the COVID pandemic began, ***how have perceptions about working from home (WFH) changed among people you know?***

- *Hugely improved -- the perception of WFH has improved among almost all (90-100%) the people I know*
- *Substantially improved -- the perception of WFH has improved among most but not all of the people I know*
- *Slightly improved -- the perception of WFH has improved among some people I know but not most*
- *No change*
- *Slightly worsened -- the perception of WFH has worsened among some, but not most, people I know*
- *Substantially worsened -- the perception of WFH has worsened among most, but not all, people I know*
- *Hugely worsened -- the perception of WFH has worsened among almost all (90-100%) the people I know*

Notes: Data are from 15,000 survey responses collected in May, July, August, September, and October 2020 by Inc-Query and QuestionPro. Each wave collected 2,500 responses, except the August wave which collected 5,000. We re-weight raw responses to match the share of working age respondents in the 2010-2019 CPS in each {industry x state x earnings} cell.

Figure 6: The WFH experience has exceeded expectations



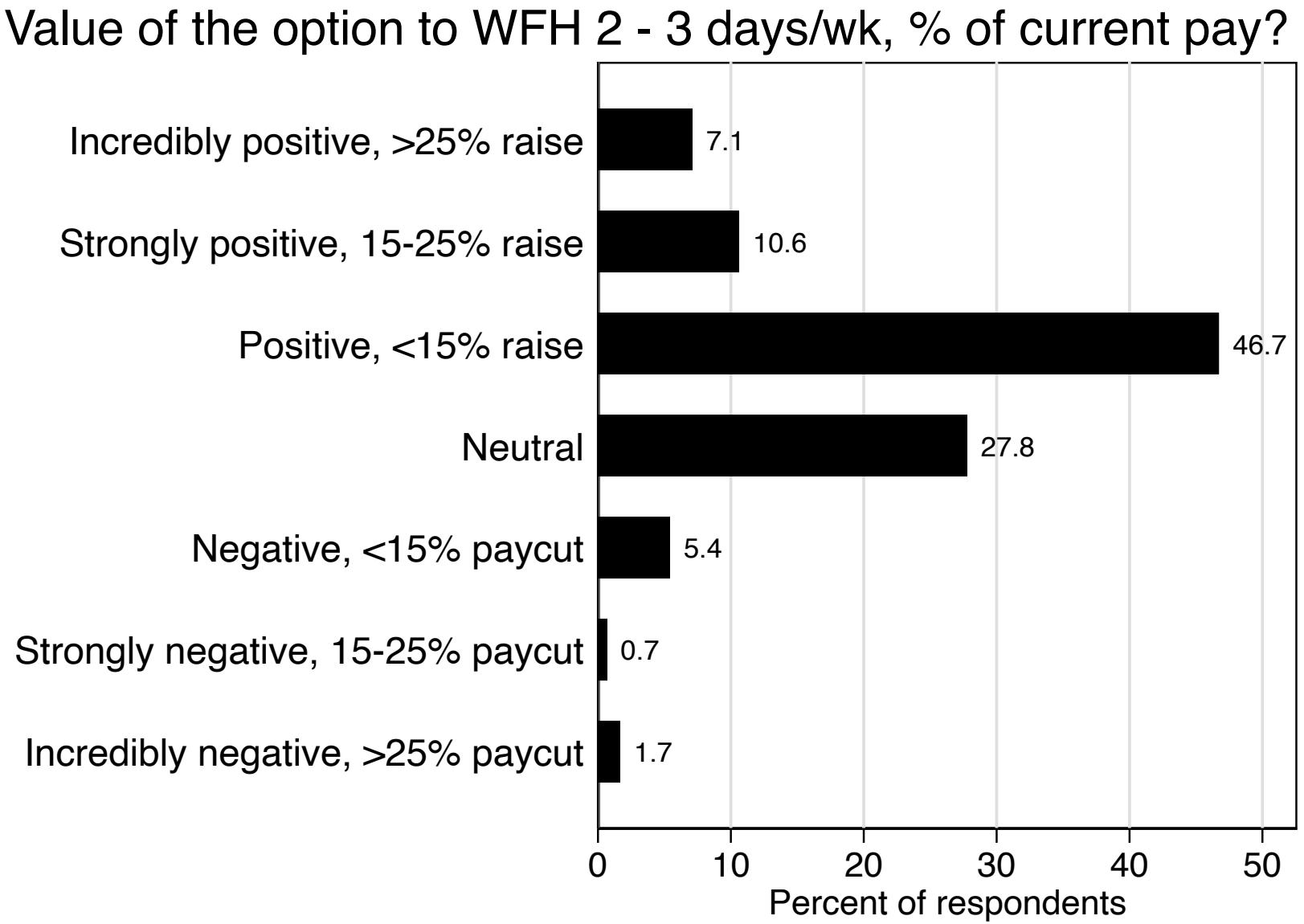
Source: Responses to the question:

*Compared to your expectations **before COVID (in 2019)** how has working from home turned out for you?*

- *Hugely better -- I am 20%+ more productive than I expected*
- *Substantially better -- I am to 10% to 19% more productive than I expected*
- *Better -- I am 1% to 9% more productive than I expected*
- *About the same*
- *Worse -- I am 1% to 9% less productive than I expected*
- *Substantially worse -- I am to 10% to 19% less productive than I expected*
- *Hugely worse -- I am 20%+ less productive than I expected*

Notes: Data are from 15,000 survey responses collected in May, July, August, September, and October 2020 by Inc-Query and QuestionPro. Each wave collected 2,500 responses, except the August wave which collected 5,000. We re-weight raw responses to match the share of working age respondents in the 2010-2019 CPS in each {industry x state x earnings} cell.

Figure 7: Working from home is a valuable perk



Source: Responses to a two-part question.

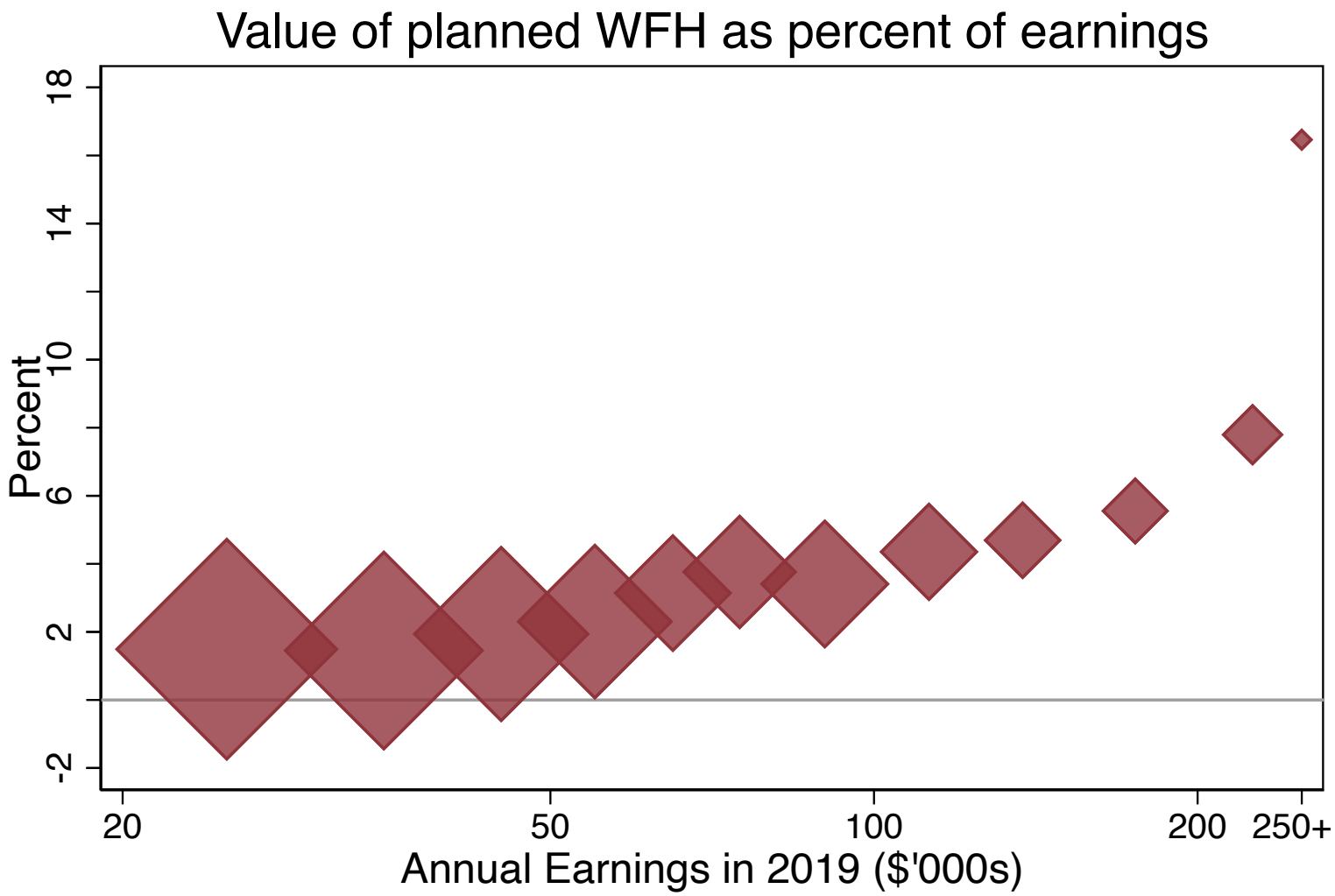
Part 1: ***After COVID, in 2022 and later,*** *how would you feel about working from home* ***2 or 3 days*** *a week?"*

- *Positive: I would view it as a benefit or extra pay*
- *Neutral*
- *Negative: I would view it as a cost or a pay cut*

Part 2: *How much of a* ***pay raise [cut]*** *(as a percent of your current pay) would you value as much as the option to work from home 2 or 3 days a week?*

Data are from 15,000 survey responses collected in May, July, August, September, and October 2020 by Inc-Query and QuestionPro. Each wave collected 2,500 responses, except the August wave which collected 5,000. We re-weight raw responses to match the share of working age respondents in the 2010-2019 CPS in each {industry x state x earnings} cell.

Figure 8: The WFH shift produces greater benefits for higher-earning workers



Note: Marker size is proportional to the number of respondents by earnings level

Source: Responses to the questions:

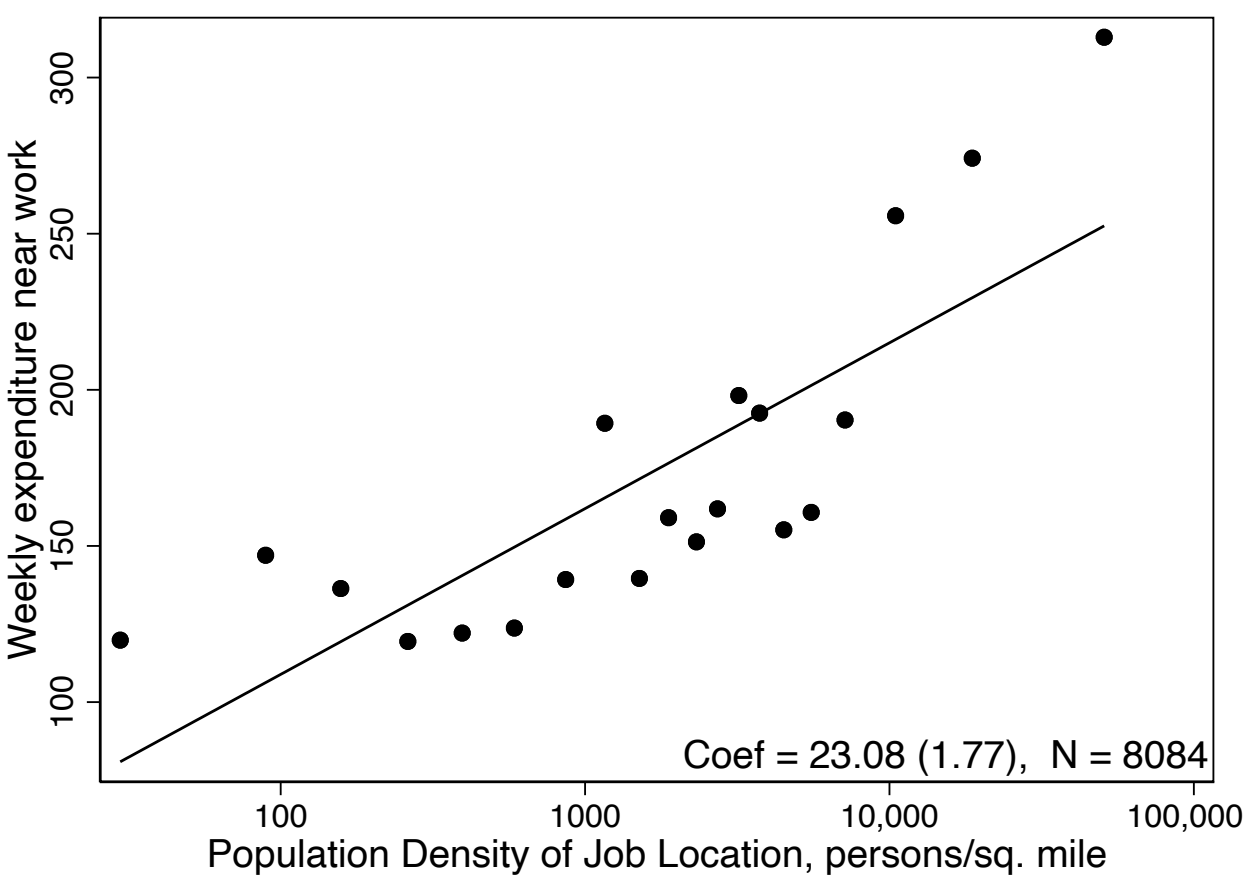
How much did you earn by working in 2019?

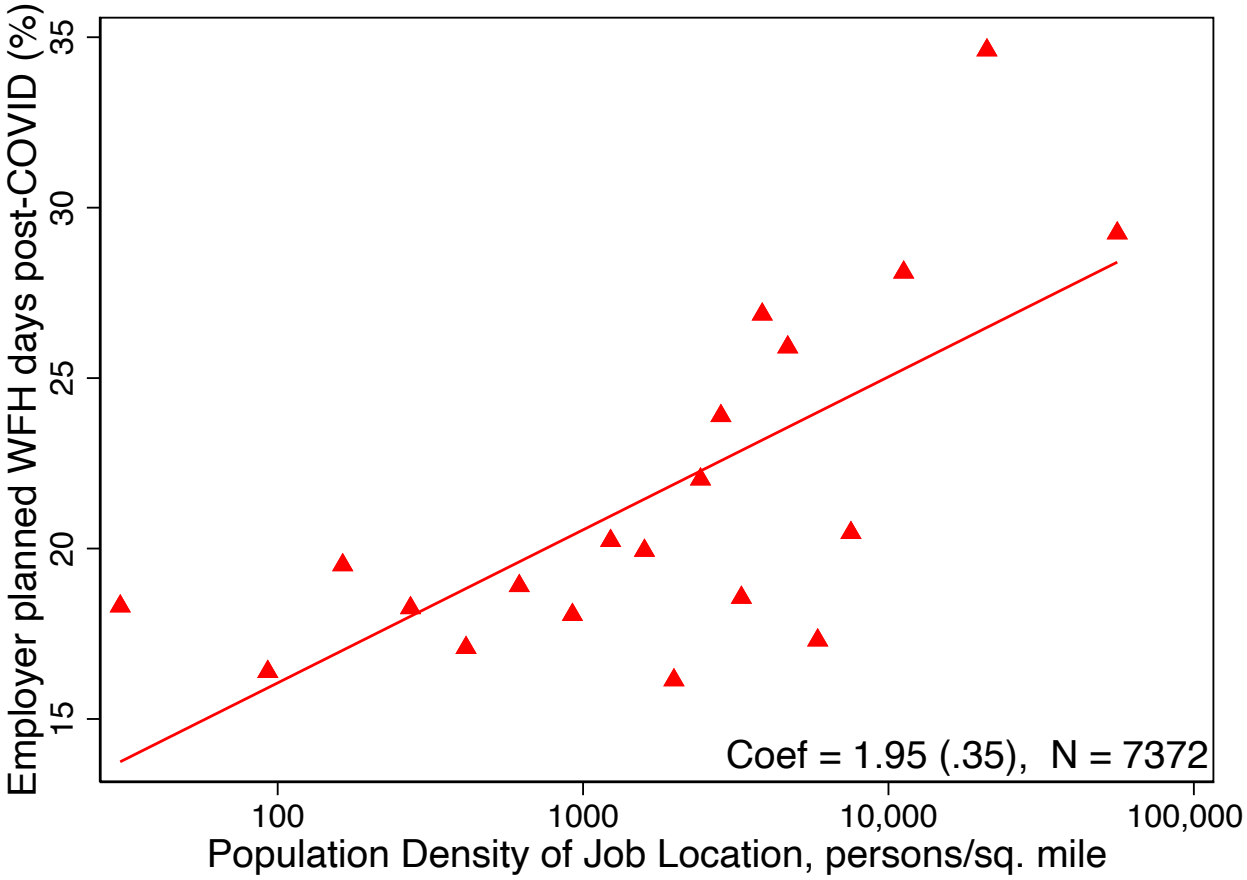
*How much of a **pay raise [cut]** (as a percent of your current pay) would value as much as the option to work from home 2 or 3 days a week?*

***After COVID, in 2022 and later,** how often is your employer planning for you to work full days at home?*

Notes: Data are from 15,000 survey responses collected in May, July, August, September, and October 2020 by Inc-Query and QuestionPro. Each wave collected 2,500 responses, except the August wave which collected 5,000. We re-weight raw responses to match the share of working age respondents in the 2010-2019 CPS in each {industry x state x earnings} cell. For each earnings level we compute the value of WFH as percent of earnings, by adding the subjective value of working from home, plus the value of commute time savings. The latter equals one half the respondent's hourly wage times the number of hours spent commuting (both ways) in 2019.

Figure 9: Spatial reallocation of worker spending away from dense city centers

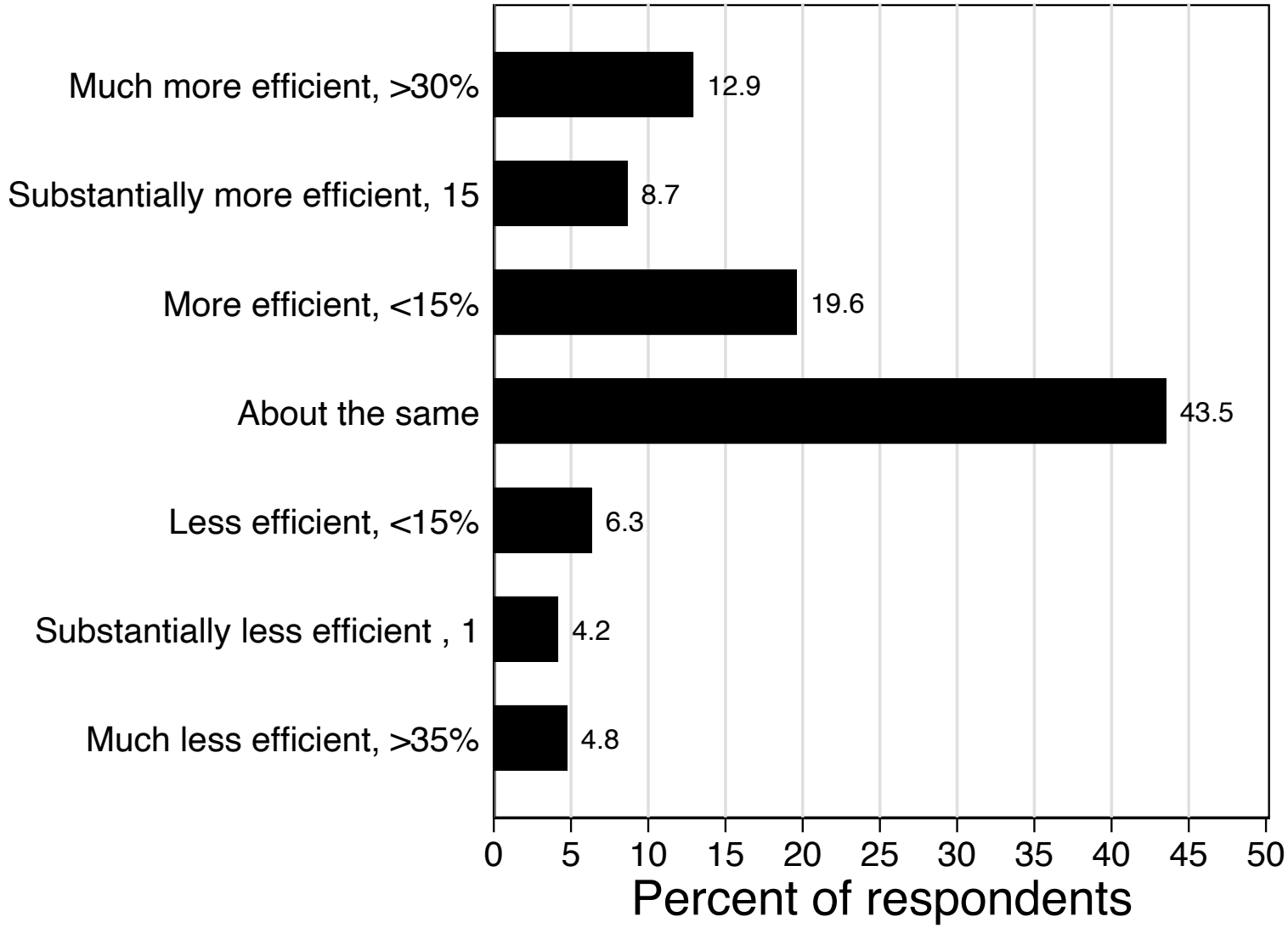




Source: Responses to the questions *"**In 2019, before COVID,** in what ZIP code was your job located?"*, *"**In 2019,** when you worked at your employer's business premises, roughly how much money did you spend during a **typical day** on food and drinks (e.g., lunch, coffee, snacks, etc.)?"*, and *"**In 2019,** when you worked at your employer's business premises, roughly how much money did you spend during a **typical week** in bars, restaurants, and other entertainment venues that are near to your workplace?"*

Notes: Data are from 10,000 survey responses collected in August, October, and November 2020 by Inc-Query and QuestionPro. Each wave collected 2,500 responses, except the August wave which collected 5,000. We re-weight raw responses to match the share of working age respondents in the 2010-2019 CPS in each {industry x state x earnings} cell.

Figure 10: Efficiency of WFH vs. Working on Business Premises



Source: Responses to the question:

*"How does your efficiency working from home **during the COVID-19 pandemic** compare to your efficiency working on business premises **before the pandemic?"***

Notes: Data are from 10,000 survey responses collected in August, October, and November 2020 by Inc-Query and QuestionPro. Each wave collected 2,500 responses, except the August wave which collected 5,000. We re-weight raw responses to match the industry-state-earnings shares of working-age persons in the CPS from 2010 to 2019. The right chart also uses responses to questions about employment status (selection), pay levels (for earnings weights) and, for the blue bar, how much their employer plans for them to work from home after the pandemic ends.

Table 1: Share of respondents WFH during COVID-19

Percent of respondents WFH during COVID	Estimate	(SE)
Overall	35.3	(0.4)
Women	32.9	(0.6)
Men	38.5	(0.6)
Age 20 to 29	36.5	(1.0)
Age 30 to 39	40.2	(0.8)
Age 40 to 49	35.9	(0.8)
Age 50 to 64	28.3	(0.8)
Less than high school	11.0	(3.2)
High school	20.4	(0.9)
1 to 3 years of college	27.2	(0.8)
4year college degree	44.4	(0.8)
Graduate degree	48.6	(0.8)

Percent of respondents WFH during COVID	Estimate	(SE)
Overall, ever WFH during COVID	57.9	(0.5)
Ann. Earnings of $20 to $50K	27.5	(0.7)
Ann. Earnings of $50 to $100K	43.7	(0.7)
Ann. Earnings of $100 to $150K	51.1	(1.0)
Ann. Earnings over $150K	52.2	(1.1)
Goods-producing sectors	28.6	(1.0)
Service sectors	36.5	(0.4)
No children	32.3	(0.7)
Living with children under 18	36.4	(0.6)
Red state	31.7	(0.6)
Blue state	38.0	(0.5)

Notes: Percent share of respondents who are working from home ("this week") during the COVID-19 pandemic, except the top right which estimates the share who "ever" worked from home during the pandemic. Data are from 15,000 survey responses collected in May, July, August, September, and October 2020 by Inc-Query and QuestionPro. Each wave collected 2,500 responses, except the August wave which collected 5,000. We reweight raw responses to match the share of working age respondents in the 20102019 CPS in each {industry x state x earnings} cell.

Table 2: What predicts working from home during and after COVID?

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
								Percent Share WFH Days	
Dependent Variable	100 x 1(WFH during COVID)							Employee Desired	Employer Planned
Years of education	10.04***	7.09***	7.08***	7.02***	7.00***	6.91***	5.56***	0.80	1.24*
	(0.82)	(0.90)	(0.91)	(0.91)	(0.91)	(0.91)	(0.95)	(0.87)	(0.66)
log(Earnings)		8.20***	8.14***	7.74***	7.72***	8.31***	7.16***	1.35	7.80***
		(1.06)	(1.13)	(1.15)	(1.15)	(1.16)	(1.18)	(1.05)	(0.80)
1(Male)			0.30	0.10	0.09	-0.02	-0.47	-4.39**	1.16
			(2.40)	(2.39)	(2.39)	(2.40)	(2.39)	(2.13)	(1.60)
1(Lives with children under 18)			0.04	0.29	0.29	-1.89	-1.69	0.72	2.64*
			(2.14)	(2.13)	(2.13)	(2.15)	(2.15)	(1.98)	(1.59)
1(Male) x 1(Lives with children under 18)			0.03	-0.22	-0.22	0.31	-0.36	-6.13**	3.04
			(3.35)	(3.34)	(3.34)	(3.33)	(3.33)	(2.94)	(2.30)
Biden vote share (state of residence)				2.53***	2.54***	2.41**	2.17**	1.00	-0.02
				(0.96)	(0.96)	(0.96)	(0.98)	(0.83)	(0.62)
Internet quality					0.46	0.55	0.26	1.80*	-0.55
					(1.23)	(1.23)	(1.20)	(1.01)	(0.80)
Date fixed effects	Y	Y	Y	Y	Y	Y	Y	Y	Y
Age bin fixed effects						Y	Y	Y	Y
Industry Fixed Effects							Y	Y	Y
Dependent variable mean	34.30	34.30	34.30	34.30	34.30	34.30	34.30	44.96	21.59
Observations	10,234	10,234	10,234	10,234	10,234	10,234	10,234	10,234	9,370
R-squared	0.04	0.05	0.05	0.06	0.06	0.06	0.08	0.03	0.09

Notes: Columns (1) to (7) show how the probability of WFH during COVID is associated worker characteristics. Columns (8) and (9) regress the number of work from home days desired by employees and planned by employers as a percent share of all paid working days on the same characteristics. Continuous independent variables are standardized so their coefficients reflect a 1-standard deviation change. Data are from four survey waves carried out by QuestionPro and IncQuery in May, July, August, and September/October 2020 with 2,500 responses in the first two and the last, plus 5,000 in August. We re-weight raw responses to match the share of working age respondents in the 2010-2019 CPS in each {industry x state x earnings} cell. Column (10) uses a slightly smaller sample because we did not ask about employer plans for post-COVID work from home in the May survey.

Table 3: Worker-desired WFH is fairly uniform. Employer plans are not.

Percent share of paid WFH days post-COVID	Employee desired	(SE)	Employer planned	(SE)
Overall	44.0	(0.4)	21.5	(0.3)
Women	45.9	(0.6)	18.2	(0.5)
Men	41.6	(0.5)	25.9	(0.5)
Age 20 to 29	42.2	(0.9)	23.0	(0.8)
Age 30 to 39	47.2	(0.7)	25.4	(0.7)
Age 40 to 49	44.9	(0.7)	22.8	(0.7)
Age 50 to 64	41.2	(0.9)	13.8	(0.7)
Less than high school	39.4	(4.5)	16.9	(3.8)
High school	38.4	(1.1)	14.3	(0.8)
1 to 3 years of college	45.4	(0.9)	17.7	(0.7)
4year college degree	46.3	(0.7)	23.8	(0.7)
Graduate degree	43.9	(0.6)	29.9	(0.6)

Percent share of paid WFH days post-COVID	Employee desired	(SE)	Employer planned	(SE)
Ann. Earnings of $20 to $50K	42.3	(0.7)	15.6	(0.6)
Ann. Earnings of $50 to $100K	46.4	(0.7)	26.7	(0.6)
Ann. Earnings of $100 to $150K	45.8	(0.9)	32.8	(0.9)
Ann. Earnings over $150K	45.6	(0.9)	40.4	(1.0)
Goods-producing sectors	40.7	(1.0)	19.0	(0.8)
Service sectors	44.7	(0.4)	22.0	(0.4)
No children	43.8	(0.6)	17.3	(0.5)
Living with children under 18	44.5	(0.5)	25.8	(0.5)
Red (Republican) State	43.7	(0.6)	20.6	(0.5)
Blue (Democratic) State	44.3	(0.5)	22.2	(0.5)

Notes: Percent share of respondents who are working from home ("this week") during the COVID19 pandemic, except the top right which estimates the share who "ever" worked from home during the pandemic. Data are from 15,000 survey responses collected in May, July, August, September, and October 2020 by Inc-Query and QuestionPro. Each wave collected 2,500 responses, except the August wave which collected 5,000. We reweight raw responses to match the share of working age respondents in the 2010-2019 CPS in each {industry x state x earnings} cell.

Table 4: Residual fear of proximity to other people

If a COVID vaccine is discovered and made widely available, which of the following would best fit your views on social distancing?

	Percent of respondents	(SE)
Complete return to pre-COVID activities	28.0	(0.4)
Substantial return to pre-COVID activities, but I would still be wary of things like riding the subway or getting into a crowded elevator	35.6	(0.5)
Partial return to pre-COVID activities, but I would be wary of many activities like eating out or using ride-share taxis	24.4	(0.4)
No return to pre-COVID activities, as I will continue to social distance	12.0	(0.3)
Observations	10,201	

Notes: Data are from 15,000 survey responses collected in May, July, August, September, and October 2020 by Inc-Query and QuestionPro. Each wave collected 2,500 responses, except the August wave which collected 5,000. We re-weight raw responses to match the share of working age respondents in the 2010-2019 CPS in each {industry x state x earnings} cell.

Table 5: Working from home is a valuable perk. The benefits of a shift towards WFH are unevenly distributed across demographic groups

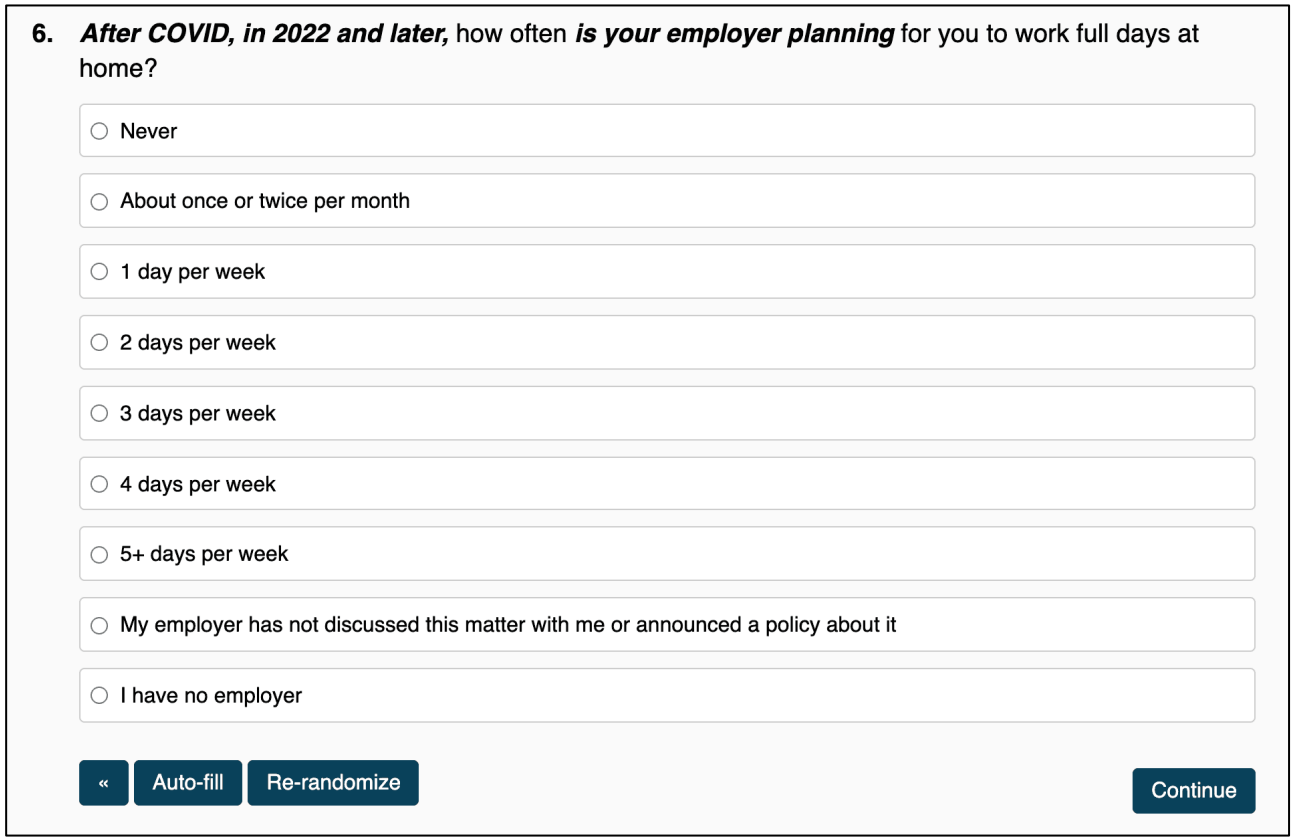
Percent share of paid WFH days post-COVID	Value of planned post-COVID WFH, % earnings	(SE)	Perk value of the option to WFH, % earnings	(SE)
Overall	2.5	(0.1)	7.6	(0.1)
Women	1.9	(0.1)	7.5	(0.2)
Men	3.4	(0.1)	7.7	(0.2)
Age 20 to 29	2.4	(0.2)	7.9	(0.3)
Age 30 to 39	2.9	(0.1)	8.5	(0.2)
Age 40 to 49	2.9	(0.1)	8.5	(0.2)
Age 50 to 64	1.8	(0.1)	5.2	(0.3)
Less than high school	2.3	(0.9)	1.8	(1.7)
High school	1.5	(0.2)	6.3	(0.4)
1 to 3 years of college	1.8	(0.1)	7.1	(0.3)
4year college degree	2.5	(0.1)	7.5	(0.2)
Graduate degree	4.4	(0.2)	9.8	(0.2)

Percent share of paid WFH days post-COVID	Value of planned post-COVID WFH, % earnings	(SE)	Perk value of the option to WFH, % earnings	(SE)
Ann. Earnings of $20 to $50K	1.6	(0.1)	6.8	(0.2)
Ann. Earnings of $50 to $100K	3.0	(0.1)	8.1	(0.2)
Ann. Earnings of $100 to $150K	4.5	(0.2)	9.1	(0.3)
Ann. Earnings over $150K	7.0	(0.3)	12.1	(0.4)
Goods-producing sectors	2.9	(0.2)	7.8	(0.4)
Service sectors	2.4	(0.1)	7.6	(0.1)
No children	1.8	(0.1)	6.6	(0.2)
Living with children under 18	3.2	(0.1)	8.6	(0.2)
Red (Republican) State	2.3	(0.1)	7.7	(0.2)
Blue (Democratic) State	2.7	(0.1)	7.5	(0.2)

Notes: The "total value of planned WFH" is equal to the "perk value of WFH" 2 to 3 days per week scaled by how much work from home each respondent's employer is planning. The "perk value of WFH" itself comes from responses to the following two-part question: Part 1: “After COVID, in 2022 and later, how would you feel about working from home 2 or 3 days a week?” Part 2: “How much of a pay raise [cut] (as a percent of your current pay) would you value as much as the option to work from home 2 or 3 days a week?”. Data are from 15,000 survey responses collected in May, July, August, September, and October 2020 by Inc-Query and QuestionPro. Each wave collected 2,500 responses, except the August wave which collected 5,000. We reweight raw responses to match the share of working age respondents in the 2010-2019 CPS in each {industry x state x earnings} cell.

Appendix

Figure A.1 Sample survey questions



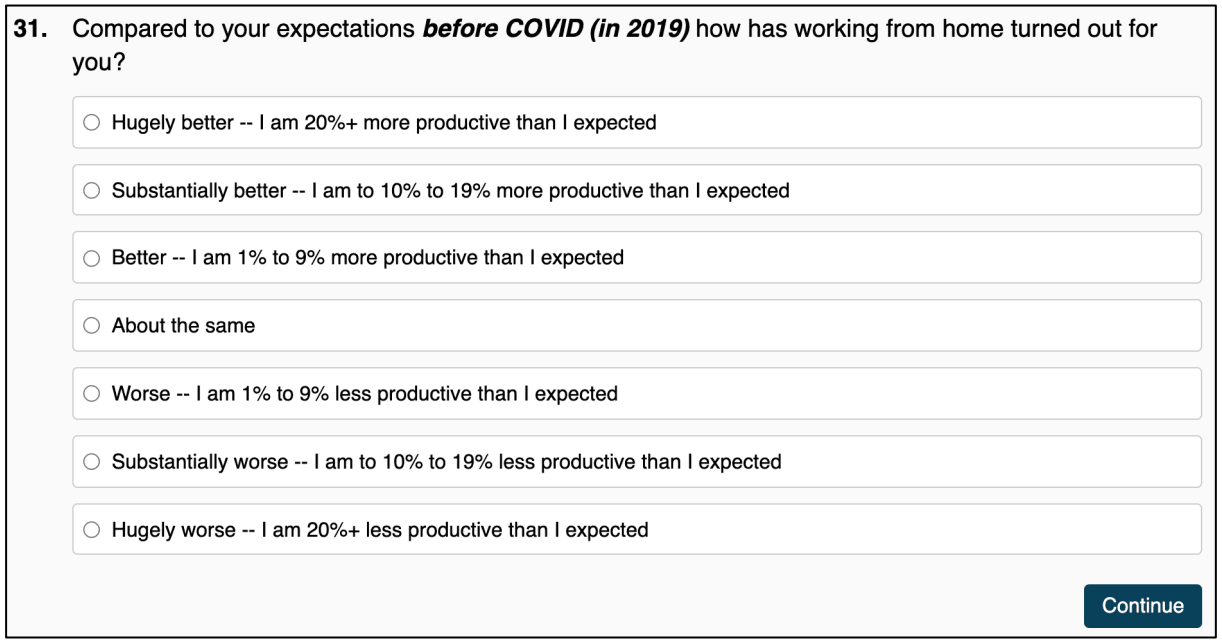


Table A.1 Summary Statistics

Variable	Mean	SD	p25	p50	p75	N
Earnings, $'000s	58.8	55.2	35	45	65	13,746
Age	40.8	11.7	35	35	57	13,746
Years of education	15.0	2.2	14	16	16	13,746
100***1**(Ever WFH during COVID?)	57.9	49.4	0	100	100	8,706
100***1**(Currently WFH during COVID)	35.3	47.8	0	0	100	13,746
Percent desired post-COVID WFH days	44.5	40.1	0	40	100	13,746
Percent employer planned post-COVID WFH days	21.5	34.8	0	0	40	9,912
Commute time pre-COVID (minutes)	28.5	27.3	10	20	35	13,739
Percent raise equal to option to WFH 2-3 days/week	7.2	12.0	0	5	13	12,372
How much more productive than expected has WFH been?	7.6	12.4	0	5	15	6,043
Can you do your job from home (0 to 100 % scale)	62.1	53.2	0	80	100	7,262
Percent higher effectiveness WFH during COVID over business premises pre-COVID	4.5	16.6	0	0	13	6,448
Investments in infrastructure, equipment for WFH by employer or self, $	659.7	1327.3	0	100	500	6,435
Hours invested learning to WFH effectively	13.7	21.8	2	6	20	6,451
Weekly spending near work, $	170.1	187.6	40	100	230	10,156
1(Female)	58.1	49.3	0	100	100	13,746
1(Red State)	42.9	49.5	0	0	100	13,746

Notes: Summary statistics for key variables, re-weighted to match the share of people in the 2010-2019 CPS in each {industry x state x earnings} cell. Data are from 15,000 survey responses collected in May, July, August, September, and October 2020 by Inc-Query and QuestionPro. Each wave collected 2,500 responses, except the August wave which collected 5,000. Not all questions (and hence not all variables) appear in all waves. Number of observations is less than the 12,500 survey responses primarily due to dropping responses that took less than 3 minutes to respond.

Table A.2 WFH stigma has diminished

Percent of respondents	Net change in WFH perception	(SE)	Positive change in WFH perception	(SE)	Percent of respondents	Net change in WFH perception	(SE)	Positive change in WFH perception	(SE)
Overall	59.3	(0.6)	65.8	(0.5)					
Women	57.5	(0.9)	64.0	(0.7)	Ann. Earnings of $20 to $50K	54.3	(1.1)	61.1	(0.8)
Men	61.8	(0.8)	68.4	(0.6)	Ann. Earnings of $50 to $100K	63.8	(1.0)	69.8	(0.8)
					Ann. Earnings of $100 to $150K	70.7	(1.4)	77.6	(1.0)
Age 20 to 29	60.4	(1.4)	68.3	(1.0)	Ann. Earnings over $150K	79.1	(1.3)	84.9	(0.9)
Age 30 to 39	60.6	(1.1)	66.9	(0.9)					
Age 40 to 49	61.9	(1.1)	68.1	(0.9)	Goods-producing sectors	52.1	(1.8)	61.4	(1.3)
Age 50 to 64	54.3	(1.3)	60.2	(1.0)	Service sectors	60.6	(0.6)	66.6	(0.5)
Less than high school	39.3	(8.2)	52.5	(5.8)	No children	54.8	(0.9)	61.2	(0.7)
High school	43.1	(1.7)	51.1	(1.3)	Living with children under 18	63.9	(0.8)	70.6	(0.6)
1 to 3 years of college	56.0	(1.3)	62.5	(1.0)					
4-year college degree	64.1	(1.0)	69.7	(0.8)	Red (Republican) state	57.3	(0.9)	64.7	(0.7)
Graduate degree	73.4	(1.0)	79.9	(0.7)	Blue (Democratic) state	60.8	(0.8)	66.7	(0.6)

Notes: This table reports (1) the net change in perceptions about working from home, equal to the percent of respondents who report working from home perceptions have improved among some, most, or almost all the people they know, minus the percent who report they have worsened; (2) the raw percent of respondents who report perceptions of working from home have improved. Data are from 15,000 survey responses collected in May, July, August, September, and October 2020 by Inc-Query and QuestionPro. Each wave collected 2,500 responses, except the August wave which collected 5,000. We reweight raw responses to match the share of working age respondents in the 20102019 CPS in each {industry x state x earnings} cell.

Table A.3 Productivity of WFH during COVID relative to expectations

Percent difference between WFH productivity and expectations	Mean	(SE)
Overall	7.6	(0.2)
Women	6.6	(0.3)
Men	8.6	(0.2)
Age 20 to 29	6.7	(0.4)
Age 30 to 39	7.9	(0.3)
Age 40 to 49	8.9	(0.3)
Age 50 to 64	6.1	(0.4)
Less than high school	7.8	(2.1)
High school	5.0	(0.6)
1 to 3 years of college	7.2	(0.4)
4-year college degree	7.6	(0.3)
Graduate degree	8.8	(0.3)

Percent difference between WFH productivity and expectations	Mean	(SE)
Ann. Earnings of $20 to $50K	6.8	(0.3)
Ann. Earnings of $50 to $100K	7.8	(0.3)
Ann. Earnings of $100 to $150K	8.1	(0.4)
Ann. Earnings over $150K	11.5	(0.4)
Goods-producing sectors	8.1	(0.4)
Service sectors	7.5	(0.2)
No children	6.1	(0.3)
Living with children under 18	8.7	(0.2)
Red (Republican) state	7.3	(0.3)
Blue (Democratic) state	7.7	(0.2)

Notes: This table computes the average percent difference between productivity while working from home during COVID and their expected work-from-home productivity prior to the pandemic. Data are from 15,000 survey responses collected in May, July, August, September, and October 2020 by Inc-Query and QuestionPro. Each wave collected 2,500 responses, except the August wave which collected 5,000. We reweight raw responses to match the share of working age respondents in the 20102019 CPS in each {industry x state x earnings} cell.

Table A.4 Investments enabling work from home

Average investment into WFH	Hours	(SE)	$ (employer + employee)	(SE)	Average investment into WFH	Hours	(SE)	$ (employer + employee)	(SE)
Overall	13.7	(0.3)	659.8	(16.6)					
Women	12.8	(0.4)	417.3	(19.4)	Ann. Earnings of $20 to $50K	14.0	(0.6)	446.5	(27.3)
Men	14.7	(0.4)	924.7	(25.5)	Ann. Earnings of $50 to $100K	13.6	(0.4)	737.7	(28.9)
					Ann. Earnings of $100 to $150K	13.0	(0.6)	930.8	(44.9)
Age 20 to 29	14.8	(0.7)	684.0	(38.4)	Ann. Earnings over $150K	13.5	(0.5)	1,367.3	(51.9)
Age 30 to 39	14.5	(0.5)	728.5	(30.8)					
Age 40 to 49	13.3	(0.5)	709.9	(30.8)	Goods-producing sectors	12.7	(0.5)	736.2	(47.8)
Age 50 to 64	11.8	(0.6)	455.1	(32.4)	Service sectors	14.8	(0.4)	816.4	(23.2)
Less than high school	21.0	(2.8)	1,983.7	(377.2)	No children	12.4	(0.4)	460.1	(21.9)
High school	17.0	(1.3)	360.9	(38.9)	Living with children under 18	14.5	(0.4)	698	(25)
1 to 3 years of college	14.8	(0.7)	449.9	(29.7)					
4year college degree	12.1	(0.4)	599.1	(25.9)	Red (Republican) State	14.2	(0.4)	600.6	(24.5)
Graduate degree	13.5	(0.4)	1,000.8	(33.0)	Blue (Democratic) State	13.4	(0.4)	700.3	(22.2)

Notes: Average number of hours and dollars (paid by employer or employee) invested in enabling work from home duirng the pandemic. Data are from 15,000 survey responses collected in May, July, August, September, and October 2020 by Inc-Query and QuestionPro. Each wave collected 2,500 responses, except the August wave which collected 5,000. We reweight raw responses to match the share of working age respondents in the 20102019 CPS in each {industry x state x earnings} cell.

Table A.5 Residual fear of proximity to other people, across demographics

Percent of workers who would return to pre-COVID activities "completely"	Mean	(SE)
Overall	28.0	(0.4)
Women	20.9	(0.6)
Men	38.0	(0.7)
Age 20 to 29	23.8	(1.0)
Age 30 to 39	30.2	(0.8)
Age 40 to 49	34.8	(0.9)
Age 50 to 64	23.0	(0.9)
Less than high school	37.1	(5.6)
High school	28.9	(1.2)
1 to 3 years of college	23.2	(0.9)
4year college degree	23.0	(0.8)
Graduate degree	41.8	(0.9)

Percent of workers who would return to pre-COVID activities "completely"	Mean	(SE)
Ann. Earnings of $20 to $50K	25.3	(0.7)
Ann. Earnings of $50 to $100K	28.9	(0.8)
Ann. Earnings of $100 to $150K	35.3	(1.2)
Ann. Earnings over $150K	49.9	(1.3)
Goods-producing sectors	37.0	(1.3)
Service sectors	26.3	(0.5)
No children	24.2	(0.6)
Living with children under 18	32.0	(0.6)
Red (Republican) state	27.8	(0.7)
Blue (Democratic) state	28.2	(0.6)

Notes: This table computes the percent share of workers who would return to pre-COVID activities "completely" if a vaccine is found and made widely available. Data are from 15,000 survey responses collected in May, July, August, September, and October 2020 by Inc-Query and QuestionPro. Each wave collected 2,500 responses, except the August wave which collected 5,000. We reweight raw responses to match the share of working age respondents in the 20102019 CPS in each {industry x state x earnings} cell.

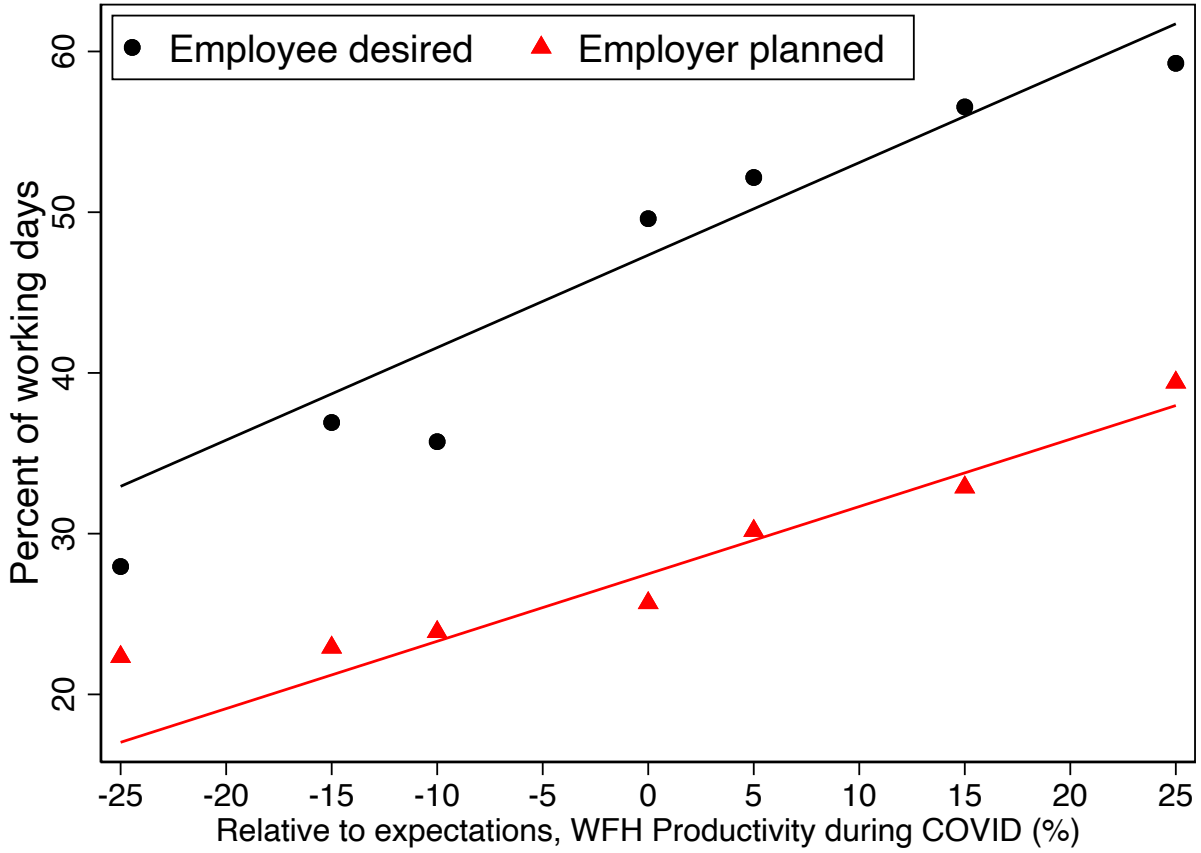
Table A.6: Residual fear of proximity to other people (reasons cited)

You have stated that you ***would not return completely to pre-COVID activities***, if a COVID vaccine is discovered and made widely available. What ***reasons*** are behind your answer? Please check all that apply

	Percent of respondents	(SE)
I am concerned about the effectiveness/safety/that not enough people will take the COVID vaccine	81.84	(0.740)
I am concerned about other potential diseases	24.31	(0.824)
I have gotten used to social distancing, using e-commerce, and avoiding in-person goods and services	21.04	(0.783)
Observations	2713	

Notes: Data are from 5,000 survey responses collected in September and October 2020 by Inc-Query and QuestionPro. Each wave collected 2,500 responses, but we only asked this question if the respondent stated they would not return "completely" to pre-COVID activities in the event a vaccine was discovered and made widely available. We re-weight raw responses to match the share of working age respondents in the 2010-2019 CPS in each {industry x state x earnings} cell.

Figure A.2 Employer plans and employee desires for post-COVID WFH versus productivity of WFH during COVID relative to expectations



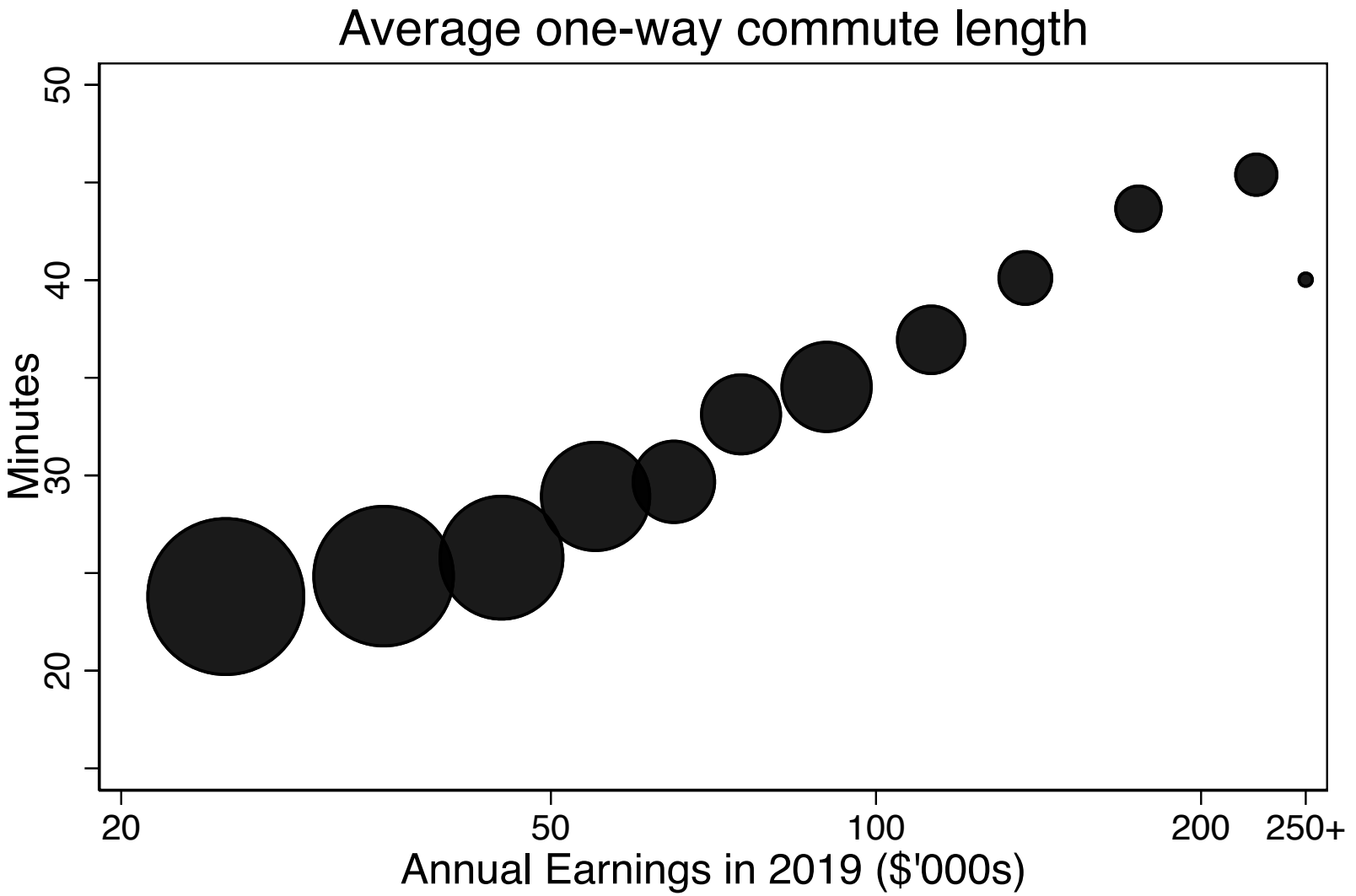
Notes: This figure estimates the percent share of days spent working from home post-COVID desired by employees and planned by their employers, as a function of how work from home productivity during COVID has turned out relative to expectations. Data are from 15,000 survey responses collected in May, July, August, September, and October 2020 by Inc-Query and QuestionPro. Each wave collected 2,500 responses, except the August wave which collected 5,000. We re-weight raw responses to match the share of working age respondents in the 2010-2019 CPS in each {industry x state x earnings} cell.

Table A.7 Employer plans and employee desires for post-COVID WFH versus change in perceptions about WFH

	Percent WFH days post-COVID (SE)				
Perceptions about WFH	**Employee desired**		**Employer planned**		**N**
Improved among almost all (90 to 100%)	52.0	(0.8)	30.9	(0.7)	2731
Improved among most	46.6	(0.7)	21.0	(0.7)	2643
Improved among some	41.1	(1.0)	20.5	(0.9)	1358
No change	36.8	(0.9)	12.8	(0.7)	2005
Worsened	40.7	(1.6)	27.2	(1.5)	604

Notes: This table estimates the percent share of days spent working from home post-COVID desired by employees and planned by their employers, as a function of how the employee believes perceptions about working from home have changed. Data are from four survey waves carried out by QuestionPro and IncQuery in May, July, August, and September/October 2020 with 2,500 responses in the first two and the last, plus 5,000 in August. We re-weight raw responses to match the share of working age respondents in the 20102019 CPS in each {industry x state x earnings} cell.

Figure A.3 Higher income workers tend to commute for longer



Note: Marker size is proportional to the number of respondents by earnings level

Source: Responses to the questions:

*In **2019 (before COVID)** how long was your typical commute to work in minutes?*

How much did you earn by working in 2019?

Notes: The figure shows the average one-way commute time as a function of reported earnings in 2019. Data are from 15,000 survey responses collected in May, July, August, September, and October 2020 by Inc-Query and QuestionPro. Each wave collected 2,500 responses, except the August wave which collected 5,000. We re-weight raw responses to match the share of working age respondents in the 2010-2019 CPS in each {industry x state x earnings} cell.
Marker size is proportional to the number of respondents per earnings level after reweighting.

Table A.7 Vaccine concerns across demographics

Percent of respondents voicing concerns about vaccine safety, effectiveness, or take-up	Mean	(SE)	Percent of respondents voicing concerns about vaccine safety, effectiveness, or take-up	Mean	(SE)
Overall	81.8	(0.7)			
Women	83.6	(1.0)	Ann. Earnings of $20 to $50K	83.7	(1.3)
Men	79.1	(1.1)	Ann. Earnings of $50 to $100K	79.2	(1.3)
			Ann. Earnings of $100 to $150K	79.2	(1.9)
Age 20 to 29	77.9	(1.9)	Ann. Earnings over $150K	79.0	(2.0)
Age 30 to 39	79.4	(1.5)			
Age 40 to 49	85.8	(1.2)	Goods-producing sectors	78.0	(2.3)
Age 50 to 64	83.8	(1.4)	Service sectors	82.5	(0.8)
Less than high school	60.2	(11.5)	No children	83.3	(1.0)
High school	77.1	(2.1)	Living with children under 18	80.1	(1.1)
1 to 3 years of college	84.0	(1.5)			
4year college degree	82.1	(1.3)	Red (Republican) state	82.5	(1.1)
Graduate degree	83.9	(1.3)	Blue (Democratic) state	81.3	(1.0)

Notes: This table estimates the percent of respondents who are concerned about vaccine effectiveness, safety, or take-up, among those who would not "completely" return to pre-COVID activities in the event a vaccine is discovered and made widely available. Data are from 15,000 survey responses collected in May, July, August, September, and October 2020 by Inc-Query and QuestionPro. Each wave collected 2,500 responses, except the August wave which collected 5,000. We reweight raw responses to match the share of working age respondents in the 20102019 CPS in each {industry x state x earnings} cell.

Table A.8 Efficiency of WFH vs. working on business premises across demographics

Efficiency while WFH during COVID relative to business premises before COVID, % difference	Mean	(SE)
Overall	4.5	(0.2)
Women	2.6	(0.3)
Men	6.6	(0.2)
Age 20 to 29	3.5	(0.5)
Age 30 to 39	5.4	(0.4)
Age 40 to 49	6.0	(0.4)
Age 50 to 64	2.1	(0.5)
Less than high school	9.9	(2.9)
High school	1.5	(0.7)
1 to 3 years of college	3.0	(0.5)
4year college degree	4.5	(0.3)
Graduate degree	6.7	(0.3)

Efficiency while WFH during COVID relative to business premises before COVID, % difference	Mean	(SE)
Ann. Earnings of $20 to $50K	2.6	(0.4)
Ann. Earnings of $50 to $100K	5.0	(0.3)
Ann. Earnings of $100 to $150K	6.7	(0.4)
Ann. Earnings over $150K	11.8	(0.5)
Goods-producing sectors	5.7	(0.5)
Service sectors	4.3	(0.2)
No children	2.7	(0.4)
Living with children under 18	5.9	(0.2)
Red state	4.4	(0.3)
Blue state	4.5	(0.3)

Notes: This table estimates the difference in efficiency while working from home during COVID relative to working on business premises before COVID, among respondents who worked from home at some point during COVID. Data from 15,000 survey responses collected in May, July, August, September, and October 2020 by Inc-Query and QuestionPro. Each wave collected 2,500 responses, except the August wave which collected 5,000. We re-weight raw responses to match the share of working age respondents in the 2010-2019 CPS in each {industry x state x earnings} cell.