The Rise of Remote Work

Evidence on Productivity and Preferences from Firm and Worker Surveys *

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June 2023

Abstract

Drawing on surveys of small business owners and employees, we present three main findings about the evolution of remote work after the onset of COVID-19. First, uptake of remote work was abrupt and widespread in jobs suitable for telework according to the task-based measure from Dingel and Neiman (2020). The initial adoption lead to a persistent shift in work arrangements that both firms and workers forecast would continue into the future. Second, business leaders' perceptions of how remote work affected productivity shifted over time. In early 2020, 70 percent of small business owners reported a productivity dip due to remote work. By contrast, the median business owner reported a positive productivity impact of remote work by 2021. Third, 21 percent of workers report being willing to accept a pay cut in excess of 10 percent if it allowed them to continue working from home, but the median worker in a teleworkable job would not tradeoff any compensation for the option of continued remote work. Taken together, our evidence points to perceived productivity gains and some workers' preferences as reasons for the persistence of remote work in the years following the onset of COVID-19.

*A prior version of this paper circulated under the title "What Jobs Are Being Done at Home During the COVID-19 Crisis? Evidence from Firm-Level Surveys." We thank the leadership team at Alignable for providing data for this paper. The authors have no financial connection with the company. Bartik is at the University of Illinois. Cullen, Luca, and Stanton are at Harvard Business School. Glaeser is at the Harvard Economics Department.

1 Introduction

Economists have long discussed the potential for broader adoption of remote work, dating back at least a quarter century (Gaspar and Glaeser 1998). Remote work advocates pointed to a techno-utopian vision with little time wasted on commuting, and in which people work from anywhere they choose (Toffler 1980). Despite this promise, remote work adoption remained low prior to the COVID-19 pandemic. Skeptics pointed to the possibility of lower productivity of remote workers, resulting from challenges such as monitoring and learning, as well as reduced opportunities for chance encounters that could spur innovation (Catalini 2018).

The COVID-19 pandemic brought about widespread disruptions and lockdowns, which forced many businesses to either shut down or transition to remote work. In this paper, we report results from nation-wide surveys of U.S. business owners and workers, conducted repeatedly over the span of two years after the onset of COVID-19. We examine three core issues: (1) business owners' choices to transition to remote work, and remain remote, as a function of industry characteristics (2) the evolving productivity effects of transitioning to remote work, including the sources of gains and challenges from adopting remote work, (3) employees' valuation of remote work as an amenity, measured by their willingness to trade off salary for working from home. We document that remote work remained persistent during our sample period and we shed light on possible reasons why firms and workers did not immediately revert back to their pre-pandemic modes of in-office operation.

We first show that the pandemic-induced growth of remote work was substantial and persistent. Nearly half of small business owners in surveys conducted in March and April of 2020 reported transitioning on-site workers to remote work. Business owners in January and May 2021 surveys reported that remote work remained elevated, with over half indicating

that some workers were engaged in remote work at the time of the survey (including workers who were newly hired into remote positions or those who worked remotely prior to the pandemic). This employer-level sampling frame reflects the extent to which businesses were impacted by remote work, but the shift to remote work likely did not include all workers. Worker-level surveys, conducted in 2022, allow us to pinpoint the extent to which remote work permeated the labor force. Approximately a third of workers who were on-site before the pandemic reported working remotely at least one day per week; a quarter worked remotely at least 2 days per week. Variation in remote work adoption and persistence tracks the Dingel and Neiman (2020) measure of telework suitability based on the task content of different occupations. These patterns indicate that many jobs could have been done outside of the office prior to the pandemic, but most firms and workers were not working remotely. The onset of COVID-19 shifted work arrangements, and we explore possible reasons for the persistence of this shift.

Second, business owners and senior leaders reported that remote work became more productive over time. At the beginning of the pandemic, 70 percent of small business owners perceived a productivity dip due to remote work, but this pattern reversed in subsequent surveys, with the median owner reporting a positive productivity impact by early 2021. Firms engaged in adjustments that improved productivity, including technological investments, the introduction of training programs, and alteration of job characteristics and task assignments. Surveyed workers point to improvements in managers' ability to lead remote teams as an important contributor to the positive shift in productivity experienced over time. Nevertheless, after a year of experience with remote work, business owners reported in the 2021 survey wave reported difficultly monitoring remote employees, and they believed remote employees were less able to learn new skills. These challenges appear to be compounded in firms with

more people, as owners of larger firms are, on average, less optimistic about the productivity effects of remote work.

Finally, the amenity value of remote work varies considerably across individuals. Workers' willingness to trade off pay for the option to work remotely differs markedly across people: approximately 60% of respondents would not accept lower pay in exchange for remote work as an amenity, despite working in a job that is suitable for telework. While most workers do not value remote work, the shift to working from home is valued by a sizeable share of the labor force. 21% of workers would accept a pay cut of 10% or more to avoid returning to the office. Socio-demographic characteristics explain some variation in the amenity value of remote work. Among those whose jobs can be done remotely, females are 16% more likely than males to be willing to give up at least 10% of their pay to remain remote. Those with a college degree report higher valuations for remote work, while workers 50 or older are the least likely to be willing to pay anything to work remotely.

Taken together, our evidence on the arc of productivity and the amenity value of remote work helps to explain why it has persisted even after COVID-19 health concerns subsided for many workers. Our results make three main contributions relative to a voluminous concurrent literature. First, our paper draws from multiple surveys over time, allowing us to trace the evolution of individual perceptions toward remote work. While each survey is primarily cross-sectional, we can track some repeat responses by business owners. Results from a within-business owner analysis of changes in remote work productivity perceptions largely match the positive evolution that we document in repeated cross-sections. Second, we have both firm-level and employee-level surveys – allowing us to understand points of agreement and tension from the employer and employee perspectives. While our measures of the degree of remote work persistence qualitatively align with Barrero, Bloom, and Davis

(2021) on why remote work will stick, our evidence on the employer perspective has, to our knowledge, only had limited coverage in the prior literature. Indeed, a popular media narrative in the first 2 years after COVID onset suggested that workers and managers were at odds over remote work (Rosalsky 2022). Our evidence suggests this tension was not universal, as many firms embraced hybrid or fully remote arrangements. While employees tended to be more optimistic about remote work productivity than employers in our surveys, by and large their reports corroborate each others' experiences. Still, some employers did report lower productivity under remote work, yet our surveys show that few of these employers with negative productivity perceptions enforced return-to-office policies for workers. It is possible that the large number of employers with positive remote work perceptions boosted workers' outside options in the labor market generally, limiting the ability of any employer – even those with modestly negative views of remote work – to impose a return to the pre-pandemic status quo. Third, we elicit willingness to pay for the opportunity to work remotely and capture some of the first measures of workers' valuations for remote work as an amenity in the post-pandemic era.

2 Data

2.1 Sample Description and Survey Timeline

Our first survey population is owners of small businesses, collected through surveys conducted by Alignable, Inc., https://www.alignable.com, the largest network and community of Small Business Owners in North America. The Alignable surveys were conducted in 4 waves. Each wave went out to a large subset of Alignable's members, although Alignable did not share the exact number of members solicited. The first survey was conducted in March

and April of 2020 (N=1699). Wave 2 occurred eight weeks after the first survey, in May 2020, when Alignable conducted a follow-up survey to probe remote work further (N=915). The first two Alignable surveys occurred while much of the country was under stay-at-home restrictions. Wave 3 of the Alignable survey was conducted in January of 2021, after reopening had occurred in much of the country, but at a time when mobility patterns had not returned to pre-Covid levels for either commuting or personal trips (N=2344). The fourth wave occurred in May of 2021, when vaccines had become available to the majority of the population (N=463). Most waves of the small business owner surveys had similar questions, allowing us to study changes over time, while each wave also had a distinct set of questions that were relevant for forecasts and perceptions at the time of the survey.

For our main analysis, we pool survey waves in 2020 between March and May, totalling 2,545 completed responses, and pool survey waves in 2021 between January and May, totalling 2,789 responses.[1] Table 1 describes the total number of unique survey respondents, and the number who completed each question in square brackets.

The small business owner surveys comes from a convenience sample, making benchmarks to other sources important for understanding the representativeness of estimates from these samples. Figure 1 Panel A shows that the pooled survey sample roughly matches the firm size distribution of small businesses in the 2017 U.S. Census of businesses. The Alignable firms are, however, slightly larger than those in the Census for a mechanical reason: the remote work questions were only deployed to business owners who reported having at least 2 total employees (including themselves), whereas the Census includes firms with only a single person working.

Panel B of Figure 1 shows that the survey data roughly matches the distribution of

[1]Each survey wave is largely cross-sectional. When computing summary statistics for repeat respondents, we take the first non-missing observation for each distinct survey question.

teleworkability at the industry-level in the Census data. These industry-level measures of teleworkability come from Dingel and Neiman (2020), who construct an occupation-level classification of remote work feasibility (i.e. an assessment of which jobs could plausibly be done at home) that they aggregate to the industry level. We note that post-vaccine surveys somewhat over-represent firms in industries with relatively high teleworkable employment compared to the pre-pandemic Census data. It is possible that these firms were most resilient through the pandemic, contributing to their over-representation. Overall, these exercises suggest that the convenience samples are roughly representative of the universe of small businesses. Prior work with a similar sampling design yielded accurate forecasts of demand for Paycheck Protection Program loans (Bartik et al. 2020), suggesting that aggregating across the participants in these surveys yields reliable inference.[2]

We also conducted two survey waves of workers through the Lucid platform. Lucid is a quota based internet sampling company that produces representative survey samples based on population demographics. We utilized a sampling scheme to target respondents who were employed at the time of the survey with demographics that match the Census distribution of age, gender, and income. Wave 1 of the worker survey was conducted in November and December 2021 and had 1810 respondents while Wave 2 of the worker survey was conducted in June 2022 and had 974 respondents. We have found that the Lucid sample is skewed toward occupations that are more likely to be digital or teleworkable, so we have re-weighted the Lucid responses to match the distribution of Standard Occupational Classification System (SOC) codes in the Occupational Employment Statistics (OES) data from the Bureau of Labor Statistics.

[2]Other papers using surveys over this time period have documented the power of convenience samples to approximate the distribution of firm characteristics in administrative samples across different contexts (Humphries, Neilson, and Ulyssea 2020; Guerrero-Amezaga et al. 2022).

3 Results

Table 1 reports summary statistics from firm survey waves pooled from the first half of 2020 (Column 1) and the first half of 2021 (Column 2), and the difference between those means (Column 3). The difference in these pooled waves roughly corresponds to the pre- and post-vaccine era. Employee survey waves from 2021 and 2022 are presented in Columns 4 and 5, and their difference in Column 6.

The first row of results captures employment relative to January 2020, before the pandemic had become widespread. In both the pre and post-vaccine surveys, sample firms had between 10 and 11 employees on average. In the early survey waves, firms reported that headcount had fallen on average by about 23 percent between January and April 2020. Nationally, nonfarm private employment fell 16% over the same January to April 2020 period, according to BLS payroll surveys.

3.1 The Level and Persistence of Remote Work

In the first half of 2020, 47% of firms had transitioned at least some workers who had previously been working on-site to remote work.[3] The reported share of firms with workers who transitioned to remote work was 40% for the employers in our post-vaccine survey waves in the first half of 2021.[4] In the post-vaccine surveys, 54% of employers reported having at

[3]The pre-vaccine remote work measures are binary indicators based on the question "Relative to January 2020, have any of your employees transitioned to working remotely or working from home?".

[4]The post-vaccine remote work measures come from the question "Over the last year, did any of your employees work remotely (regularly working at home 2+ days/week)? Select all that apply." The answer choices were: a) "No", b) "Yes, and they were already remote pre-pandemic", c) "Yes, existing employees transitioned to remote work and they remain remote today", d) "Yes, existing employees transitioned to remote work but they have returned to the office or left the firm", e) "Yes, new employees were hired into permanently remote positions", f) "Yes, new employees were hired into temporarily remote positions." We code employees who transition based on choices c), d), and e). If we include option f), our measure increases from 40% to 41.5%.

least some employees who were remote, which includes firms with remote employees before Covid and new employees who joined the firm as remote workers. The worker surveys corroborate the extreme movement to remote work and its persistence. In 2021, 32% of workers reported having transitioned from on-site to remote work, and this share remains virtually unchanged in 2022. By the summer of 2022, 35% of respondents worked remotely at least 1 day per week after we re-weight the sample to match the distribution of the workforce, while over 40% of the raw responses (without re-weighting) indicate some working from home at the time of the survey.[5] These results are roughly consistent with the updated data series reported in Barrero, Bloom, and Davis (2021), whose own surveys indicate that a bit over 40% of workers were remote during the early summer of 2022.

We further validate our measures of remote work prevalence by comparing them with the potential for remote work measure from Dingel and Neiman (2020) at the industry level. The Dingel and Neiman (2020) classification has been influential for understanding the potential for remote work across industries and countries (Saltiel 2020; Gottlieb et al. 2021), and the ability for firms to transition to remote work reduced the likelihood of financial distress during the pandemic (Papanikolaou and Schmidt 2022). Aggregating the Dingel and Neiman measure up to the industry-level, the average small business in the Alignable sample had 27 to 31 percent of their workforce in a teleworkable occupation. In the first wave of our Alignable survey, there is a 30 percent correlation across industries between the potential for remote work identified by Dingel and Neiman (2020) and the actual prevalence of remote work in the survey. The correlation is 28 percent in the post-vaccine survey. These correlations are presented graphically in Figure 2 Panel A. Panel B presents a comparison

[5]Tabulations for remote work prevalence in the worker surveys come from the questions "Have you worked from home (remotely) for your main job at any point since March 2020?", "Did you primarily work from home prior to the onset of the COVID-19 pandemic in March of 2020?" and "Last week, how many days did you work from home for your main job?".

with Current Population Survey (CPS) data from a nationally representative sample that asks respondents whether they worked remotely due to COVID in the last 4 weeks.[6] The wording of the question will mean that workers who were remote prior to the pandemic will not be included in this measure along with those who remain remote for non-health related reasons. For these reasons, our measures of remote work exceed those in the CPS, but the correlation is strong, at 0.32 and 0.29 in the pre-vaccine and post-vaccine surveys, respectively.

Respondents in both employer and worker surveys predicted that remote work would persist long-term. Returning to Table 1, the row labeled "Share Remote Work 2+ Days in Future," displays employers' predictions for the average share of their workforce that will "continue to work remotely (at least 2 normal working days per week) once the COVID-19 crisis ends and other businesses and services reopen." In the post-vaccine firm survey, employers with remote workers indicate that 52% of their workforce would continue to remain remote at least 2 day per week. For workers, approximately 26% of June 2022 survey respondents indicated they would remain remote at least 2 days/week at this time next year "assuming no pandemic interruptions," while 13% (unreported in the Table) indicated they would be fully remote and a further 9% indicated they would work remotely 1 day per week.[7] Given these answers, at the time of our surveys, the modal worker with any days working from home expected that a hybrid schedule, working remotely between 2-4 days per week, would be most likely going forward.

[6]Education explains a substantial share of the variation in the Dingel and Neiman (2020) measure and the CPS rate of remote work. See Mongey, Pilossoph, and Weinberg (2021); Bick et al. (2020); Forsythe et al. (2020) for implications for inequality.

[7]Employer responses in the Survey of Business Uncertainty predicted a long-term increase in remote work early in the pandemic, consistent with our results (Altig et al. 2020). This shift in expectations remained elevated over time.

3.2 Remote Work Productivity

To capture firm perceptions about the productivity consequences of remote work, we asked business owners in the Alignable survey to quantify productivity relative to pre-COVID non-remote levels. In most survey waves, we asked about individual productivity with the question "Compared to January 2020, how has remote work affected productivity for the employees who transitioned to working from home?" Respondents were asked to move a slider between -100 and 100, with labels "Much Less Productive" at -80, "About the Same" at 0, and "Much More Productive" at +80. In the third survey wave we also used a between-subjects design to assess the company-wide, rather than individual-level, implications of remote work. Instead of the default question about individual-level productivity, half of the respondents saw a question phrased as "Compared to January 2020, how did your business's overall productivity change as a result of remote work?" The mean and standard deviation of responses when the framing is about individual worker versus company productivity are nearly identical, so we pool the results from these two separate questions.[8]

To assess workers' perceptions of the productivity of remote work, we asked the following analogous questions "Thinking about your most recent work from home experience, how does the productivity of remote work for you and your coworkers compare to in-office productivity?" Participants saw the same sliders from -100 to 100. To assess changes over the pandemic, we asked "Reflecting on the last 20 months, has remote work become harder or easier overall compared to when you first started working remotely?". Respondents chose from 5 answers: "Much harder", which we code as -2, "Harder", which we code as -1, "About the same", which we code as 0, "Easier", which we code as 1, and "Much easier", which we

[8] As we discuss later in Figure 4, the productivity assessments framed at the firm and work level also vary over the firm size distribution as a function of whether we use the worker or the firm-level framing.

code as 2.

While the shift to remote work was accompanied by productivity declines in the early stages of the pandemic, merely one year later, not only did firms and employees report regaining productivity relative to January 2020, but the median respondent reported that productivity surpassed what it had been before the pandemic. Rows 6-8 of Table 1 describe the dramatic shift in productivity experienced between 2020 and 2021. "Productivity of Remote Workers" (row 6) summarizes reported productivity of remote workers from the firm perspective (Columns 1-2) and the employee perspective (Columns 4-5). In the first half of 2020, firms with workers switching to remote work reported lower average productivity for remote work than in-person work, with a mean answer of -16.30, which is statistically different from 0.[9] By the first half of 2021, firms reported that the productivity of remote work was higher than in-person work, with an average response of 16.76, a statistically significant increase of 33 points on a -100 to 100 scale relative to the prior year. Employee self-reports align with employer responses. Employees who transitioned to working remotely in 2021 perceived a boost in productivity when comparing remote work with in-person work (mean=19.13), and this persists into 2022 (mean=21.08).

When we aggregate responses simply by whether the respondent perceived remote work to be more or less productive than in-person work (see "Share with Productivity >0", row 7), we find the shift in perceived productivity is not driven by a subset of extreme responses but rather a shift at the median. In 2020, seventy percent of employers reported that remote

[9]The only other firm-level survey of remote work productivity from early in the pandemic that we are aware of comes from Ozimek (2020). He asked 500 hiring managers in April of 2020 how work from home progressed relative to expectations, with 56% reporting it going better than expected. He also probes reasons why productivity has changed – with the main factors being technological challenges and workers becoming distracted while at home. International surveys of employers from later in the pandemic include Criscuolo et al. (2021) and Erdsiek (2021), both of which conclude that many employers had positive perceptions of remote work productivity as the pandemic progressed. These surveys also suggest that firms that invested in practice changes to facilitate remote work are more optimistic about the long-term use of remote work.

work reduced productivity relative to in-person work, but by 2021 less than half of employers viewed remote work as less productive.

Finally, when asked directly to assess how the productivity of remote work has changed, comparing the present with remote work during the first month of pandemic disruptions, again on a scale of -100 to 100, respondents in 2021 reported a 10.54 point increase in productivity, which is statistically different from 0. When we compare the same respondents across multiple survey waves (N=65), the average within-person change is 10.98 points, closely matching the retrospective perception of changes from the full sample.

Figure 3 Panel A shows the entire distribution of employers' perceived relative productivity of remote to in-person work. We observe the rightward shift of the entire distribution from predominantly negative to predominantly positive between 2020 and 2021. Panel B displays a histogram of employee perceived relative productivity of remote work, corroborating the alignment between employer and employee perception in 2021. The 2022 employee survey also indicates that the boost in the perceived relative productivity of remote work compared to in-person work remains remarkably persistent. Taken together, we find robust evidence of an upward shift in the perceived productivity of remote work. By 2021, the perceived productivity of remote work overtook the perceived productivity of in-person work for both business owners and employees.

3.3 Sources of Remote Work Productivity Changes

We have examined firm, industry, and worker-level factors that correlate with the relative level of remote work productivity or its change over the pandemic. Conditional on engaging in remote work, neither the industry nor occupational suitability for telework, education, or gender correlate with our productivity measures. Thus, measures of theoretical suitability

for remote work appear to matter most for the extensive margin, rather than for variation in assessments on the intensive margin.

However, firm size prior to the pandemic is robustly negatively correlated with the relative productivity of remote work (see Appendix Table A1). Size is the only pre-pandemic firm characteristic that has a meaningful correlation with productivity assessments. Owners of larger firms reported lower levels of productivity at the early stages of the pandemic, and the negative relationship between firm size and productivity remained through our post-vaccine surveys. Looking at the raw data, Figure 4 suggests that firms with between 30-60 workers in January of 2020 had the lowest assessed productivity effects of remote work in January of 2021, whereas the relationship appears to recover a bit for firms above 100 employees. Our data contain very few larger firms, as our sampling frame for firm-level responses was based on small businesses, so we cannot detect whether this uptick would extend to much larger firms.

We now turn to providing evidence on additional sources of changes in remote work productivity over time, as the surveys were designed to uncover several inputs that may correlate with perceptions of longer-term remote work productivity impacts, including on hiring, learning about new tasks or skills, and worker management. We asked respondents in the May 2021 survey wave about the main positive and negative factors contributing to their experience with remote work using the questions "Are there any factors that have helped to improve remote worker productivity over the past year? (Select all that apply)" and "Are there any factors that have reduced remote worker productivity over the past year? (Select all that apply)." On the positive side, respondents could select: "Coordination became easier as more people worked remotely", "Employees learned to work remotely more effectively or we conducted training", "We changed processes or routines", "We started us-

ing new technologies", and "We hired employees who are better suited for remote work". In addition to these options, respondents could select "Not applicable: Nothing has been positive" (chosen by 35%) or could enter free text. Options on the negative side included: "Team relationships deteriorated/communication difficulties", "Difficulty onboarding or hiring new people", "Team burn-out, exhaustion, and/or health problems", "Monitoring employees became harder", and "Team members leaving the firm".

Table 2 displays the share choosing each option (as the mean of the dependent variable), along with regression coefficients relating the responses to industry-level teleworkability and firm size prior to the pandemic. The main sources of positive contributors are: new technology (chosen by 32%), process or routine changes (29%), and learning/training (24%). All three are positively correlated with industry-teleworkability, while only learning/training is positively correlated with the pre-pandemic firm size. Improved coordination was chosen by under 15% of responses and hiring more suitable workers was chosen by under 2%.

The three most important negative factors are communication difficulties or relationship deterioration (25%), monitoring challenges (24%), and burnout (22%). Onboarding challenges and attrition were chosen by 12 and 9 percent of respondents, respectively. Responses highlight these main challenges arose after a year of remote work. Industries most prone to going fully remote (high teleworkability), while appearing to reap several advantages of going remote, also faced communications and monitoring difficulties. Larger firms also suffered greater communications loss. Firm size also appears to correlate with onboarding challenges.

Taken together, it appears that larger firms and those with more teleworkable employees were more effective at training workers for remote work, while process changes and new technology help to explain the positive productivity effects documented later in the pandemic. However, larger firms suffered communications losses, which may explain why the leaders of

many large public companies have pushed aggressively for return to office policies. These patterns help to explain the positive productivity effects of remote work in individual jobs (Bloom et al. 2015) and the low rates of pre-pandemic remote work for those in occupations involving team work (Mas and Pallais 2020).

While our prior approach asked business owners to choose the most relevant factors for positive and negative productivity changes, we asked all owners three questions to gauge their qualitative impressions on hiring, employee learning, and monitoring even if they didn't select these dimensions. We used the following questions: "Reflect on the employees you have hired directly into remote positions. On average, how do these hires compare to the employees you would have been able to hire if the position were not remote?", "Compared to in-person work, would you say that remote employees are faster, slower, or about the same in how quickly they learn on the job (how to do their tasks, how to do new things, etc.)?", and "How does your ability to spot employees' strengths and weaknesses when they are remote compare to when they are in person?".

Table 3 Panel A presents the data, which we summarize here. Fewer than 10 percent of respondents reported that the new hires for remote positions are of lower quality, while 45 percent indicated candidate quality improved relative to hires for non-remote positions. Meanwhile, 39 percent of employers perceived that remote workers are slower to pick up new tasks or learn new skills on-the-job (Column 3), consistent with the notion that observability or face-to-face interactions may facilitate knowledge transmission (Sandvik et al. 2020; Battiston, Blanes i Vidal, and Kirchmaier 2021). 61 percent perceived that monitoring was significantly more difficult under remote work (Column 4).

We also probed workers with detailed questions related to perceptions of the drivers of productivity changes. These include: "Relative to working in person, how easy is it for you

and your coworkers to get up to speed on new projects or tasks when working remotely?", "Relative to working in person, how easy is it for you and your coworkers to learn new skills at work when working remotely?", "Relative to working in person, how easy is it for your boss to understand your work and contribution when working remotely?", and "Over the last 20 months, has your boss become better or worse at managing remote teams? If you do not have a boss, please select Not applicable".

In Table 3 Panel B, workers are split roughly equally between perceiving that remote increased, decreased or left unchanged their ability to get up to speed or pick up new skills. However, 43 percent believe their manager became better at managing work after the transition to remote work. This is a somewhat surprising result given managers' own accounts to journalists indicate increased difficulties with their jobs (Savage 2022). It is possible that workers feel liberated from monitoring or excessive supervision, the dimensions where managers report difficulty in remote environments. This leads to our next question about how workers value some of these aspects of remote work as an amenity.

3.4 Valuations of Remote Work as an Amenity

Remote work affects not only productivity, but also the experience of work. Ultimately the longevity of remote work, and associated compensation, will reflect both the perceived productivity of working remotely as well as employee preference for remote work (Barrero et al. 2022). There are many reasons that remote work might be considered an amenity. For example commute times and costs may decline, home-offices may be more relaxing, and home-kitchens may produce better meals than options at the workplace. On the other hand, finding space at home to work may be burdensome and expensive (Stanton and Tiwari 2021),

and employees may miss spending time with colleagues.

We examine which types of employees view remote work as an amenity, versus a disamenity, by examining how workers would respond to wage adjustments to maintain remote-work arrangements. We asked two questions of workers: first, "Suppose your employer told you that returning to the office 5 days/week was mandatory to keep your current pay, but you could work remotely if you took a pay cut. Would you work in the office or would you take a pay cut to work remotely?" Those who answer that they would not take a paycut to work remotely in the first question are coded as being willing to pay at most 0% of their salary to work remotely; for the rest, we asked what size pay cut they would be willing to accept. Specifically, the question was worded: "we are interested in understanding how much value you place on working remotely, and how much of a pay cut – if any – you would be willing to take in order to maintain the ability to work remotely on an ongoing basis. With that in mind, what's the largest cut you would take in order to continue working from home (rather working from the office 5 days/week or quitting to find a new job)? For example, if you would be willing to take a 20% pay cut if it allowed you to work remotely at your current job, select 20%." These questions allow us to estimate the strength of worker preferences for remote work through their willingness to pay for the opportunity to work remotely compared to on-site.

In Figure 5 we describe which types of workers, among those in teleworkable occupations, were willing to accept a pay cut to work remotely at the time of the surveys. The figure also provides detail on the largest pay cut respondents would accept. About 40% would have been willing to take a pay cut greater than or equal to 5% (see the orange crosses for $\geq 5\%$ of Salary), meaning that 60% were unwilling to take a small pay cut to remain remote.[10] 21%

[10] 5% was the smallest category available to respondents.

of respondents were willing to pay at least 10% of their salary to remain remote.[11] About 9% of respondents were willing to give up 20% of salary or more. These results indicate that the modal worker has a limited valuation for remote work amenities, but there is a subset of the labor force that highly values remote work.

The remaining rows of Figure 5 explore whether this heterogeneity varies systematically with worker characteristics. Workers with a college degree are more likely, at 44% compared to 34%, to be willing to pay a non-zero amount for remote work. They are also 24 percent more likely to be willing to pay in excess of 10% or 20% of salary than those without a degree. Patterns by age, shown in the next 3 rows, indicate that older workers were less likely than young workers to be willing to pay for remote work. Around 14% of workers over 50 were willing to give up more than 10% of their compensation to remain remote, whereas 24% of those younger than 50 were willing to do so.

The distribution of willingness to pay for females versus males has interesting patterns. 37% of females have a positive willingness to pay for remote work compared to 42% of males, but females who do value remote work would be willing to pay more to keep the option. Overall, they are 16 percent more likely than males to be willing to pay at least 10% of salary and over 60 percent more likely to be willing to pay at least 20% of salary to remain remote. We originally expected that these differences would arise because of childcare responsibilities, but instead we detect few differences based on whether the respondent is the primary caregiver for a child.

The next few rows examine how willingness to pay varies across industries and assessments of productivity. Not surprisingly, those in construction, manufacturing, and

[11] Our evidence shows valuations for remote work seem remarkably stable. For example, Mas and Pallais (2017) find that about 25% of workers would be willing to give up approximately 14% of their pay for a remote work option.

oil and gas extraction have the lowest willingness to pay. Those in professional services, health/education, and other industries have higher shares of willingness to pay. It is possible that some of these industry differences arise from productivity factors, as workers in the bottom tercile of self-reported productivity with remote work have the lowest willingness to pay.

Finally, revealed preferences for remote work seem to align with stated willingness to pay. Those who teleworked pre-pandemic have much higher willingness to pay and those who switched jobs during the pandemic, which for many would have represented a move to a remote occupation, have a higher willingness to pay to remain remote rather than joining their colleagues in office. It is possible that expansion of those willing to switch jobs for remote positions will alleviate some of the adverse selection concerns documented with remote work pre-pandemic (Emanuel and Harrington 2021).

4 Conclusion

The COVID pandemic led to dramatic economic disruptions, as health concerns created by the virus led people to stay home and businesses to suspend in-person activities (Alfaro et al. 2020; Béland, Brodeur, and Wright). While the shift to remote work was sizeable and allowed those in teleworkable occupations to avoid unemployment (Brynjolfsson et al. 2020; Forsythe et al. 2020; Bick et al. 2020), many business leaders intended to reopen in-person operations as soon as possible (Balla-Elliott et al. 2022). This sentiment seemingly reflected the early experiences with remote work, which we document in this paper were largely associated with productivity declines.

However, emerging research, documented here and elsewhere, suggests that remote work

will be much more prevalent in the future (Bick et al. 2020; Barrero, Bloom, and Davis 2021). Our evidence suggests that it is the combination of firms' improved productivity after gaining experience with remote work, plus some workers' high willingness to pay for telework as an amenity, that contributes to the long-term increase in remote work that the pandemic generated. Firms point to organizational learning, investment in IT, and process changes as core to understanding why remote work productivity increased over time. As organizations potentially become more geographically dispersed in the future, we see the documentation of these factors as especially important for managers who will need to navigate leading remote teams.

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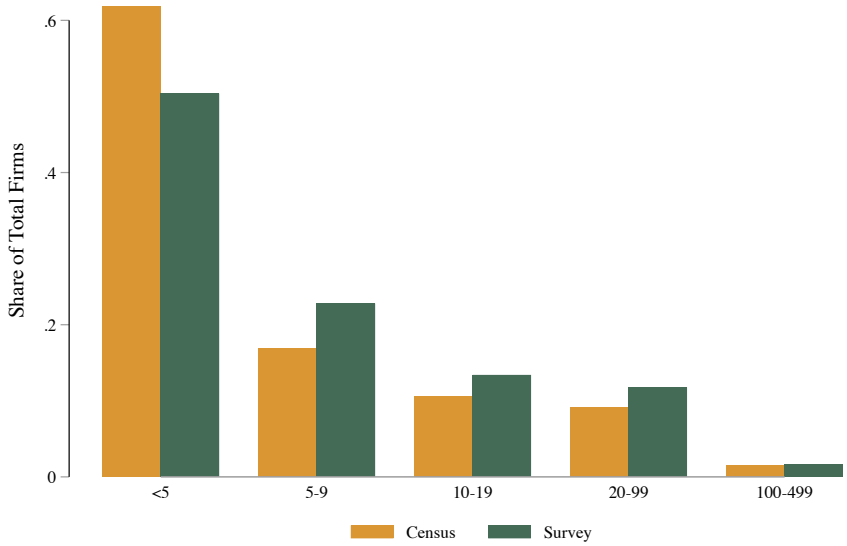
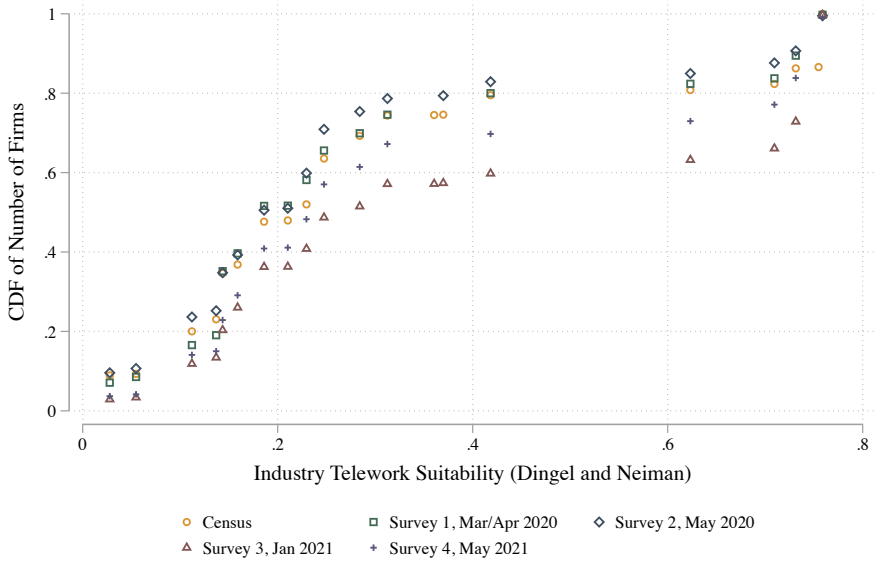
Figures and Tables



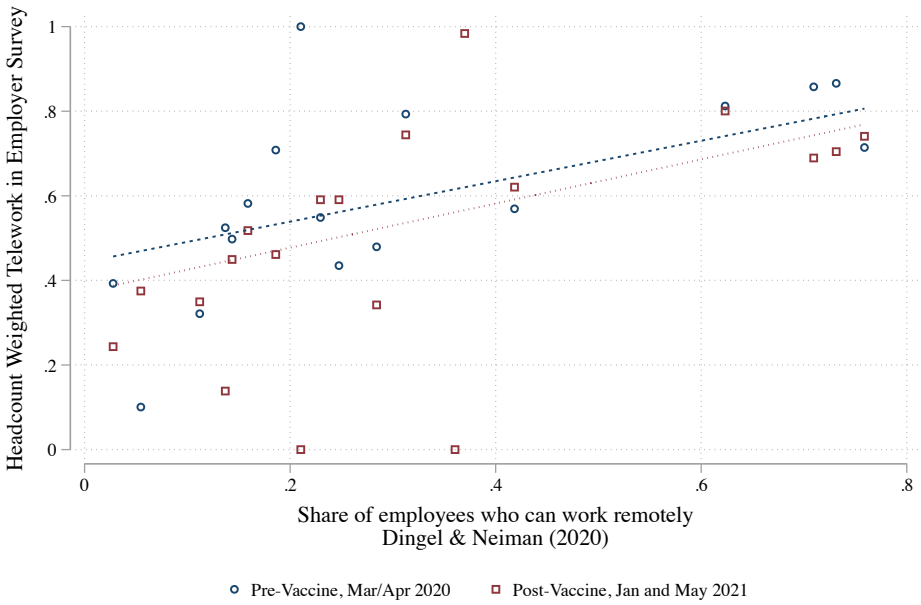
(a) Firm Sizes in the Census and Employer Survey



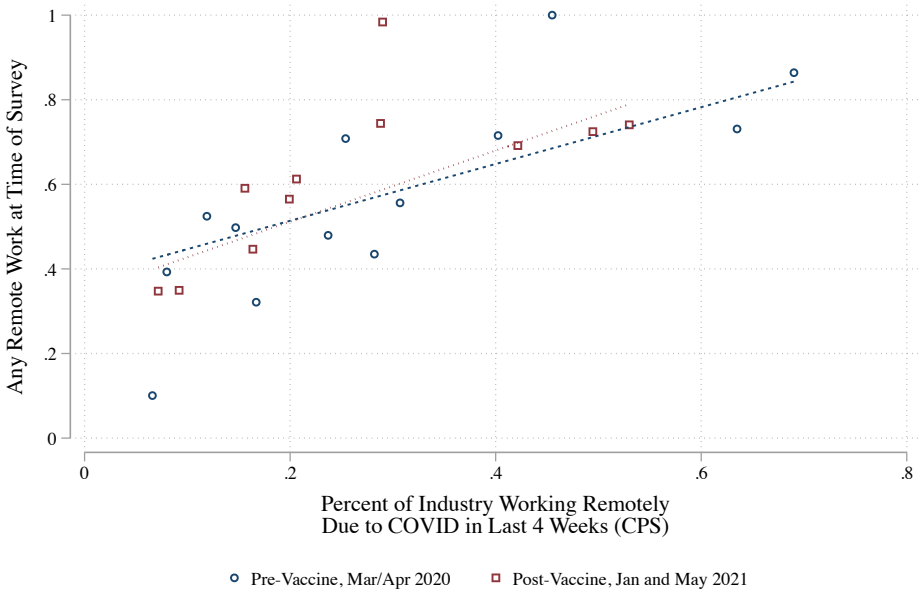
(b) Industry Teleworkability in the Census and Employer Surveys

Figure 1: Comparison of Business Owner Survey Responses with Census Distributions

Note: This figure displays headcount distributions for firms in the 2017 U.S. Census of Businesses with under 500 employees and firms in the employer surveys from Alignable. Panel (a) pools across all Alignable survey waves. Panel (b) plots the CDF of industry teleworkability, based on Dingel and Neiman (2020), for the Census and each survey wave.

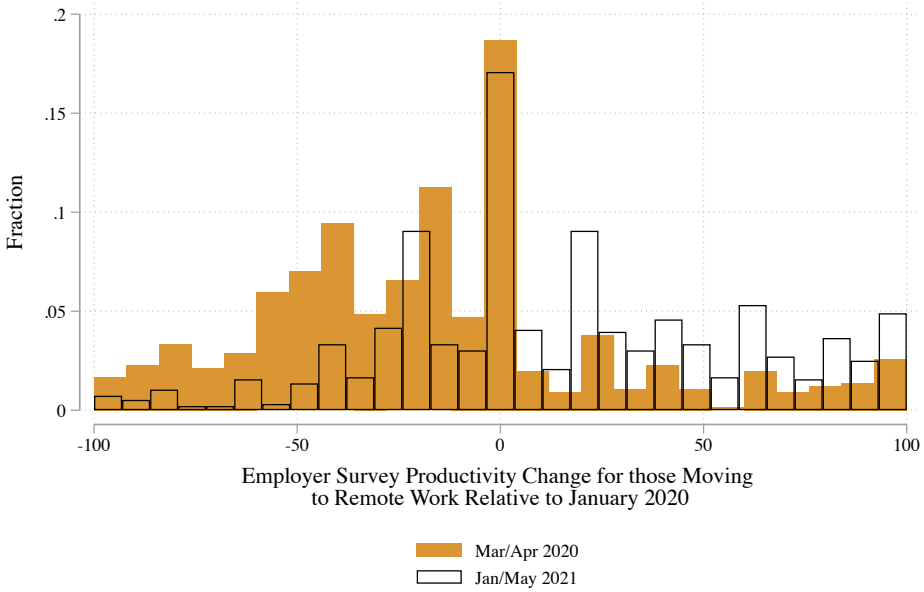


(a) Remote work in different waves of the Alignable employer surveys relative to the industry-level measure of teleworkability from Dingel and Neiman (2020).

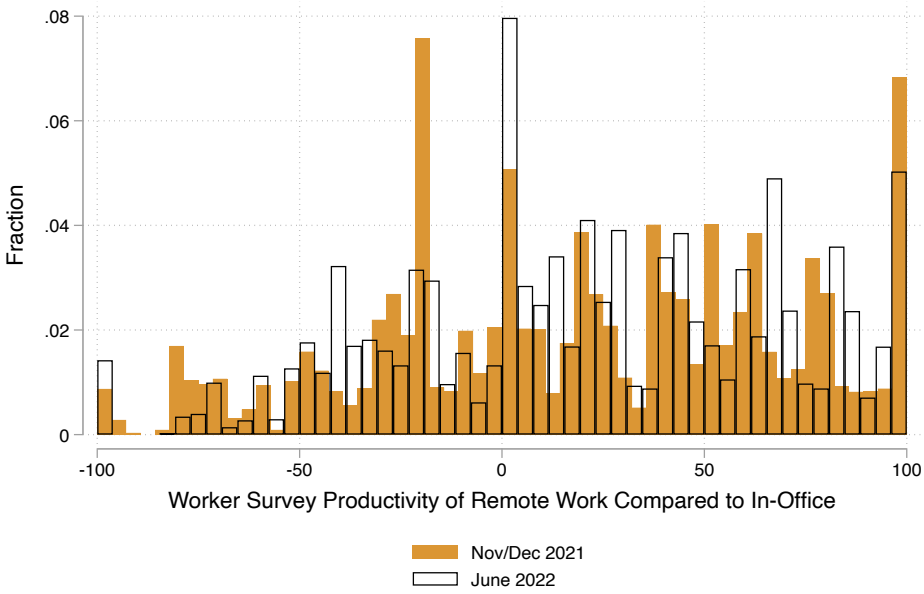


(b) Remote work levels in the Alignable employer surveys relative to concurrent reported industry-level remote work due to COVID in the last 4 weeks from Current Population Survey supplements.

Figure 2: Remote Work Relative to the Dingel and Neiman Teleworkability Measure and Current Population Survey Measures of Remote Work



(a) Distribution of business owner responses to relative productivity of remote work. The mean productivity change is -16.30 (N=658) in the Mar/April 2020 survey and 15.67 (N=960) in the Jan/May 2021 surveys. Excluding zeros (the slider default), the mean productivity changes are -17.44 (N=615) and 18.37 (N=819), respectively. There are 65 respondents with responses in both surveys, and the mean within-respondent change is 10.98.

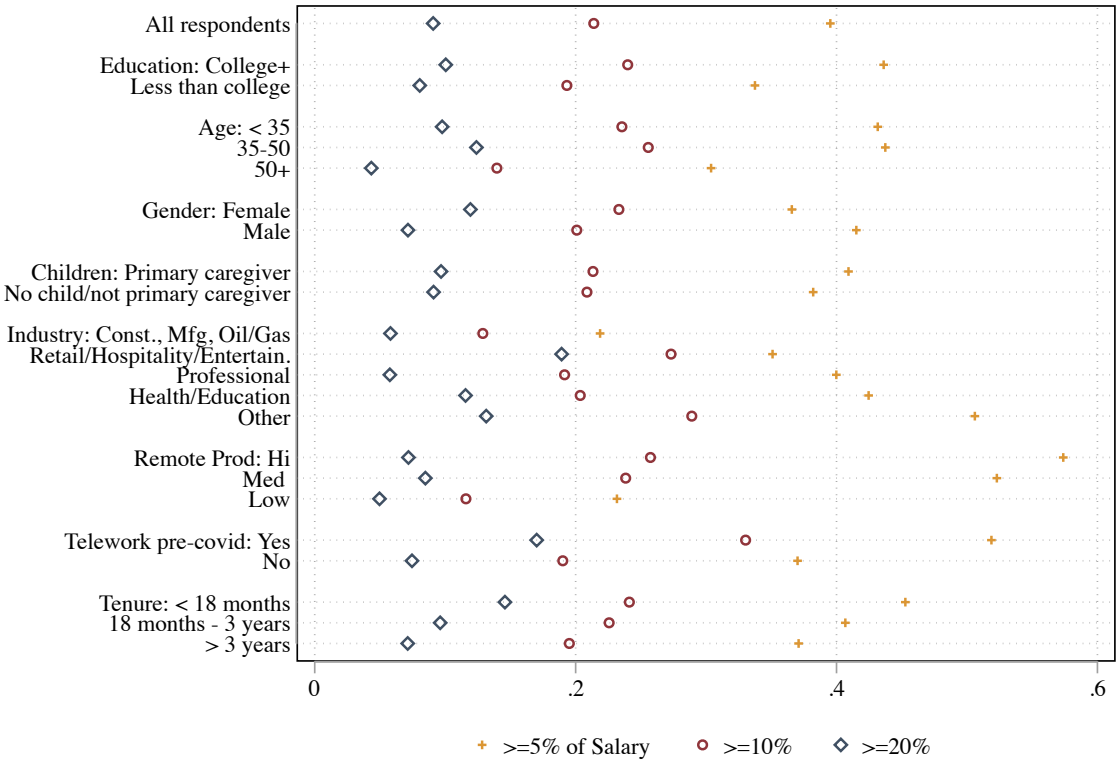


(b) Distribution of worker responses to relative productivity of remote work compared to in-office, excluding those who were remote pre-Covid. The mean productivity change after reweighting by occupation is 19.76 (N=1130), is 20.11 (N=1103) after excluding zeros (the slider default), and is 14.91 (N=1058) if excluding those at 100.The share of workers reporting that remote work has become easier or much easier (relative to the same, harder or much harder) is 0.53 (N=1177).

Figure 3: Productivity Relative to In-Office Work in Employer and Worker Surveys

Notes: This figure displays two measures of perceived changes in productivity between the pre-pandemic era and January of 2021 (survey wave 3) as a function of firm size in January of 2020. The separate productivity measures come from questions where managers and business owners were asked about changes in productivity framed at the firm-level or the worker-level.

Figure 4: Employer Survey Evidence on Productivity Impacts of Remote Work Over the Firm Size Distribution



Notes: This figure reports measures of worker willingness to pay to work remotely. The sample consists of the 2,362 workers in the Lucid worker surveys (both round 1 and round 2) who both answer questions about willingness to pay to work remotely and do not report "Not applicable: My job cannot be done remotely." Estimates from the worker survey are reweighted to match Bureau of Labor Statistics economy-wide occupation shares from OES data.

Figure 5: Worker Willingness to Pay for Remote Work

Table 1: Survey Summary Statistics

	Firm Surveys			Worker Surveys		
	Pre-Vax	Post-Vax	Diff	Wave 1	Wave 2	Diff
	Mar/Apr & May 2020	Jan & May 2021		Nov/Dec 2021	June 2022	
	(1)	(2)	(3)	(4)	(5)	(6)
Employees at Time	10.4	10.8	0.4			
	(24.2)	(33.6)	(0.9)			
	[1674]	[2611]				
Jan to April 2020 Emp Change	-0.23					
	(0.60)					
	[1668]					
Any Workers Switching to Remote	0.47	0.40	-0.07	0.32	0.31	-0.01
	(0.50)	(0.49)	(0.02)	(0.47)	(0.46)	(0.46)
	[1699]	[2611]		[1806]	[971]	
Any Workers Remote		0.54		0.33	0.35	0.02
		(0.50)		(0.47)	(0.48)	(0.03)
		[2611]		[1805]	[971]	
Share Remote 2+ Days in Future	0.41	0.52	0.11	0.25	0.26	0.01
	(0.34)	(0.35)	(0.03)	(0.43)	(0.44)	(0.44)
	[173]	[785]		[1806]	[971]	
Productivity of Remote Work	-16.30	16.76	33.06	19.13	21.08	1.95
	(42.94)	(43.71)	(2.20)	(49.64)	(47.36)	(4.46)
	[658]	[914]		[743]	[387]	
Share with Productivity > 0	0.31	0.55	0.25	0.63	0.68	0.05
	(0.46)	(0.50)	(0.02)	(0.48)	(0.47)	(0.05)
	[658]	[914]		[743]	[387]	
Change in Remote Productivity		10.54		0.51	0.65	0.14
		(34.88)		(1.08)	(0.94)	(0.94)
		[130]		[1096]	[586]	
Sample Size	2545	2789		1810	974	

Notes: This table displays summary statistics for four waves of firm surveys, taken at different times from Alignable businesses, and two waves of worker survey conducted through the Lucid platform. Mapping from survey questions to variables is described in the text. We group together the two firm surveys conducted prior to COVID-19 vaccinations becoming available (Column 1) and the two surveys conducted after COVID-19 vaccinations became available (Column 2). Each rows summarizes survey responses along with means, standard deviations (in parentheses) for non-binary variables, and the number of observations for the response [in brackets]. Columns 3 and 6 display the difference between the prior columns in the firm and worker surveys, respectively, with standard errors for the estimates of the difference (in parentheses). Remote productivity measures are only populated for firms or workers transitioning to remote work after March 2020. In firm survey wave 2, the question about remote persistence is only asked to firms having remote workers. Means in the worker surveys are re-weighted to match the occupation distribution in OES data. In practice, this puts additional weight on observations from respondents in non-teleworkable occupations (Dingel and Neiman 2020) and is why the sample size on the remote work productivity question is larger than the mean rate of remote work multiplied by the original sample size.

Table 2: Positive and Negative Factors Contributing to Remote Work Productivity

Panel A: Positive Contributors to Productivity	(1)	(2)	(3)	(4)	(5)
	Coordination	Learning	Process Changes	New Tech	New Hires
Industry Teleworkability (D & N)	0.284***	0.331***	0.308***	0.308***	0.0376
	(0.0945)	(0.109)	(0.117)	(0.117)	(0.0324)
Log Firm Employment Pre-Covid+1	0.00801	0.0841***	0.0195	0.0402	-0.00583
	(0.0245)	(0.0280)	(0.0321)	(0.0311)	(0.00573)
Mean of DV	.144	.235	.292	.318	.011
N	277	277	277	277	277
R^2	.0421	.0609	.0298	.0387	.0134
	(1)	(2)	(3)	(4)	(5)
Panel B: Negative Contributors to Productivity					
	(1)	(2)	(3)	(4)	(5)
	Communications	Onboarding	Burnout	Monitoring	Attrition
Industry Teleworkability (D & N)	0.301***	0.0946	0.169	0.293***	0.140**
	(0.113)	(0.0801)	(0.106)	(0.111)	(0.0710)
Log Firm Employment Pre-Covid+1	0.0716**	0.0553**	0.0116	0.0366	0.0120
	(0.0283)	(0.0235)	(0.0278)	(0.0265)	(0.0215)
Mean of DV	.247	.12	.218	.244	.091
N	275	275	275	275	275
R^2	.0457	.0286	.0115	.0315	.0309

Note: This table reports regressions of dummy variables from the May 2021 wave of firm surveys. Dependent variables in Panel A are indicators for responses to the question "Are there any factors that have helped to improve remote worker productivity over the past year? (Select all that apply)." The dependent variables across the 5 columns come from these choices: "Coordination became easier as more people worked remotely", "Employees learned to work remotely more effectively or we conducted training", "We changed processes or routines", "We started using new technologies", and "We hired employees who are better suited for remote work". In addition to these options, respondents could enter free text. 98 respondents (35%) also chose "Nothing has been positive". Dependent variables in Panel B are responses to the question "Are there any factors that have reduced remote worker productivity over the past year? (Select all that apply)." The dependent variables across the 5 columns come from these choices: "Team relationships deteriorated/communication difficulties", "Difficulty onboarding or hiring new people", "Team burn-out, exhaustion, and/or health problems", "Monitoring employees became harder", and "Team members leaving the firm". Industry is missing for some respondents, so regressions include an unreported dummy variable for missing industry-level teleworkability. The mean and standard deviation of the Industry Teleworkability measure in this sample is 0.27. Robust standard errors in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 3: Remote Work Effects on Inputs to Long-Run Outcomes

	Hiring	Learning		Management		
		Up-to-speed New Tasks	New Skills	Monitoring	Boss Understanding Job	Boss Overall Management
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A. Firms						
Higher/easier/	0.45		0.09	0.10		
better/faster	(0.04)		(0.02)	(0.02)		
About the same	0.46		0.51	0.29		
	(0.04)		(0.03)	(0.03)		
Lower/harder/	0.09		0.39	0.61		
worse/slower	(0.02)		(0.03)	(0.03)		
N	140		272	265		
Panel B. Workers						
Higher/easier/		0.27	0.26		0.24	0.43
better/faster		(0.01)	(0.01)		(0.01)	(0.01)
About the same		0.43	0.40		0.48	0.43
		(0.01)	(0.01)		(0.01)	(0.01)
Lower/harder/		0.30	0.34		0.28	0.14
worse/slower		(0.01)	(0.01)		(0.01)	(0.01)
N		1654	1655		1554	1526

Notes: This table displays responses to questions about how remote has affected hiring, management, and worker learning for wave 4 of the surveys taken by Alignable businesses (Panel A), and worker surveys conducted through Lucid (Panel B). Panel B pools both round 1 and round 2 of the Lucid worker surveys. Estimates from the worker survey are reweighted to match Bureau of Labor Statistics economy-wide occupation shares from OES data. The survey questions in Panel A all come from firm survey Wave 4 in May 2021, while those in Panel B come from waves 1 (November/December 2021) and 2 (June 2022) of the worker survey. The survey question for Panel A, Column 1 was: "Reflect on the employees you have hired directly into remote positions. On average, how do these hires compare to the employees you would have been able to hire if the position were not remote?" The survey question for Panel A, Column (3) was "Compared to in-person work, would you say that remote employees are faster, slower, or about the same in how quickly they learn on the job (how to do their tasks, how to do new things, etc.)?". The survey question for Panel A, Column (4) was: "How does your ability to spot employees' strengths and weaknesses when they are remote compare to when they are in person?". The survey question for Panel B, Column (2) was: "Relative to working in person, how easy is it for you and your coworkers to get up to speed on new projects or tasks when working remotely?" The survey question for Panel B, Column (3) was: "Relative to working in person, how easy is it for you and your coworkers to learn new skills at work when working remotely?". The survey question for Panel B, Column (5) was: "Relative to working in person, how easy is it for your boss to understand your work and contribution when working remotely?". The survey question for Panel B, Column (6) was: "Over the last 20 months, has your boss become better or worse at managing remote teams? If you do not have a boss, please select 'Not applicable'". Standard errors are shown in parentheses.

Appendix Tables

Table A1: Correlates of Remote Work Productivity

Wave:	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Mar/Apr 2020		Jan + May 2021			Worker Nov/Dec 2021	
DV:	Rel. Worker Prod			Rel. Org Prod	Evolution	Rel. Prod	Evolution
Ind. Teleworkability (D & N)	-0.817	-1.198	9.162	-9.620	54.721		
	(21.266)	(21.384)	(13.118)	(41.094)	(58.893)		
Share of Ind. with BA+	26.454	32.214	-9.253	26.341	-84.864		
	(37.490)	(36.942)	(18.074)	(57.878)	(87.271)		
Share of Ind. Female	1.337	4.069	1.377	6.883	-0.559		
	(11.157)	(11.740)	(8.019)	(26.416)	(28.368)		
Log Firm Employment Pre-Covid+1	-3.855**	-4.220***	-5.449**	-5.691*	-3.616		
	(1.352)	(1.423)	(2.250)	(3.124)	(5.100)		
Occupation Teleworkability (D & N)						-0.251	0.149
						(9.244)	(0.160)
Has BA+ Degree						-2.009	0.026
						(5.998)	(0.122)
Female Worker						-5.560	-0.029
						(4.578)	(0.065)
Children at Home						-1.130	-0.066
						(4.396)	(0.082)
Occupation Collaboration Z-Score						0.247	0.044
						(3.144)	(0.069)
State FE:	No	Yes	Yes	Yes	Yes	Yes	Yes
Time FE:	No	Yes	Yes	Yes	No	No	No
Exclude Pre-COVID Remote:						Yes	Yes
Joint P-value of Telework and BA+	.02	9.8e-03	.75	.374	.634	.944	.643
Mean of DV	-17.51	-17.51	14.36	16.63	10.63	18.48	0.59
N	610	610	493	339	109	845	882
N Industries or Occupations	17	17	17	16	14	70	71
R^2	.0245	.0743	.163	.171	.242	.105	.124

Notes: Regressions of various productivity measures on firm, industry, and worker characteristics. The dependent variable in columns 1-3 is the assessment of the relative change in worker productivity. In column 4, it is the change in firm-level productivity. In column 5 it is the evolution of productivity, based on a retrospective question about how productivity with remote work evolved since the beginning of Covid. In column 6 it is the level of relative productivity for workers, and column 7 asks about the change in productivity relative to the beginning of remote work. Standard errors clustered by industry in the firm owner surveys and by occupation in the worker survey. Estimates from the worker survey are reweighted to match Bureau of Labor Statistics economy-wide occupation shares from OES data. Productivity measures are only populated for those firms or workers who worked remotely during Covid. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$