THE EFFECTS OF REMOTE WORK ON COLLABORATION AMONG INFORMATION WORKERS

By David Holtz

IN THIS BRIEF

The COVID-19 pandemic has caused a rapid shift among information workers to full-time remote work. As both full-time remote work and flexible work policies become more common, it is important to examine the causal effects of firmwide remote work on communication and collaboration.

This study uses rich data from the emails, calendars, instant messages, video/audio calls and work-week hours of more than 61,000 Microsoft employees in the United States during the first six months of 2020.

Results show that firmwide remote work caused the collaboration network of workers to become more static and siloed, with fewer bridges between disparate parts of the organization.

The amount of synchronous communication such as video conferences decreased, while asynchronous communication such as email increased.

Together, these effects may make it harder for employees to acquire and share new information.

In a matter of weeks, the COVID-19 pandemic caused approximately one in three U.S. workers to shift to work-from-home (WFH) arrangements. Before the pandemic, at most 5% of Americans worked from home for more than three days per week. But by April 2020, as many as 37% of Americans were working remotely full-time, accounting for 46% of all U.S. wages (Dingel & Neiman, 2020).

Although there is a large body of research studying remote work and virtual teams (see, e.g., Allen et al., 2015), almost all of this research has been noncausal, meaning it has not been able to identify the causal effects of remote work on work outcomes and collaboration patterns. Microsoft's companywide WFH policy during the pandemic served as an unexpected opportunity to causally identify the impact of remote work on employees' collaboration networks and practices. Microsoft enacted a WFH mandate in April 2020, requiring all nonessential U.S. workers to work remotely. Before the onset of the pandemic, just 18% of the company's employees had worked from home. After the mandate, Microsoft's entire U.S. workforce was working from home full-time.

We studied the effects of this WFH mandate on workers' collaboration networks and their choice of communication media. Our results suggest that remote work ossified workers' networks and made those networks less dynamic across time. We also find that remote work caused workers to communicate more often through asynchronous media, such as email and instant messaging, and to work longer hours.

PRIOR RESEARCH

Personal-network topologies—including the strength of interpersonal ties—have an important impact on work, according to prior research. For example:

• Individual workers gain access to new information through both formal and informal connections to people in different parts of their organizations (Granovetter, 1973).

• Certain network configurations can aid the production of high-quality, creative output (Uzzi & Spiro, 2005).

• Network dynamics over time can affect the success of both individuals and firms (Kneeland, 2009; Burt & Merluzzi, 2016; Zeng et al., 2021).

• Firms can gain a competitive advantage from engaging in "knowledge transfer," a process in which the experiences of people from one part of the organization are transferred to and used by people in other parts (Argote & Ingram, 2000).

In addition, the strength of ties among workers can affect the sharing of novel information. For example, two people connected by a strong tie can often transfer information

by weak ties, they are more likely to gain access to new information (Granovetter, 1973 and 1982; Burt, 2009). While people with weak ties interact less frequently than those with strong ties, they also share different, fresh perspectives and knowledge that may lead to new and creative solutions.

RESEARCH METHODOLOGY

We analyzed anonymized, individual-level data describing the communication practices of 61,182 U.S. Microsoft employees during the period of December 2019 through June 2020. This gave us data from both before and after Microsoft's April 2020 shift to firmwide remote work. This dataset includes the overwhelming majority of Microsoft's U.S. workforce, although there are some exceptions, such as people who hold senior leadership positions, and we exclude members of teams that routinely handle particularly sensitive data.

We analyzed this data using a modified difference-in-differences (DiD) model. Standard DiD is an econometric approach that lets researchers infer the causal effect of a treatment by comparing longitudinal data from at least two groups, some "treated" and some not. Provided that the identifying assumptions of the DiD model are satisfied, the causal effect of the treatment is obtained by comparing

> **Firms can gain a competitive advantage from engaging in 'knowledge transfer,' where the experiences of one part of the organization are transferred to and used by people in other parts.**

easily, as they are likely to share a common perspective. They also are likely to trust each other, cooperate with one another, and make an effort to ensure that the information they share is both well understood and usable (Reagans & McEvily, 2003; Hansen, 1999; Krackhardt, 2003; Levin & Cross, 2004).

At the same time, however, when people are connected

two factors: The magnitude of the gap between the treated and untreated groups after the treatment is delivered, and the magnitude of the gap between the groups before the treatment is delivered.

We modified the standard DiD model, extending it in two important ways. First, we estimated the causal effects of changes in two treatment variables: one's own remote work

status, and the remote work status of one's colleagues. Second, we introduced additional identifying assumptions, making it possible to draw causal inferences in the presence of an additional shock—in this case, the non-WFH-related aspects of COVID-19, such as increased caregiving responsibilities while sheltering in place.

Figure 1 shows time-series trends for the number of bridging ties that workers had, as well as the number of hours workers spent in unscheduled phone calls. Comparisons are made between those who worked remotely before the pandemic and those who shifted to remote work due to the pandemic; and between those with more than half their collaborators working remotely before the pandemic and those with fewer than 10% of their collaborators working remotely before the pandemic. Each comparison suggests the credibility of the "parallel trends" assumption that is required for the DiD approach to be valid in our research setting. All of the time series move in parallel prior to the shift to firmwide remote work, and they also move in parallel afterward.

One additional benefit of our empirical approach is that it lets us decompose the causal effects of firmwide remote work into two components: The direct effect of an employee working remotely on their own work practices; and the indirect effect of all an employee's colleagues working remotely on that employee's work practices.

IMPACT OF REMOTE WORK
Our resuts show that MIcrosoft's shift to firmware remote work has had several important effects:

- Remote work caused business groups within the company to become less interconnected and more siloed.

- Remote work caused a reduction in the number of ties bridging structural holes in the company's informal collaboration network. Also, individuals spent less time collaborating with the bridging ties that remained.
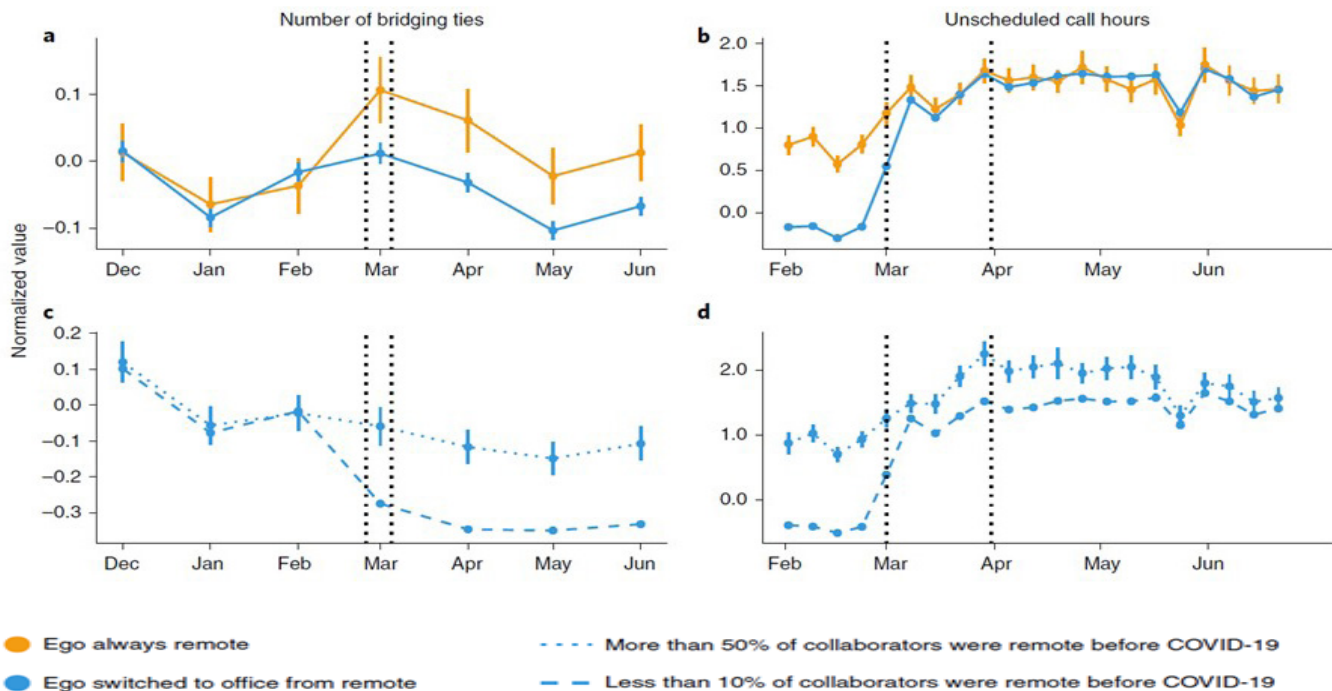

Fig. 1. Time-trend comparisons. The graph shows time series for different groups of workers and suggests the "parallel trends" assumption required for difference-in-differences (DiD) holds in our research setting. The orange line shows trends for employees who worked remotely before the pandemic; the blue line shows trends for employees who switched to remote work after the pandemic began. The dotted and dashed lines further divide workers into two other groups: those with more than half their collaborators working remotely before the pandemic (dotted), and those with less than 10% of collaborators working remotely before the pandemic (dashed).

- Remote work caused networks to become more static, with fewer ties added or deleted each month.

- Remote work caused employees to spend a greater share of their collaboration time with their stronger ties (which are well-suited to information transfer), and a smaller share of their time with weak ties (which are more likely to provide new and more innovative information).

In addition, we found that remote work caused Microsoft employees to spend less time on synchronous communication, such as conference calls, and more time on asynchronous communication, such as email. Not only were the communications media used by employees less synchronous, they were also less "rich," potentially making it more difficult for workers to convey and process complex information (Lengel & Daft, 1984; Daft & Lengel, 1986; Dennis et al., 2008).

Another finding is that the shift to firmwide remote work caused Microsoft employees to work longer hours. The increased length of the workday could be an indication that employees were less productive and required more time to complete their work, or that they replaced some of their commuting time with work time. It is also possible that employees worked the same amount of time, but spread the work over more hours of the day due to interruptions for breaks and personal, nonwork-related activities.

CONCLUSIONS

This study indicates that shifting to firmwide remote work caused workers' collaboration networks to become more heavily siloed, with fewer ties that cut across formal business units or bridge structural holes in the informal collaboration network. Our results also suggest that remote work caused workers' collaboration networks to become more static, with fewer ties added and deleted from month to month

Many firms are currently deciding whether to adopt permanent remote work policies based on observational, non-causal data, but doing so may cause firms to make suboptimal decisions. For instance, our results suggest that firms that choose a permanent remote work policy may put themselves at a disadvantage by making it more difficult for
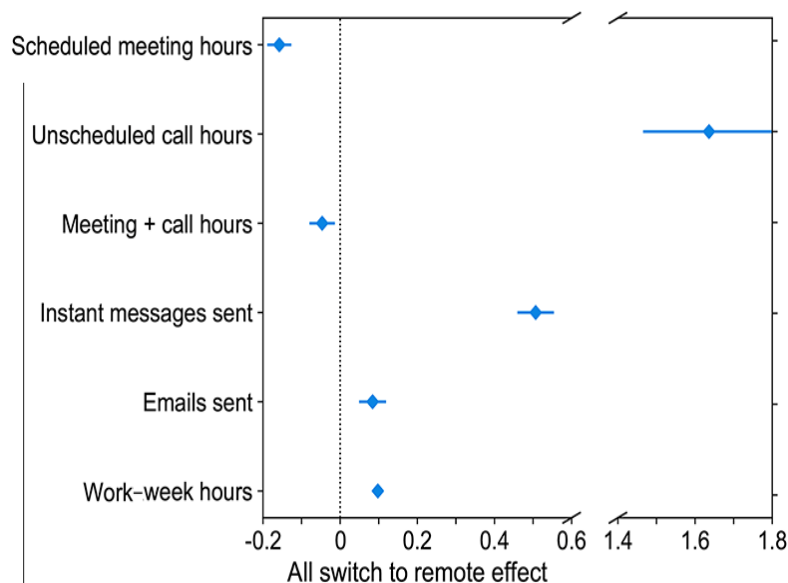

Fig. 2. The graphic shows the effects of firmwide remote work on the use of different communication media. The symbols depict point estimates based on the average level of February 2020 value (FV). Positive results (to the right of zero) indicate more use of a specific communication medium; negative results (to the left of zero) indicate less use

workers to collaborate and exchange information.

Our results also suggest that finding the optimal implementations of hybrid and/or mixed mode work may be difficult and requires future research. The most effective implementations of hybrid and mixed-mode work might be those that deliberately attempt to minimize the impact of collaborator effects on employees that are not working remotely. For example, firms might consider hybrid-work implementations in which certain teams come into the office on certain days, or in which most or all workers come into the office on some days and otherwise work remotely. Firms may also wish to consider programs in which only certain teams are permitted to work remotely.

Although firms have experimented with remote work and flexible work in the past, there are indications that this time, flexible work is here to stay. Workers and firms have invested in different types of capital required to support remote work, and innovation has shifted toward new technologies that

support remote work. Both of these factors make it more likely that for many firms, some version of remote work will persist beyond the pandemic. In light of this fact, the importance of deepening our understanding of remote work and its impacts has never been greater.

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