How Hybrid Working From Home Works Out

Nicholas Bloom[a], Ruobing Han[b] and James Liang[c]

July 19th, 2022

Abstract: Hybrid working from home (WFH), whereby employees work a mix of days at home and at work each week, has become dominant for graduate employees in the US. This paper evaluates a randomized control trial on 1612 engineers, marketing and finance employees of a large technology firm that allowed odd birthday employees to WFH on Wednesday and Friday and kept even birthday employees full time in the office. There are four key results. First, WFH reduced attrition rates by 35% and improved self-reported work satisfaction scores, highlighting how employees place a considerable value on this amenity. Second, WFH reduced hours worked on home days but increased it on other work days and the weekend, highlighting how home-working alters the structure of the working week. Third, WFH employees increased individual messaging and group video call communication, even when in the office, reflecting the impact of remote work on working patterns. Finally, while there was no significant impact of WFH on performance ratings or promotions, lines of code written increased by 8%, and employees' self-assessed productivity was up 1.8%, suggesting a small positive impact. Given these benefits for retention, job satisfaction, and productivity, after the experiment ended the firm extended hybrid WFH to the entire company.

Keywords: working from home, hybrid, productivity, field experiment, and China

Acknowledgments: We thank discussants at Berkeley, Stanford, USC, UCLA, SAIF-FISF joint seminar at Shanghai, AMES 2022, ESAM 2022, and Luohan Academy. We thank the Smith Richardson Foundation and Toulouse Network for Information Technology for co-funding. Finally, we thank Jennifer Cao, Tracy Zhang, Sherry Ye, Fangyuan Chen, Xing Zhang, Ying He, Junyi Li, Byron Ye from Trip.com and Mert Akan from Stanford for data, advice, and logistical support.

Conflict of interest, AEA, and IRB statement: No funding was received from Trip.com. James Liang is the co-founder, former CEO, and current Chairman of Trip.com. No other co-author has any financial relationship with Trip. Neither the results nor the paper was pre-screened by anyone. The experiment was registered with the American Economics Association after the experiment had begun (when Bloom and Han were invited to analyze the data) but before any data was analyzed. The experiment was IRB-exempt as the experiment was initiated by Trip.com before Bloom and Han joined the project, and only anonymous data was shared with the Stanford team.

[a] Stanford University and NBER; [b] Stanford University, [c] Trip.com and Fudan University

I. Introduction

Working from home (WFH) has been increasing for several decades in the United States but surged after the COVID-19 pandemic. By the end of 2022, about 30% of all full-paid working days will be worked from home, with hybrid WFH being the most common approach to this (Barrero et al., 2021). Hybrid WFH typically involves 2 to 3 days each week at home and the remainder in the office.

Hybrid WFH has been promoted as combining the best of working in the office and working from home. The idea is to break an employee's working week into tasks, distinguishing between tasks that are typically best done in person, like larger meetings, training events, or mentoring, and those that can be best done individually, like reading, writing, or coding. The in-person tasks are organized to take place on the office days, for example, Monday, Tuesday, and Thursday, under the hybrid-WFH plan that our experimental firm adopted, and the individual tasks on the Wednesday and Friday home days.

This hybrid WFH approach has four benefits. First, on home days, employees avoid having to commute and prepare for work, which for the average US employee saves about 70 minutes a day, with this time usually split into both additional work and leisure by employees.[1] Second, home working is often better for individual-focused activities like coding or writing as it is usually quieter.[2] Third, WFH also allows greater time flexibility. For example, employees can break to exercise, go to the doctor or pick their children up from school. Finally, hybrid WFH can also reduce space costs if firms rotate the days in which teams work from home. Detractors argue, however, that hybrid WFH is complex, suffers from transition costs from switching between fully in-person and fully remote, and is detrimental to employee performance and innovation. Not surprisingly, there is a vigorous debate about the efficacy of hybrid WFH among managers, policymakers, and the media.

In this paper, we describe a randomized control trial that took place in 2021 and 2022 when Trip.com, a NASDAQ-listed global travel agent with 35,000 employees headquartered in Shanghai, decided to evaluate hybrid WFH. Their motivation was to improve employee job satisfaction to reduce attrition and ease hiring. The obstacle to implementing hybrid WFH was managers' concerns that employees would

[1] See, for example, Barrero et al. (2020) and Teodorovicz et al. (2022).
[2] For example, Bloom, Liang, Roberts and Ying (2014) found a 4% increase in per-minute productivity for home-working on individual tasks, which was primarily attributed to a quieter home working environment.

underperform on their days at home. So Trip.com decided to formally evaluate a hybrid WFH system in two divisions over six months before making a decision over a full firm roll-out.

They took the 1612 engineers, marketing, and finance employees in the Airfare and IT divisions and randomized them into providing the option to WFH on Wednesday and Friday. Those with odd birthdays (those born on the 1st, 3rd, 5th, etc., day of the month) were randomized into the treatment group allowing hybrid-WFH, while those with even birthdays were the control group who continued to come into the office full-time as before.

The experiment revealed four results.

First, WFH reduced attrition rates by 35% and improved self-reported work satisfaction scores, highlighting how employees place a sizeable average value on this amenity. This is consistent with the prior results from Mas and Pallais (2017 and 2018), Maestas (2018) and Barrero et al. (2021) that employees value working from home at the equivalent of about a 4% to 8% wage increase.

Second, WFH reduced hours worked by around 80 minutes on home days but increased it on other work days and the weekend by about 30 minutes in total, highlighting how home-working alters the structure of the working week. Employees reported working from home afforded them the flexibility to attend a dentist appointment, pick their children up from school, exercise, or travel to their hometown early on a Friday. This matches the survey evidence from the US that the second-largest benefit of working from home is flexibility (the largest is avoiding commuting). The experiment highlights this mechanism, showing how employees substitute working hours away from WFH days for office days and weekends.

Third, WFH employees increased individual messaging and group video call communication, even when in the office, reflecting the impact of remote work on modes of communication. This was a surprising result and suggests that home working leads to persistent changes in employees' behavior even in their days in the office. Interviewing employees, we heard that they became accustomed to a more asynchronous written style of communication, carrying this over to their days working in the office.

Finally, we found no impact on WFH performance reviews or promotions overall or in any individual sub-group. Lines of code written by the treatment employees, another measure of employee productivity for IT engineers, rose by 8% compared to the control employees. Employees' self-assessed productivity impact of working from home was also positive, with an average post-experiment assessed impact of 1.8%. Taken together, this suggests perhaps a small, potentially positive impact of hybrid-WFH on productivity. This is important as the main criticism of hybrid-WFH has been its negative impact on productivity, which executives like Elon Musk at Tesla, Jamie Dimon at JP Morgan, and David Solomon at Goldman Sachs have noted when pushing for a full return to the office. The prior randomized control trial evidence on WFH has focused on call center employees, who, while easy to measure and evaluate, do not have much of a team or creative component in their job. In contrast, the Trip.com employees in this experiment are graduate employees working in teams and creating new products and services. So this small positive result in a large sample of 1612 employees is notable.

Once the 6-month experiment ended, the firm evaluated the data on performance, attrition, employee satisfaction, and communications and decided to roll the WFH policy out to the entire company at an executive meeting. This was announced on February 14th, 2022, and was immediately picked up by the Chinese media, with coverage in Reuters, South China Morning Post, US News, Yahoo and the Standard because working from home was exceedingly rare at that time in China. Since then, several other tech firms have been following this and considering adopting similar policies, although the March 2022 Shanghai lockdown has interrupted this process.

This paper connects to three strands of literature.

First, there is literature on the adoption and impact of working from home on firms and their employees. The closest papers are Bloom et al. (2014), who run a field experiment at cTrip.com[3] on 250 call-center workers, and Emanuel and Harrington (2021), who examine the call center of a large US firm. Both find positive productivity effects of working from home of around 10%, reduced attrition but negative promotion effects. The challenge with these papers is that call center employees are not really team workers or involved in creative tasks, so it is hard to extrapolate these findings to professional or

[3] cTrip.com purchased Trip.com, a smaller Singaporean travel agent, and adopted the name. So cTrip.com and trip.com are ostensibly the same firm.

managerial employees. Choudhury et al. (2019) study US Patent examiners who were allowed to work from anywhere, finding productivity rose by 4.4%, although they note that patent examiners, like call center workers, are in roles that do not require significant collaboration. Choudhury et al. (2022) study an NGO in Bangladesh, finding in an RCT that hybrid WFH is associated with higher levels of emails and increased productivity. Kunn et al. (2021) exploits natural variation in remote vs. in-person competitions in professional chess during the pandemic and find a negative impact of the remote activity, but again chess playing is not a team activity. Finally, Gibbs et al. (2022) examine graduate team employees in an Asian IT firm who shifted to working from home during the pandemic. They find large negative effects on productivity, although their result examines a shift from fully in-person to fully remote executed at speed at the onset of the pandemic without a control group, making these results hard to assess. As such, our study is, as far as we know, the only randomized evaluation of the impact of hybrid working-from-home.

A second piece of literature tries to evaluate the impact of working from home through self-assessed performance surveys. Etheridge et al. (2020) find that employees who work from home state they are about as productive as in the office. Barrero et al. (2021) report US employees to perceive about a 3% to 5% increase in productivity, while Aksoy et al. (2022) report slightly lower (but still positive) figures from 20 countries globally.

Finally, recent research examines the extent and incidence of WFH during the COVID pandemic and the outcomes associated with WFH. See, for example, Adams-Prassle et al. (2020), Althoff et al. (2020), Bartik et al. (2020), Bick et al. (2020), Brynjolfsson et al. (2020), Mongey et al. (2020) and Ozimek (2020). Bai et al (2021), Davis et al. (2021), Favilukis et al. (2020), Pagano et al. (2020), and Papanikolaou and Schmidt (2020) study the relationship between firm-level stock returns during the COVID pandemic and the capacity of their employees to work from home. Behrens et al. (2021) and Davis et al. (2022) offer general equilibrium analyses of WFH and its consequences, while Gupta et al. (2021) look at the impact of WFH on property markets, Liu and Su (2021) the impact of density via WFH on valuations and Delventhal et al. (2021) impacts on city structure. Like us, they stress that the effects of a shift to WFH are highly uneven across people and locations.

Section II discusses the experimental design, section III the impact of attrition and employee satisfaction, section IV the impact of messaging and communication, and section V the impact on performance evaluations, promotions, and productivity. Finally, section VI concludes.

II The Experiment

Our experiment took place at Trip.com, the third-largest global travel agent by sales in 2019 (after Expedia.com and Booking.com). Trip.com was established in 1999, was quoted on NASDAQ in 2003, and was worth about $20bn at the time of the experiment. It is headquartered in Shanghai with offices across China and internationally, accommodating its roughly 35,000 employees.

In the summer of 2021, Trip.com decided to evaluate hybrid WFH after seeing its popularity of this amongst US tech firms. The firm believed this could improve employee job satisfaction, reducing the costs of employee attrition and potentially improving productivity.

The key obstacle to implementing hybrid WFH was the concern of many managers that employees would underperform on their days at home. In addition, in 2021, no major Chinese firm was offering hybrid WFH, with total attendance at the office the norm. So Trip.com decided to formally evaluate a hybrid WFH system in two divisions over six months before making a decision over a full firm roll-out.

The first step took place on July 27th, 2021, when the firm surveyed all 1612 engineers, marketing and finance employees in the Airfare and IT divisions about the option of hybrid WFH. They chose these two divisions as representatives of the firm, with a mix of employee types to assess any potentially heterogeneous impacts. Just over 70% of the employees in these divisions are technical employees, writing software code for the website, and front-end or back-end operating systems. The remainder work in business development, so talking to airlines, travel agents, or vendors to develop new services and products, in market planning and executing advertising and marketing campaigns, and in business services, dealing with a range of financial, regulatory, and strategy issues. Across these groups, 24% were managers spanning employees across seven grade levels, from recent graduates to heads of the division. As such, this experimental population reflects a broad range of professional and managerial graduate jobs, with a sufficient sample size to meaningfully test variations across these groups.

The employees were sent an email (see Appendix A1) outlining how the 6-month experiment offered them the option (but not the obligation) to WFH on Wednesday and Friday. After the initial email and two follow-up reminders, a group of 518 employees volunteered. The firm randomized odd employees, those born on the 1st, 3rd, 5th, 7th, etc., to become eligible for the hybrid-WFH scheme starting on the week of the 9th of August.

Senior management at the firm was surprised at the low volunteer rate of the optional hybrid-WFH scheme. They suspected that many employees were hesitating because of concerns that volunteering would be seen as a negative signal of ambition and productivity.[4] So, on 6th September, all the remaining 1094 non-volunteer employees were told they were also included in the program. The odd birthday employees were again randomized into the hybrid WFH treatment and began the experiment on the week of 13th September.

Figure 1 shows some pictures of employees working in the office (left side) and employees working from home from October 2021 (right side). A few points are worth noting. First, in 2021 COVID incidence rates in Shanghai were extremely low, so employees were neither masked nor socially distanced at the office. So this office control baseline is comparable to a pre (or post) COVID situation in the US. Second, employees all worked in modern open-plan offices in desk groupings of four or six colleagues from the same team. In contrast, when working from home, they usually worked alone in their apartments, typically in the living room or kitchen. Figure 2 shows the overall office (on the left), highlighting this is a large modern building, similar to many large US and European corporate offices. The figure also shows an example floor-plan for part of the second floor, highlighting how entire teams tend to have their desks clustered together.

Table 1 shows the demographics of the 1612 experimental population broken out by volunteer and non-volunteer status. Overall we can see how these employees are typically in their mid-30s, about two-thirds are male, with all of them having a university undergraduate degree and almost one-third having a graduate degree (typically a master's degree). In addition, nearly half of the employees are married with

[4] This is not unreasonable. For example, Harrington and Emmanuel (2021) found in the US firm they evaluated that work-from-home employees were negatively selected on productivity.

children. The major differences between the volunteers and non-volunteers are in age, tenure, and managerial status – volunteers tend to be younger, less experienced, and non-managers with longer commutes. These differences are not surprising because managing employees remotely was seen as potentially challenging. Hence, employees with managerial roles were less keen on the scheme, and avoiding long commutes was a major rationale for WFH. Interestingly, volunteers and non-volunteers have the same performance scores, highlighting, at least in this case, the lack of any negative selection effects around WFH.

Figure 3 plots the take-up rates of WFH on Wednesday and Friday by volunteer and non-volunteer groups. We see a few notable facts. First, take-up overall was about 55% for volunteers and 40% for non-volunteers, indicating that both groups tended to WFH only one day, typically Friday, each week. At Trip.com, large meetings and product launches often happen mid-week, so Fridays are seen as a better day to work from home. Second, the take-up rate even for non-volunteers was 40%, indicating that Trip.com's suspicion that many employees did not volunteer out of fear of negative signaling was well-founded, and highlights how amenities like work-from-home, holiday, maternity, or paternity leave may need to be mandatory in order to ensure reasonable take-up rates. Third, take-up surged on Fridays before major holidays. Many employees returned to their hometowns,[5] using their WFH day to travel home on the quieter Thursday evening or Friday morning. Finally, take-up rates jumped for both treatment and control employees in late January 2022 after a COVID case in the Shanghai building. Trip.com allowed all employees at that point to WFH, so the experiment effectively ended early on Friday, 21st January.

Looking at take-up rates in Table 2 we see that, as expected employees with a longer commute and children are more likely to opt to WFH on Wednesday or Friday. In contrast, take-up is surprisingly flat across gender, age, and seniority (level).

Table 3 shows striking evidence of heavy coordination across employees within teams on work-from-home days. In column (1), we regress whether a treated individual works remotely on a Wednesday or Friday, conditional on the share of their team members working remotely on that day, finding a large, highly significant coefficient of 0.551. This indicates if an individual's whole team works from home on

[5] Most Shanghai employees who are not local are from neighboring provinces of Jiangsu and Zhejiang. And the Shanghai headquarter is right next to the bullet-train station. So some employees stopped renting expensive Shanghai apartments and just booked hotels nearby for two to three nights per week.

a particular day, they are 55% more like to do the same than if the entire team comes to work. In columns (2) to (5), we control for a range of fixed-effects, in particular date and individual fixed-effects to check if this correlation is being driven by individual events (like holidays when everyone works from home) or persistent differences across teams, finding very similar results. So this reveals remarkably strong coordination by teams to working from home on the same days. This matches the survey results from the US that employees' primary motivation for coming to work is to spend time with colleagues and co-workers (see Appendix figure A9), suggesting that hybrid-WFH works best when office and home days are coordinated. We see in the Trip.com experiment that teams are endogenously coordinating within the Wednesday-Friday schedule to have the same office and home days.

III Employee Attrition and Job Satisfaction

Perhaps the most important result for Trip.com was the substantial reduction in attrition rates seen in the treatment employees. Figure 4 shows this result, highlighting in the panel on the left how the 6-month attrition rate for the treatment group was 4.7% versus 7.2% for the control group, a 35% reduction in attrition. In the panel on the right, we break this impact of attrition down between the volunteer and non-volunteer groups and see the largest impact, with a 48% reduction in quit rates (9.6% vs. 5.0%) in the volunteer group. This is not particularly surprising given this group had initially volunteered for hybrid WFH so presumably had the strongest preference for WFH. Interestingly, the larger gap with respect to volunteering status comes from the higher quit rates in the control group rather than the lower quit rates in the treatment group, which is likely driven in part by the fact (as shown in Table 1) that the volunteers had lower tenure, less managerial roles, and longer commutes. This highlights how WFH can reduce employee attrition rates, particularly amongst groups with higher baseline levels of attrition.

Table 4 builds on the quit rate results to show that, based on an anonymous[6] firm survey, treatment employees are more likely to recommend the firm to friends, and have higher levels of work satisfaction, life satisfaction, and work-life balance than control employees. As we see in the 3rd row, this is particularly among the volunteer group. This is important given the increasing concerns for employee burnout in long-hours graduate jobs, with some commentators linking this to WFH. These results

[6] The survey was anonymous, although it is possible employees did not trust this. However, this potential lack of trust in an anonymous survey would likely be reasonably balanced across the treatment and control employees, so this would impact the constant but presumably not the treatment coefficient.

indicate that hybrid-WFH can potentially be a tool to help address employee issues around stress and excessive working hours. Finally, in column (5), we see that expected attrition, like actual attrition, is lower for the treatment group, particularly those who initially volunteered. Less attrition means a more stable workforce which can directly reduce training and hiring costs and indirectly boost productivity. According to the HR department of Trip.com, their internal calculation suggests losing an employee and finding a replacement amounts to 21% of the employee's annual salary.[7] These costs include, but are not limited to, the productivity loss from position vacancies, HR department's advertising, screening, and interviewing, training new employees, and the productivity loss from them still learning and not being fully productive.

IV Working Patterns

IV.A Working Hours

The experiment also changed working hours and patterns. US surveys find the primary reported benefit of working from home is reduced commuting, with the second reported benefit increased work schedule flexibility (see Appendix Figure A10). Consistent with this, treatment employees from Trip.com reported an improved ability to flex their hours when working from home, such as visiting the dentist, spending time with their children, or performing chores.

This greater flexibility when working from home shows up in Table 5 in terms of time-shifting from WFH days to other days. In the top panel, we see that treatment employees have a significant increase in their Virtual Private Network (VPN) time, which is required by employees to access company servers from home. This occurs both on their WFH days of Wednesday and Friday and on all other weekdays and the weekend. This suggests treatment employees increased working time from home even on office days and weekends. On the lower panel, we look at time in the office and notice this falls on Wednesdays and Fridays for treatment employees since they frequently work from home. This also falls somewhat on Thursdays when they are slightly more likely to take the next day off (see appendix table A8), but it is unchanged on all other days. Figure 5 left-panel shows this increase in VPN use on office days and weekends, while the right-panel shows the increase in messaging outside of core working hours. This

[7] Similarly, Linkedin sources have a 25% estimate of the costs of losing an employee in terms of their annual salary: https://www.linkedin.com/pulse/actual-cost-employee-turnover-shyambahadur-prajapati/

mirrors the results form McDermott and Hansen (2021) showing an increase in GitHub event activity outside regular hours and on weekends during the pandemic. Collectively, these suggest that WFH spreads work outside of the core 9am-5pm Monday to Friday period into evenings and weekends.

In quantitative terms we see that on Wednesday and Friday, treatment employees reduced their office time by a total of 5.6 hours (2.634+2.998) but increased their VPN time by a total of 3.2 hours (1.56+1.63). Applying the 0.75 ratio of VPN time/working time implies a total increase at the home of 4.3 hours from this additional VPN time.[8] So WFH employees work about 1.3 hours (5.6-4.3) less on Wednesday and Friday. In contrast, on all other days, they have a net reduction in office time of -0.2 hours and an increase in VPN time of 0.5 hours, which applying the VPN/working time ratio implies a net increase of 0.5 hours of total working time. Given treatment employees typically WFH one day a week (the 0.46 average take-up rate in Figure 1), we can infer they had about a 1.3 hour reduction in working time on WFH days offset by about 0.5 hours more work on all other days combined.

This shows some clear substitution of working time across days, in that employees work more than an hour less on WFH days but appear to (in part) make up for this on other days. Interestingly, although treatment employees appear to work about 0.8 hours less a week, given their similar performance and promotion results and increased coding output, they likely work more efficiently per hour. This would be consistent with the results of higher WFH working intensity in the Bloom et al. (2014) paper, where employees working at home had a higher output per minute and took fewer breaks within their working day.

Finally, we also see in Table 6 top-panel shifts in the days of work, with a significant 0.879% reduction in the number of non-working days from sick-leave, holidays, and absences within the treatment group. With about 250 working days a year, this translates into about two days fewer non-working days. This is entirely driven by reductions in sick-leave and holidays on Wednesdays and Fridays. This highlights, as employees mentioned in interviews, that when they WFH, they are often able to continue working if they have a mild illness or some childcare issue or need to be home (for example, to overseas a delivery or domestic repair) but could not come into the office. As such, WFH can increase daily labor supply,

[8] We surveyed 107 employees about VPN use and found this is used on average 75% of the time when working from home. So 1 hour of VPN time at home implies 1/0.75 hours (1 hour and 20 minutes) of additional working time.

particularly for employees who are the primary carers of young children (indeed, as we see in Appendix Table A8, employees with children have about a 25% greater reduction in non-working days on Wednesday and Friday).

In Table 6 lower-panel, we see how business trips – visits to supplies, customers, or other external contacts – fell dramatically on WFH days, particularly Fridays, but rose on the in-office days. Hence, the total weekly number of business trips remained unchanged. As such, the common pattern of WFH on Monday and Friday in US firms could increase the peak-loading of business travel onto Tuesday to Thursday.

IV.A Communications

Employees in Trip.com use verbal communications frequently in the office, given the open-plan nature of the building, as shown in Figures 1 and 2. They also commonly use three modes of written communication: email for formal, more extensive communications, like team or firm-level reminders and notifications; WeChat for personal social messaging between individuals to discuss social issues, such as lunch or weekend plans; and finally TripPal internal messaging for higher-frequency, less formal messaging typically between individual employees about various work issues (code, client, or business questions). We have the data for this TripPal communication in terms of the message sender and recipients alongside an hour stamp, so we can use this to evaluate the impact of remote working on messaging.

Perhaps unsurprisingly, the treatment employees saw a significant increase in their use of messaging of 14.1%, as highlighted in Table 7 (and shown by hour in Appendix Figure A2). As expected, this has the largest increase on the Wednesday and Friday working from home days, with rises of 14.7% and 20.8%, respectively. More notably, this messaging also increases on all other days by 10% or more, including by 12.1% on Tuesday. The Tuesday increase is the most striking as treatment employees have been working in the office the previous day (Monday), so this is not a conversation carrying over from the previous day. This is possibly conversations carrying on from the prior Friday, but from talking to employees, it is very rare for a TripPal message conversation to carry over from Friday, across the weekend, across Monday, and into the following Tuesday. Instead, the main driver is treatment employees starting to increase their overall level of messaging even in the office. For example, treatment

employees reported in discussions that if they had to ask a simple question about coding, a product, or a customer, they were now more likely to do this by message rather than in person. As we see in Appendix figure A3, this increase in messaging by treatment employees also happened rapidly, with no trend across the experiment. Hence, the change in behavior was immediate and persistent.

Figure 6 shows how this leads to more messaging by treatment employees by hour throughout the day. This figure breaks this out both by the treatment/control status of the sender and also the recipient. We see, first, that treatment employees both send and receive more messages overall, and second, that this is particularly between treatment employee pairs. This highlights this change in communications, in that treatment employees became more comfortable messaging on their work from home days, carrying this over into office days.

Table 8 highlights a related phenomenon with remote working, which is that treatment employees increased their messaging most towards team members (an increase of 21.4% for team members vs. 14.2% for non-team members) and towards close contacts (28.7% for close contacts vs. 8.7% for non-close contacts), where "close contact" is defined as co-workers they have messaged 5+ different days in the 3 months before the experiment. This highlights the silo concern of Yang et al. (2021) that WFH tends to encourage communication with individual's current contacts at the expense of making new contacts. In our experiment, we see messaging both within and across teams and new contacts increases, but the increase is notably higher for messaging to team members and pre-existing contacts.

Hence, in summary, working from home leads to increased messaging both at home and in the office, particularly between treatment pairs. This increase in messaging is greatest for team members and existing close contacts suggesting hybrid-WFH may lead to some mild silo-effect for individuals, highlighting the importance of the office days for employees to network and build up weaker ties.

V Employee Performance and Productivity

A key question for Trip.com was the impact of hybrid working from home on employee performance. To assess that, we use two measures of performance – their six-month performance reviews for the

second half of 2021, and their promotion rates. We also have data on lines of code written for 729 of the experimental employees whose primary job is coding.

Starting with performance reviews, these are extremely important within Trip.com as they determine employees' pay and career progression, so they are taken seriously. The review process for each employee is built on formal reviews provided by their managers, co-workers, direct reports, and if appropriate, customers (external or internal). They are reviewed by employees, collated by HR and managers, then discussed between the manager and employee. This lengthy process takes more than four weeks, providing a well-grounded measure of employee performance. And while these are not perfect, given their tight link to pay and career development, both managers and employees put large amounts of time and effort into these to make them informative measures of overall performance. The promotion data measures two types of promotion – a minor promotion which keeps the title but involves an additional pay increase, and a major promotion, which involves a change of title and position. For regression purposes, we code a minor promotion as "1" and a major promotion as a "2" but results show a similar null result for each examined individually.

Table 9 shows the key result from these performance reviews and promotion regressions. There is no significant or material difference between treatment and control employees overall (or by grade as shown in Appendix Figure A7). This holds in the overall sample, and for all the obvious sub-splits we did, as shown in Appendix Figures A5 and A6, where we interacted treatment with a range of measures including their manager also being in treatment, volunteer status, tenure, commute length, gender, children, messages sent and business function. In all cases, the results are almost always insignificant, and even if they are individually significant for performance reviews or promotions, they are never significant for both for the same interaction. Hence, we conclude there is no robust overall or sub-group impact of WFH on 6-month performance or promotion outcomes in the experiment.

In Table 9, we also check for spillovers within teams: could having more treatment co-workers impact individual performance. To investigate this, in columns (2) and (5), we include the share of the rest of the team in the treatment and find no significant results, and in columns (3) and (6) interact having 1+

team member in treatment (since this could shift the team to having more zoom meetings if at least one team member is at home on Wednesdays or Fridays)[9] and again find no difference.

In Table 10, we turn to lines of code written, another measure of output for computer coders. Lines of code is certainly not a perfect measure of performance,[10] but it is one of many indicators Trip.com follows internally, suggesting it provides some signal on employee's output. We find lines of code rises by about 8% for treatment employees in column (1), which is robust to adding date fixed-effects as shown in column (2). Columns (3) and (4) break this down by WFH days and non-WFH days, and we see the results are somewhat larger on the non-WFH days. This is perhaps surprising but is consistent with the data on working patterns in section IV as we know WFH employees tend to reduce hours on their home days and make up on their office days and the weekend. So on net treatment employees are writing more code across the week, with most of this uplift arising in their days in the office.

Finally, as we show in Figure 7, the employees' average belief when polled at baseline was that hybrid-WFH would have no impact on productivity, with a mean belief of 0.1%.[11] However, at the endline, this had shifted significantly positively to 1.8%, with the biggest increase in the non-volunteers who shifted from being strongly negative overall at -2.3% to effectively zero at 0.4%, while the volunteers moderated a little downward from +4% to +3.6%. This highlights how ex-ante employees appear to have diverse opinions of working from home, but this moderates and becomes more positive with experience. Interestingly, both treatment and control employees saw a similar increase in opinions, suggesting personal experience is not necessary if individuals are in close contact with co-workers who are working from home. This indicates the experience of working from home leads employees to update on the experience, consistent with the aggregate evidence of a positive society-wide update on WFH after the pandemic.[12] Moreover, when employees from four other divisions in Trip.com were polled about the

[9] Indeed, as we show in Appendix Figure A4, there was a large increase in zoom meetings across the two experimental divisions in Trip.com, driven mainly by a rise in zoom meetings on Wednesday and Friday.
[10] See, for example, the Wikipedia discussion here https://en.wikipedia.org/wiki/Source_lines_of_code
[11] Employees were asked "What is your expectation for the impact of hybrid working from home on the productivity at work, with three options of [positive], [about the same], or [negative]. Respondees that chose positive were then offered a set of options asking about how positive ranging from 5% to 15% to 35% or more, and similarly so for negative choices. For aggregate impacts we take the mid-points of each bin and 45% for >35% and -45% for <-35%.
[12] See Aksoy et al. (2022) for evidence of positive updates of employees on the productivity impact of working from home in 20 countries, including China.

productivity impact of hybrid-WFH after the end of the experiment in March 2022 the mean estimate was a similar +2.8% (on a sample of 3461 responses).

So in conclusion, we find that hybrid working from home appears to have a small and potentially positive impact on employee productivity. Two indicators (performance reviews and promotions) show no impact, while two others (lines of code and self-assessed productivity impact) show a positive impact. While this result is somewhat inconclusive, it does rule out the large negative impacts on performance some of the detractors of working from home have claimed in public statements. These mixed results also highlight the importance of careful measures of multiple performance indicators in large samples with a causal research design. These effects are potentially small in aggregate, noisy at an individual level, and in non-experimental studies correlated with other factors like the need to socially distance.

VI Conclusions

This paper evaluates a large, randomized control trial on 1612 engineers, marketing and finance employees of a multinational technology firm that allowed odd birthday employees to WFH on Wednesday and Friday and kept even birthday employees full-time in the office. There are four key results. First, WFH reduced attrition rates by 35% and improved self-reported work satisfaction scores, highlighting how employees place a large value on this amenity. Second, WFH reduced hours worked on home days but increased it on other work days and the weekend, highlighting how home-working alters the structure of the working week. Third, WFH employees increased individual messaging and group video call communication, even when in the office, reflecting the impact of remote work on modes of communication. Finally, while there was no impact of WFH on performance ratings or promotions, lines of code and employees' self-assessed productivity increased, suggesting a small and potentially positive impact on performance.

Given the benefits of increased retention and job satisfaction, once the 6-month experiment ended, the technology firm rolled out the hybrid WFH scheme to the entire company. Indeed, this positive impact was so evident within the firm that in the survey endline experiment, 54% of employees thought that the firm would stick with hybrid-WFH (40% were unsure, and 6% thought it would not), despite this being

unusual in the Chinese labor market at that time. We continue to collect data and will evaluate the longer-run impact of this experiment.

Overall this highlights how hybrid-WFH is often beneficial for both employees and firms but is usually underappreciated in advance. This was a common experience in the US and Europe during the pandemic when WFH went from being rare to mainstream and is now a permanent feature for most graduate employees.

VI Bibliography

Adams-Prassl, Abi, Teodora Boneva, Marta Golin, and Christopher Rauh. 2020 "Inequality in the Impact of the Coronavirus Shock: Evidence from Real Time Surveys." CEPR Discussion Paper 14665.

Aksoy, Cevat, Jose Barrero, Nicholas Bloom, Steven Davis, Mathias Dolls and Pablo Zarate, 2022, "Working from home around the world", EBRD mimeo.

Althoff, L., Eckert, F., Ganapati, S., and Walsh, C. (2020). The City Paradox: Skilled Services and Remote Work. CESifo Working Paper No. 8734

Bai, J., Brynjolfsson, E., Jin, W., Steffen, S., and Wan, C. (2021). Digital Resilience: How Work-From-Home Feasibility Affects Firm Performance. NBER Working Paper

Barrero, Jose Maria, Nicholas Bloom, and Steven J. Davis, 2020. "60 Million Fewer Commuting Hours per Day: How Americans Use Time Saved by Working from Home," *VoxEU CEPR Policy Portal,* 23 September.

Barrero, Jose Maria, Nicholas Bloom, and Steven J. Davis, 2021, "Why working from home will stick", NBER Working Paper

Bartik, Alexander W., Zoe B. Cullen, Edward L. Glaeser, Michael Luca, and Christopher T. Stanton, 2020. "What Jobs are Being Done at Home During the Covid-19 Crisis? Evidence from Firm-Level Surveys," NBER Working Paper No. 27422.

Behrens, Kristian, Sergey Kichko, Jackques-Francois Thisse, 2021. "Working from Home: Too Much of a Good Thing?" CESifo Working Paper No. 8831.

Bick, Alexander, Adam Blandin, and Karel Mertens, 2020. "Work from Home After the COVID-19 Outbreak," Federal Reserve Bank of Dallas Working Paper.

Bloom, Nicholas, James Liang, John Roberts, and Zhichun Jenny Ying, 2015. "Does working from home work? Evidence from a Chinese experiment," *Quarterly Journal of Economics*, 130, no. 1, 165-218.

Brynjolfsson, Erik, John J. Horton, Adam Ozimek, Daniel Rock, Garima Sharma, and Hong-Yi TuYe, 2020. "COVID-19 and Remote Work: An Early Look at US Data," NBER Working Paper No. 27344.

Brynjolfsson, Erik, John J. Horton, Christos Makridis, Alex Mas, Adam Ozimek, Daniel Rock and Hong-Yi TuYe, 2022. "How Many Americans Work Remotely?" Stanford DEL Working Paper

Choudhury, Prithwiraj, Cirrus Foroughi, and Barbara Zepp Larson, (2021). "Work-from-anywhere: The productivity effects of geographic flexibility," *Strategic Management Journal,* 42, no. 4, 655-683.

Choudhury, P., Khanna, T., Makridis, C. A., and Schirmann, K. (2022). “Is hybrid work the best of both worlds? Evidence from a field experiment”. Harvard mimeo.

Davis, Morris, Ghent, Andra and Jesse Gregory (2022), “The work-from-home technology boom and its consequences”, NBER working paper 28461

Davis, Steven J., Stephen Hansen, and Cristhian Seminario-Amez, 2021. "Firm-Level Risk Exposures and Stock Returns in the Wake of COVID-19," NBER Working Paper 27867.

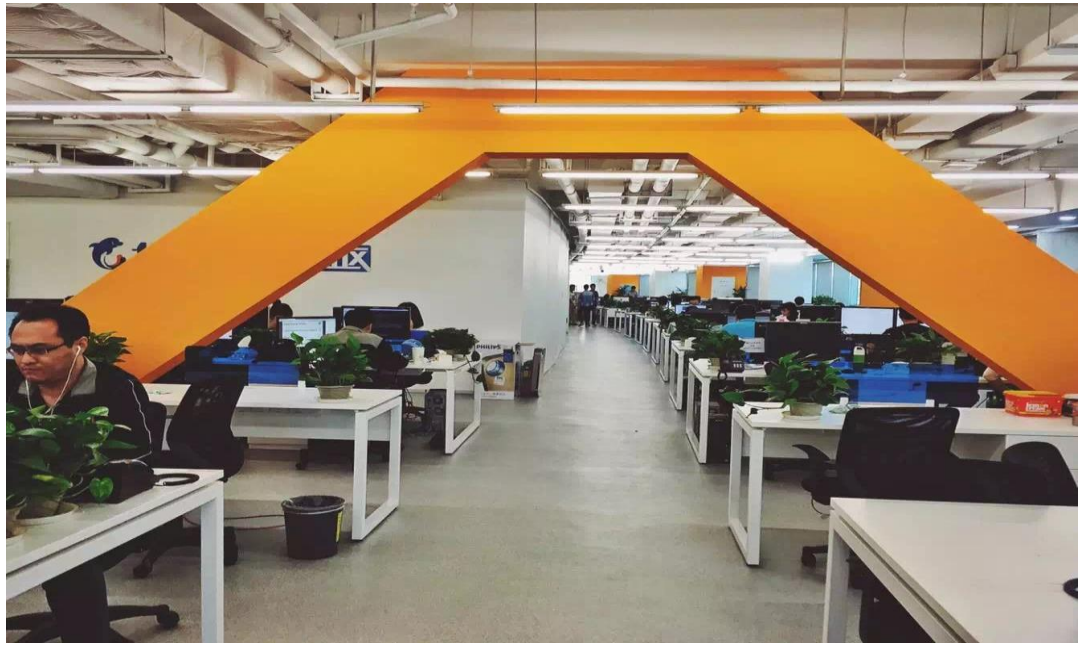
Delventhal, Matt, Eunjee Kwon, and Andrii Parkhomenko, (2021), How Do Cities Change When We Work from Home?, Working Paper.

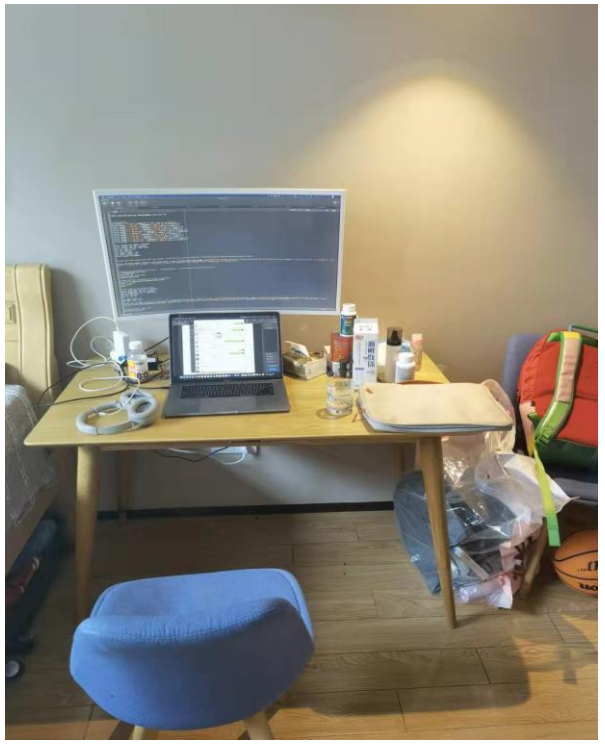
Emanuel, Natalia and Emma Harrington, 2021, " 'Working' remotely? Selection, treatment and the market provision of remote work," working paper, 9 April.

Etheridge, B., Y. Wang, and L. Tang (2020): "Worker Productivity during Lockdown and Working from Home: Evidence from Self-Reports," Covid Economics, 52, 118–151.

Favilukis, Jack, Xiaoji Lin, Ali Sharifkhan and Xiaofei Zhao, 2020. "Labor Force Telework Flexibility and Asset Prices: Evidence from the COVID-19 Pandemic," working paper.
Kunn, S., C. Seel, and D. Zegners (2021): "Cognitive Performance in Remote Work - Evidence from Professional Chess," Economic Journal.
Gibbs, Michael, Friederike Mengel and Christoph Siemroth, (2022), "Work from home and productivity: evidence from personnel and analytics data on IT professionals", *Journal of Political Economy Micro*.
Gupta, Arpit, Mittal, Vrinda, Peeters, Jonas and Stijn Van Nieuwerburgh, (2021), "Flattening the curve: Pandemic-Induced Revaluation of Urban Real Estate", NBER working paper.
Liu, Sitian, and Yichen Su, 2021, The Impact of the COVID-19 Pandemic on the Demand for Density: Evidence from the U.S. Housing Market, Working paper.
Maestas, Nicole, Kathleen Mullen, David Powell, Til von Wacher and Jeffrey Wenger, 2018, "The value of working conditions in the United States and implications for the structure of wages", NBER Working paper 25204.
Makridis, C. A. and Schloetzer, J. (2022). Does Working from Home Increase Job Satisfaction and Retention? Evidence from the COVID-19 Pandemic. SSRN working paper
Mas, Alexandre and Amanda Pallais, "Valuing alternative work arrangements," American Economic Review, 2017, 107, no. 12, 3722–59
Mas, Alexander and Amanda Pallais, 2018, "Alternative Work Arrangements," *Annual Review of Economics*, 12, 631-658.
McDermott, Grant and Benjamin Hansen, (2021), "Labor reallocation and remote work during COVID-19: real-time evidence from GitHub", NBER WP 29598
Mongey, Simon, Laura Pilossoph, and Alex Weinberg. 2020. "Which Workers Bear the Burden of Social Distancing Policies?" NBER Working Paper 27085.
Ozimek, Adam, 2020. "The future of remote work," SSRN Working Paper.
Pabilonia, Sabrina Wulff & Victoria Vernon (2021) Telework and time use. Handbook of Labor, Human Resources and Population Economics. Ed. Klaus F. Zimmerman. Springer Nature. Forthcoming.
Pagano, Marco, Christian Wagner and Josef Zechner, 2020. "Disaster Resilience and Asset Prices," working paper.
Papanikolaou, Dimitris, and Lawrence D. W. Schmidt. 2020. "Working Remotely and the Supply-side Impact of Covid-19." NBER Working Paper 27330.
Teodorovicz, Thomaz, Raffaella Sadun, Andrew Kun and Orit Shaer, 2022, "How does working from home during the COVID-19 affect what managers do? Evidence from time-use studies", Center for Economic Performance Discussion Paper 1844.

Figure 1: Office and Home (October 2021)





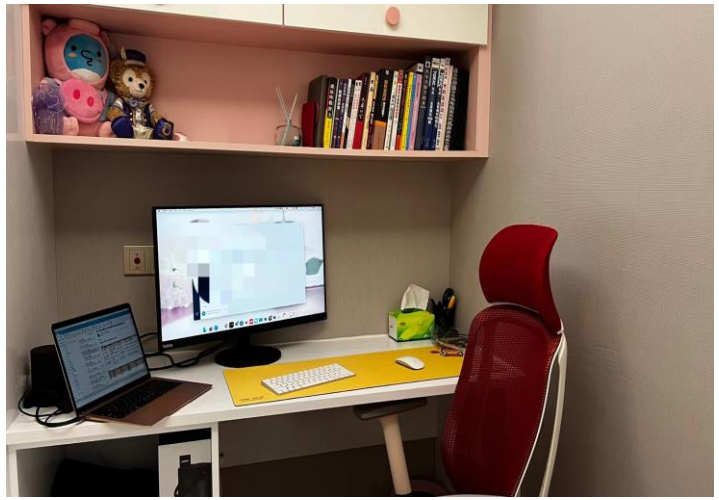


Figure 2: Trip.com has a modern office with teams usually located together

Trip.com headquarter building in Shanghai (top) and part of its floor plan (right)

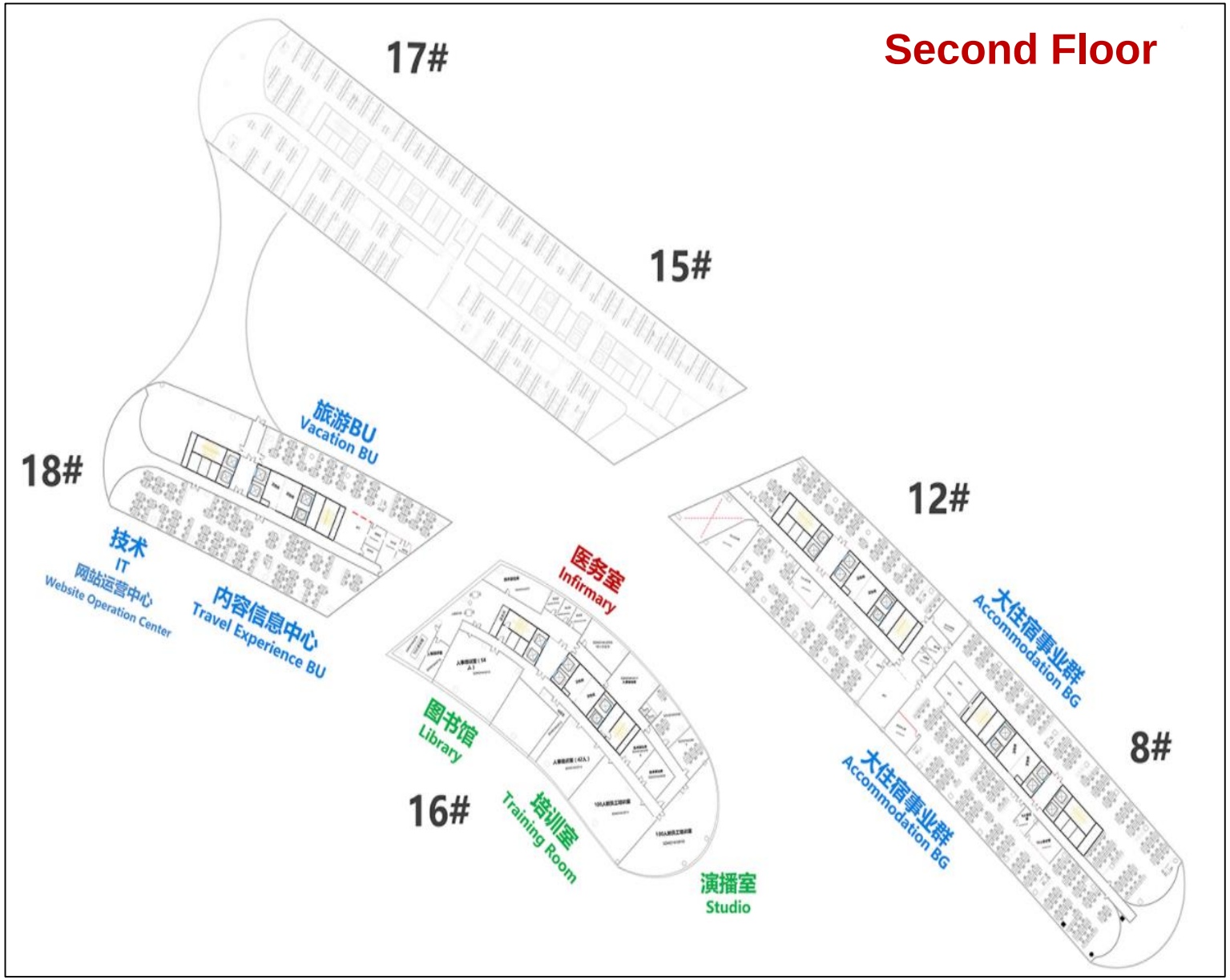
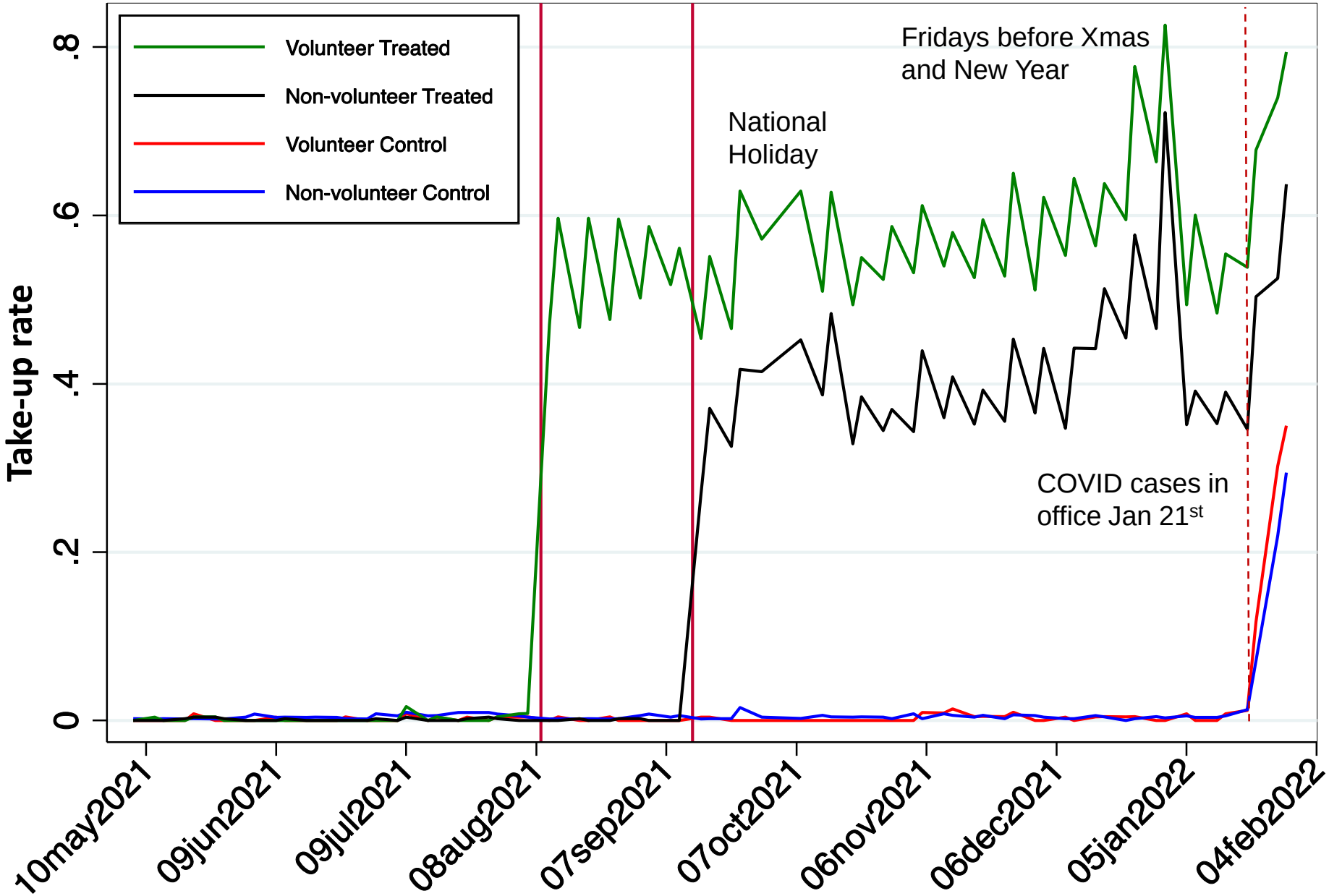


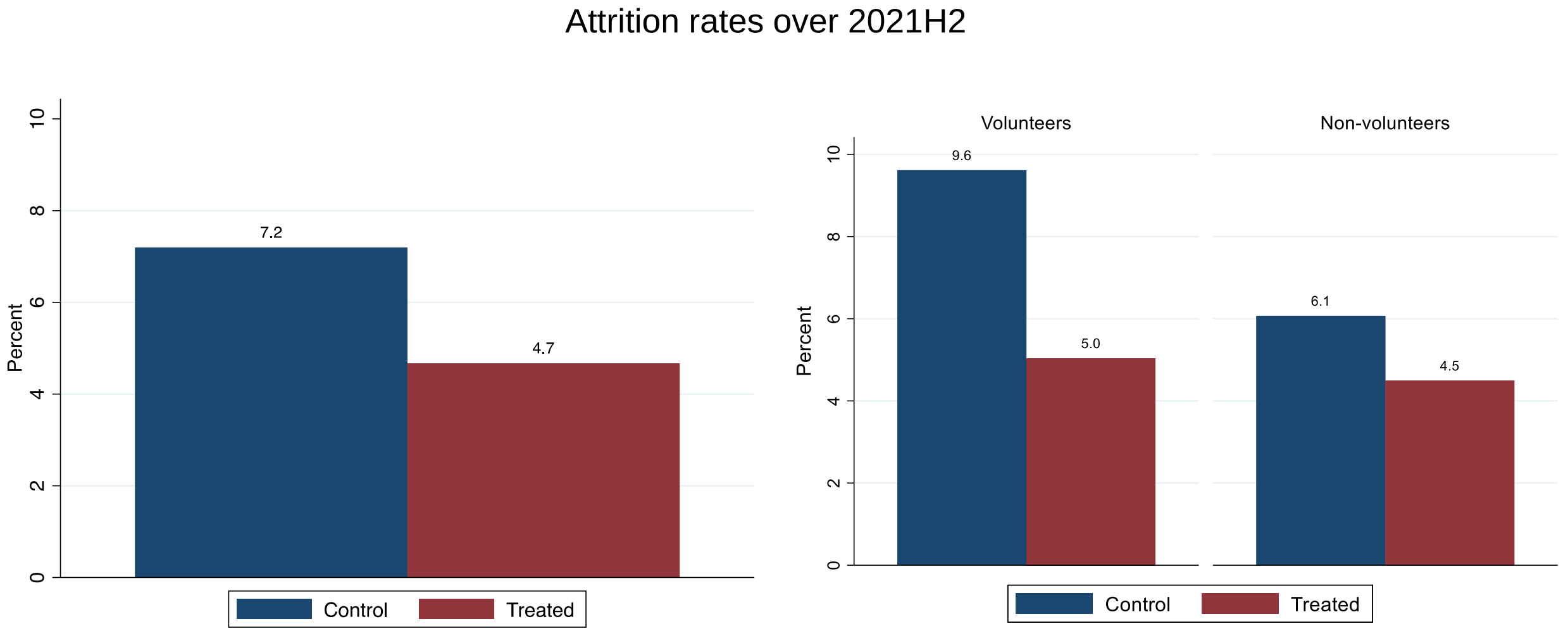
Figure 3: Take-up rate for treatment and control by volunteer status



Notes: for 1612 employees from August 9th 2021 (volunteers) and September 13th (non-volunteers) to January 23rd 2022.

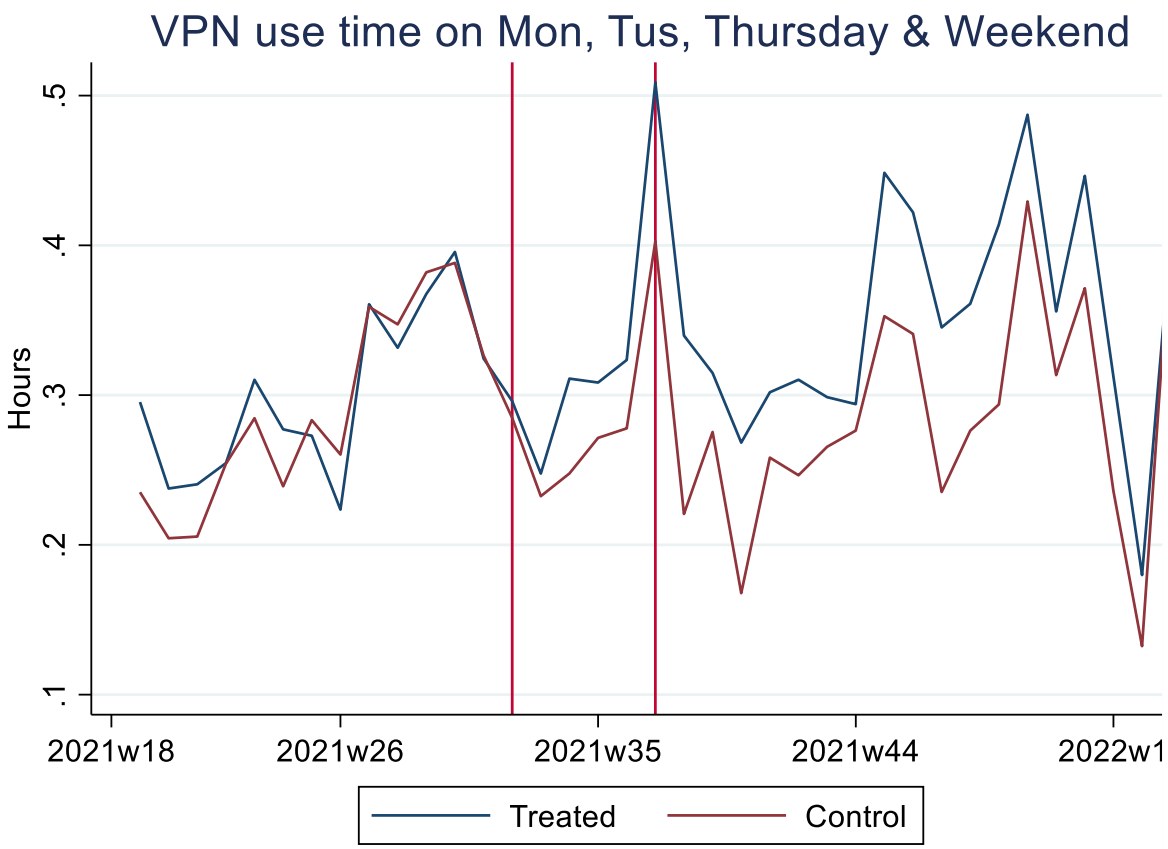
Public holidays, personal holidays and excused absence (e.g. sick leave) excluded. Take-up rate is percentage of Wednesday & Friday each week they WFH.

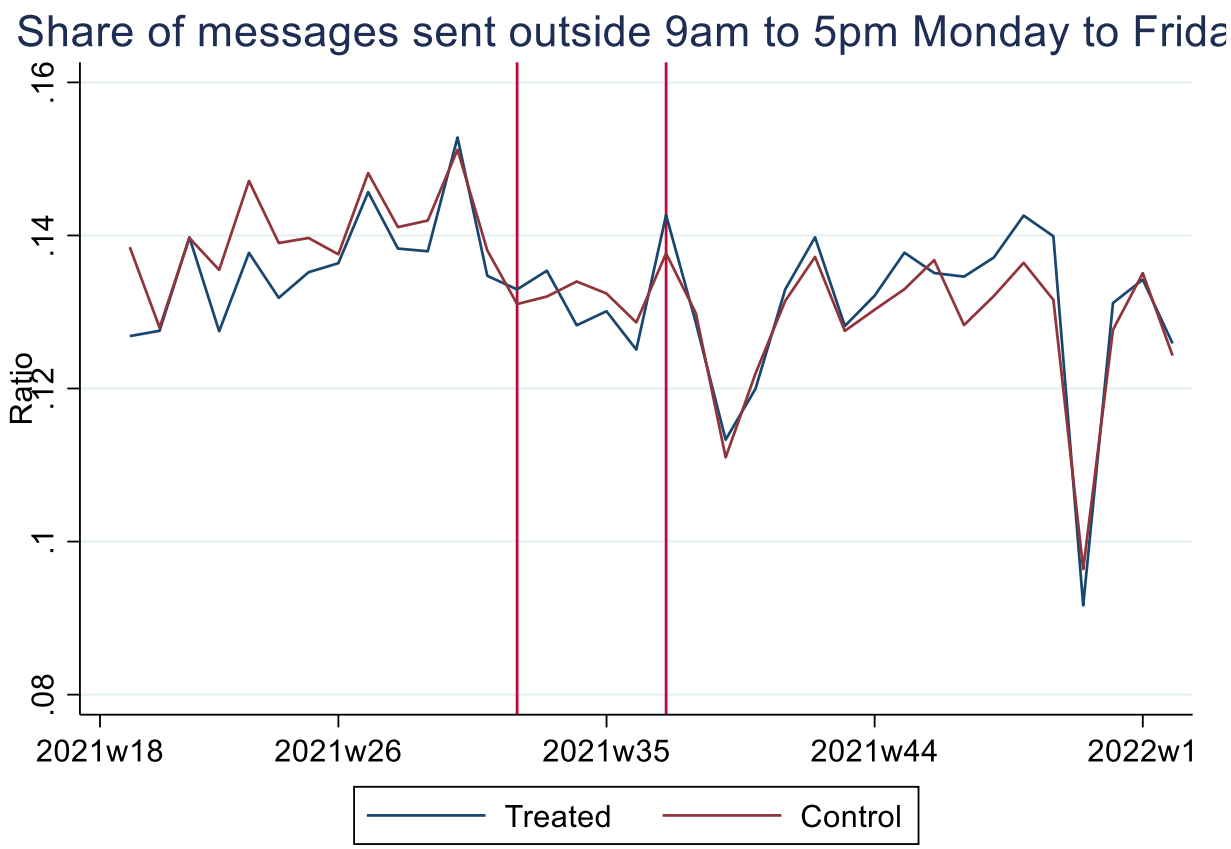
Figure 4: Attrition fell 35% in the treatment group (7.2% vs 4.7%), with the drop largest in the volunteer group (those who most want to WFH)



Notes: Results from 1612 employees. Difference significant at 5% in the overall attrition rate with a point-estimate (standard error) of -0.025 (.0117).

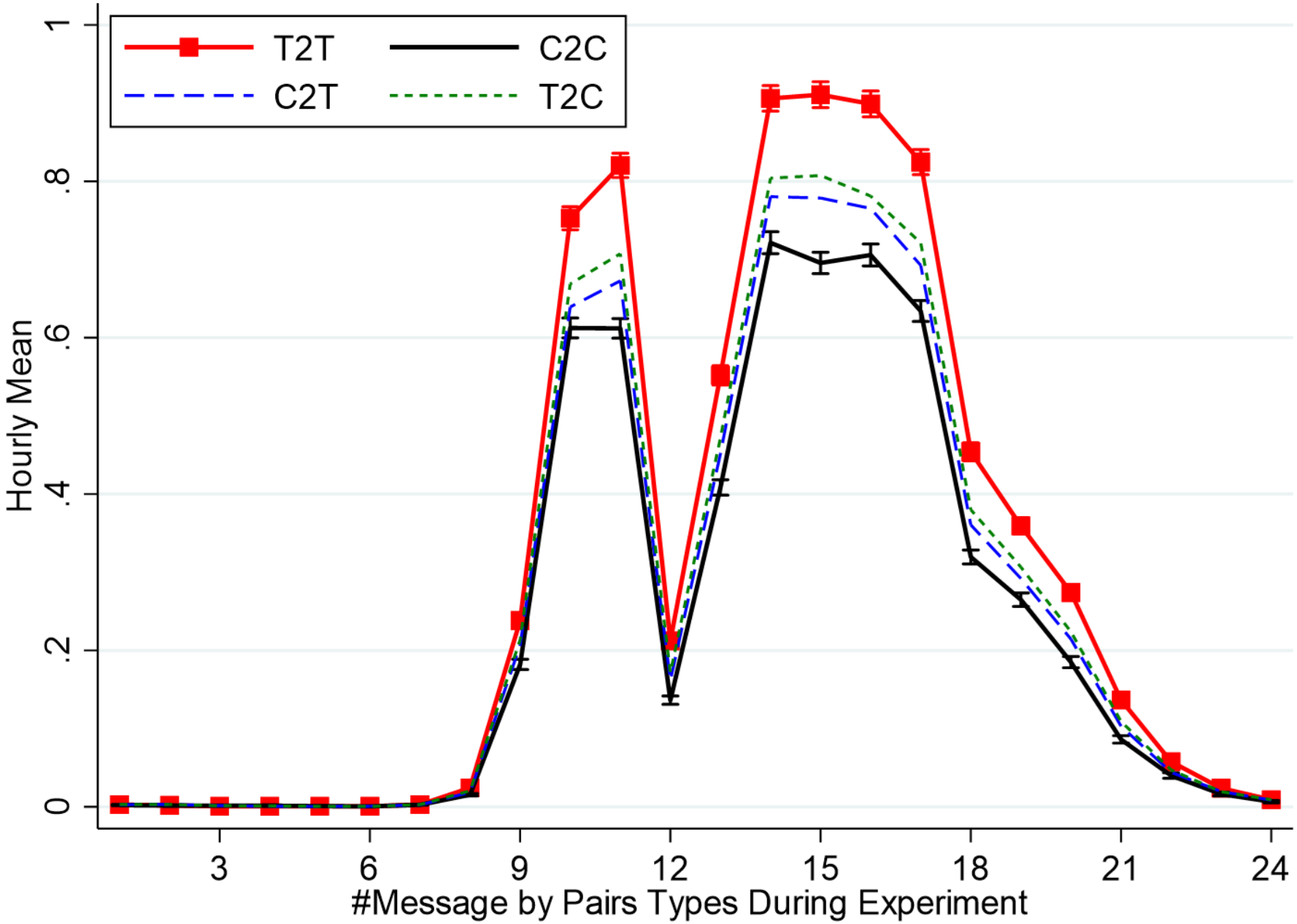
Figure 5: Treatment employees have 6.6% greater VPN use and 1.7% more messages outside regular hours





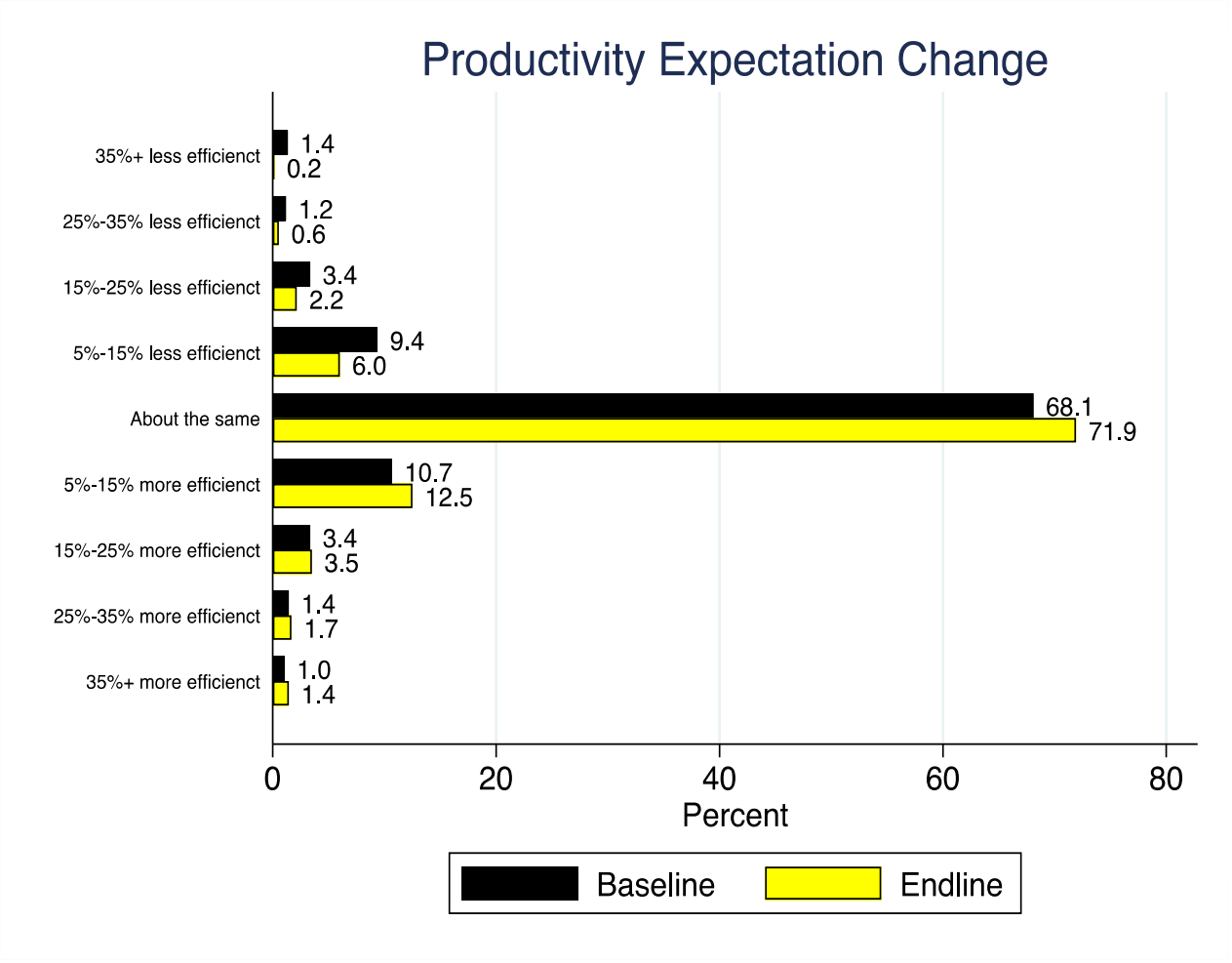
Notes: Weekly plot from May 10th 2021 to January 23rd 2022 for 1612 employees. Differences significant at the 5% level for both share of messages and VPN use between treatment and control.

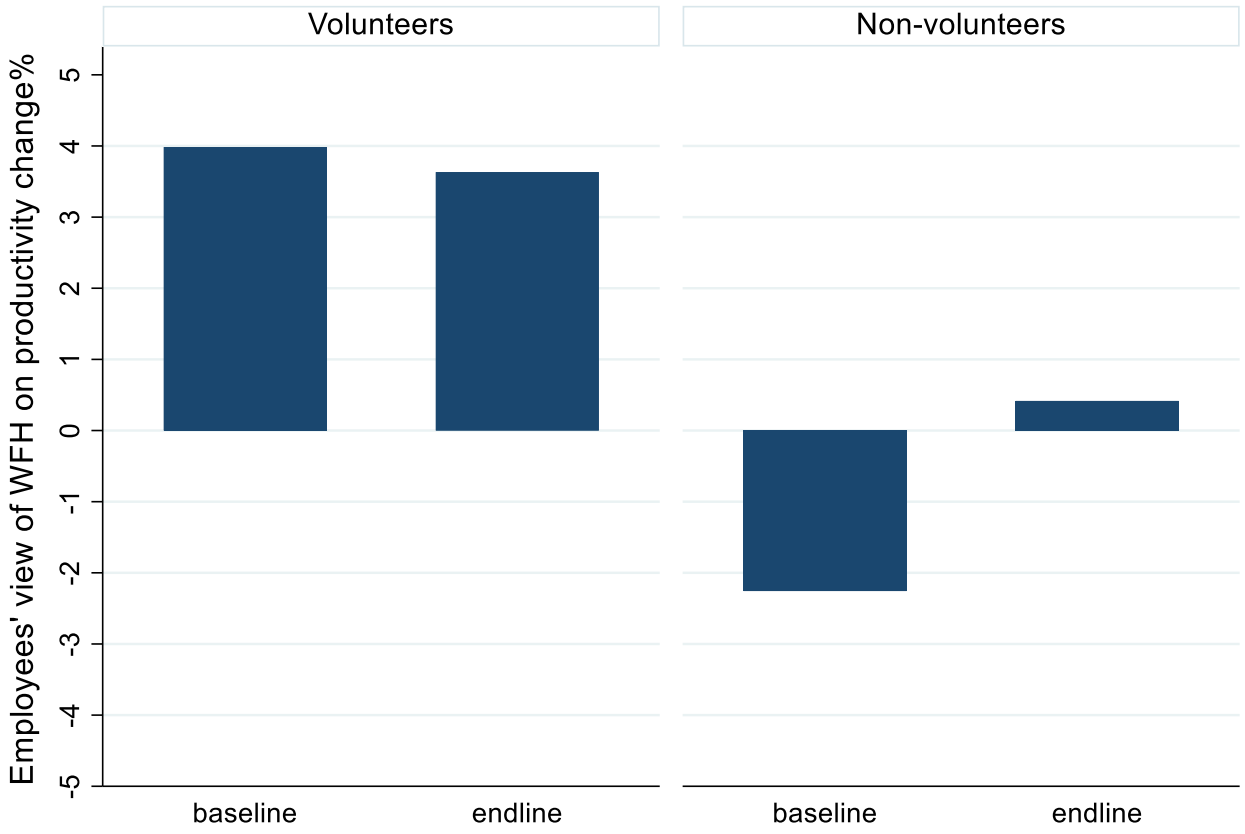
Figure 6: Treatment employees message each other more than control employees



Notes: Data for 1612 employees from August 9th 2021 (volunteers) and September 13th (non-volunteers) to January 23rd 2022. Monday to Friday combined data. Here "T2T" means messages sent from treatment to treatment employees, "C2C" means messages from control to control employees, "C2T" means messages from control to treatment employees, and "T2C" mean messages from treatment to control employees.

Figure 7: Employees views on the productivity impact of WFH increased from 0.1% at baseline to 1.8% at endline, rising most among non-volunteers





Notes: Sample from 1315 employees (463 volunteers, 852 non-v) on baseline, 1345 employees (446 volunteers, 899 non-v) on the endline.

Table 1: Descriptive statistics with volunteer vs non-volunteer breakdown

	(1) Volunteer	(2) Non-volunteer	(3) p-value of the difference
Number	518	1094	
Prior performance (1-5)	3.76	3.73	0.534
Age	32.0	32.9	0.001
Male	.681	.630	0.040
Tenure (months)	63.7	82.1	0.000
Married	.488	.518	0.263
Children	.459	.485	0.331
Level (1-7)	4.71	4.80	0.114
Grad School	.336	.318	0.478
Managerial Role	.167	.281	0.000
Commute Time (mins)	107	95.7	0.000

Notes: Sample of 1612 employees.

Table 2: WFH take-up rates

Y:Daily WFH Take-up	(1)	(2)	(3)	(4)	(5)	(6)
Treat	0.456***	0.460***	0.457***	0.457***	0.457***	0.461***
	(0.0116)	(0.0115)	(0.0114)	(0.0114)	(0.0114)	(0.0115)
Male		-0.00164	0.000151	0.00216	0.00197	-0.00000744
		(0.0132)	(0.0131)	(0.0134)	(0.0134)	(0.0134)
Age		0.00141	0.00155	0.00128	0.00128	0.000921
		(0.00141)	(0.00140)	(0.00193)	(0.00193)	(0.00192)
Married		-0.0314	-0.0339*	-0.0333	-0.0331	-0.0286
		(0.0212)	(0.0203)	(0.0203)	(0.0203)	(0.0202)
Children		0.0565***	0.0491**	0.0487**	0.0486**	0.0466**
		(0.0207)	(0.0200)	(0.0200)	(0.0200)	(0.0199)
Commute			0.0361***	0.0358***	0.0358***	0.0356***
			(0.00773)	(0.00778)	(0.00777)	(0.00774)
Level				-0.00267	-0.00293	-0.00449
				(0.00650)	(0.00651)	(0.00650)
Tenure				0.00106	0.00107	0.00121
				(0.00185)	(0.00185)	(0.00184)
Team Treated Share					0.0106	0.0106
					(0.0209)	(0.0210)
Treat Manager					-0.00116	-0.000195
					(0.0118)	(0.0118)
Messages						-0.0135***
						(0.00505)

Notes: Number of observations is 62169, where an observation is person-day (only WFH permissible Wednesday and Fridays). Age is measured in years, commute in hours, level from 1 (most junior) to 7 (most senior), team treated is a share from 0 to 1, and messages is messages per hour. All others are binary definitions. Data from August 9th to January 23rd for 1612 employees.

Table 3: Strong team-level coordination of WFH days

Y: WFH	(1)	(2)	(3)	(4)	(5)
Team WFH Share	.551***	.526***	.439***	.423***	.327***
	(.0333)	(.0362)	(.0388)	(.0390)	(.0302)
Manager WFH				.0858***	.0677***
				(.0193)	(.0107)
Date FE		Y	Y	Y	Y
Building*Floor FE			Y	Y	.
Individual FE					Y
Mean WFH	0.478	0.478	0.478	0.478	0.478
N (person*day)	25638	25638	25638	25638	25638

Notes: Team WFH% are calculated using colleagues who are participants in the experiment, leave oneself out. Data for 1612 employees from August 9th 2021 (1st wave) and September 13th (2nd wave) to January 23rd 2022. In column (5) Building*Floor fixed effects are subsumed by the individual fixed effects.

Table 4: Job satisfaction survey measures improved for treatment employees, especially those that volunteered to WFH

	(1) Recommend to friends	(2) Work satisfaction	(3) Life satisfy satisfaction	(4) Work-life balance	(5) Expected attrition
Treat	0.143	0.190*	0.223*	0.408***	-0.0185*
	(0.116)	(0.0984)	(0.118)	(0.135)	(0.0105)
Volunteer	-0.379**	-0.311**	-0.151	-0.114	-0.0599***
	(0.170)	(0.144)	(0.154)	(0.175)	(0.0141)
Treat*volunteer	0.634***	0.491***	0.384*	0.387	-0.0120
	(0.219)	(0.187)	(0.209)	(0.236)	(0.0196)
_cons	8.115***	7.934***	7.510***	6.982***	-0.0875***
	(0.0815)	(0.0682)	(0.0822)	(0.0957)	(0.00742)
N	1345	1345	1345	1345	1345

Notes: Sample from 1345 employees (446 volunteers, 899 non-volunteers) in the endline survey. Values range from 0 (lowest) to 10 (highest). For example, “recommend to friends” ranges from “Definitely no” at 0 to “Definitely yes” at 10.

Table 5: Treatment spend more time on VPN and less time in the office

	Overall	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
dependent variable				Individual daily VPN time				
Treat	.508***	.0719**	.0813**	1.56***	.0926***	1.63***	.0778***	.0877***
	(0.0328)	(0.0338)	(0.0345)	(0.0784)	(0.0336)	(0.0719)	(0.0274)	(0.0326)
Control Means	0.288***	0.267***	0.286***	0.294***	0.276***	0.288***	0.269***	0.334***
	(1.15)	(1.10)	(1.15)	(1.17)	(1.11)	(1.18)	(1.11)	(1.23)
dependent variable				Individual daily Office time				
Treat	-0.849***	-0.00904	-0.0320	-2.634***	-0.210**	-2.998***	0.00542	0.0115
	(0.0573)	(0.0646)	(0.0754)	(0.135)	(0.0941)	(0.117)	(0.0168)	(0.0122)
Control Means	6.562***	9.451***	9.269***	8.784***	8.222***	7.694***	0.991***	0.660***
	(0.0379)	(0.0466)	(0.0527)	(0.0684)	(0.0892)	(0.0504)	(0.0122)	(0.00890)
N (days)	169	25	23	24	25	24	24	24

Notes: 1612 participants, from August 9th 2021 (1st wave) and September 13th (2nd wave) to January 23rd 2022; N(person*days)=221,794. VPN and daily office time is in hours.

Table 6: Treatment employees saw a 12% (=.879/7.323) reduction in non-working days

	(1)	(2)	(3)	(4)	(5)	(6)
Non-working day	Overall	Monday	Tuesday	Wednesday	Thursday	Friday
Treat	-0.879***	0.742**	0.713**	-2.221***	1.115***	-4.505***
	(0.228)	(0.341)	(0.307)	(0.294)	(0.313)	(0.334)
_cons	7.323***	6.542***	5.251***	6.315***	7.265***	11.06***
	(0.179)	(0.242)	(0.222)	(0.230)	(0.222)	(0.256)
Business Trip						
Treat	-0.297	0.669**	0.605*	-0.847**	0.00238	-1.773***
	(0.303)	(0.293)	(0.320)	(0.332)	(0.416)	(0.358)
_cons	5.633***	3.589***	6.960***	4.104***	6.012***	7.364***
	(0.218)	(0.185)	(0.216)	(0.253)	(0.298)	(0.268)
N	158547	29436	31045	32696	32692	32678

Notes: The dependent variable is percentage of days, so -0.879 in column (1) means almost 0.9% less days were missed (about 2.3 given ≈250 working days in a year). Given the baseline of 7.323 days missed (≈18 days for holidays, absence, sick leave etc) this is a reduction of about 12%. “Business trip” is visits to suppliers, customers etc. Standard errors clustered by individual.

Table 7: Messages sent by treatment vs control employees

	Overall	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
dependent variable				Individual daily message				
Treat	4.959***	6.336***	5.967***	7.693***	4.914**	8.962***	0.345*	0.115
	(1.548)	(2.169)	(2.218)	(2.336)	(2.071)	(2.027)	(0.180)	(0.0771)
_cons	35.20***	48.10***	49.52***	52.37***	47.83***	43.04***	2.771***	0.604***
	(1.022)	(1.442)	(1.472)	(1.525)	(1.393)	(1.298)	(0.120)	(0.0506)
Coef/Means	0.141	0.132	0.121	0.147	0.103	0.208	0.124	0.190
N (days)	150	22	21	22	22	21	21	21

Notes: 1612 participants, from August 9th 2021 (1st wave) and September 13th (2nd wave) to January 23rd, 2022.

Table 8: Treatment employees increase messages most to team members and recent contacts

	(1) Team	(2) non-Team	(3) Close	(4) non-Close
Treat	0.617**	3.771***	3.16***	1.225*
	(0.244)	(1.229)	(0.793)	(0.735)
Control Means	2.878***	26.55***	11.03***	14.01***
	(0.154)	(0.806)	(1.169)	(1.14)
Coef/Control Mean	0.214	0.142	0.287	.0874
N	241800	241800	241800	241800

Notes: Team defined by same manager. Data from 1612 participants, from August 9th 2021 (1st wave) and September 13th (2nd wave) to January 23rd 2022.

Table 9: We see no evidence of performance spillover effects within teams

	(1)	(2)	(3)	(4)	(5)	(6)
	Performance grade			Promotion		
Treat	-0.0556	-0.0556	-0.0558	0.0337	0.0340	0.0337
	(0.0431)	(0.0432)	(0.0431)	(0.0310)	(0.0310)	(0.0310)
Team Treatment%		-0.0211			-0.00408	
		(0.0762)			(0.0537)	
1+ team member in treatment			0.0108			-0.0192
			(0.0668)			(0.0468)
_cons	3.494***	3.511***	3.491***	0.290***	0.287***	0.302***
	(0.0302)	(0.0476)	(0.0656)	(0.0213)	(0.0334)	(0.0460)
N	1507	1507	1507	1507	1507	1507

Notes: 1612 participants, from August 9th 2021 (1st wave) and September 13th (2nd wave) to January 23rd 2022.

Table 10: Treatment employees write about 8% more lines of code, mostly driven by increased coding on their days in the office

Dep Var: Lines of Code	M to F	M to F	W&F	M,T&T
Treat	0.0827*	0.0809*	0.0609	0.119**
	(0.0489)	(0.0484)	(0.0675)	(0.0555)
Date FE		Y	Y	Y
Project FE	Y	Y	Y	Y
Level FE	Y	Y	Y	Y
N	32612	32612	12148	19946

Notes: The dependent variable is inverse hyperbolic sine of lines of code submitted, which is extremely similar to log(1+x) so for large values is approximately a percentage change. The data covers the experimental period, so starting in August 9th 2021 for the 1st wave and September 13th for the 2nd wave, and running to January 23rd, 2022 for both waves. Lines of code is available for 729 employees whose primary role was writing code. Standard errors clustered by individual.

Appendix A1: July 27th email to solicit WFH volunteers (English translation)

Subject: WFH Trials Invite Your Participation!

Dear Airline/Technology Center partners: In order to improve employee satisfaction and happiness, and to attract and retain outstanding talents, the company is currently researching the feasibility of working from home policy. We hope that "working from home freely" can become company's corporate culture in the future. and employee benefits. In order to verify the feasibility of the policy more scientifically and rigorously, the Air-Ticket Business Department / Technology Center became one of the first batch of experimental departments.

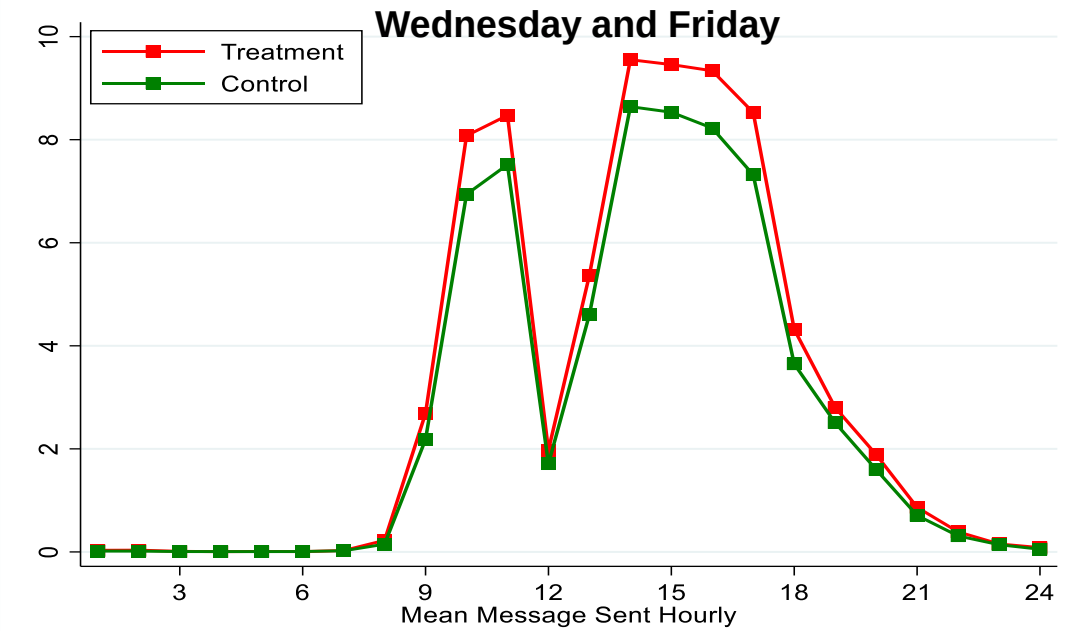
We are very supportive and welcome our Airline/Tech Center mates to join the work from home experiment! During the trial period, I experienced first-hand whether working from home was beneficial to personal output, team management, and my own living conditions. Your real feelings and every feedback will help the company to better think and design policies, so that working from home can become a "good office form, good culture and good welfare" that employees like to hear and hear. Please click this link to fill in the "Home Office Test Willingness Questionnaire" before July 31, express your participation and click this link to fill in your willingness and ideas. We invite you to join and try again, let us create a different working scene together!

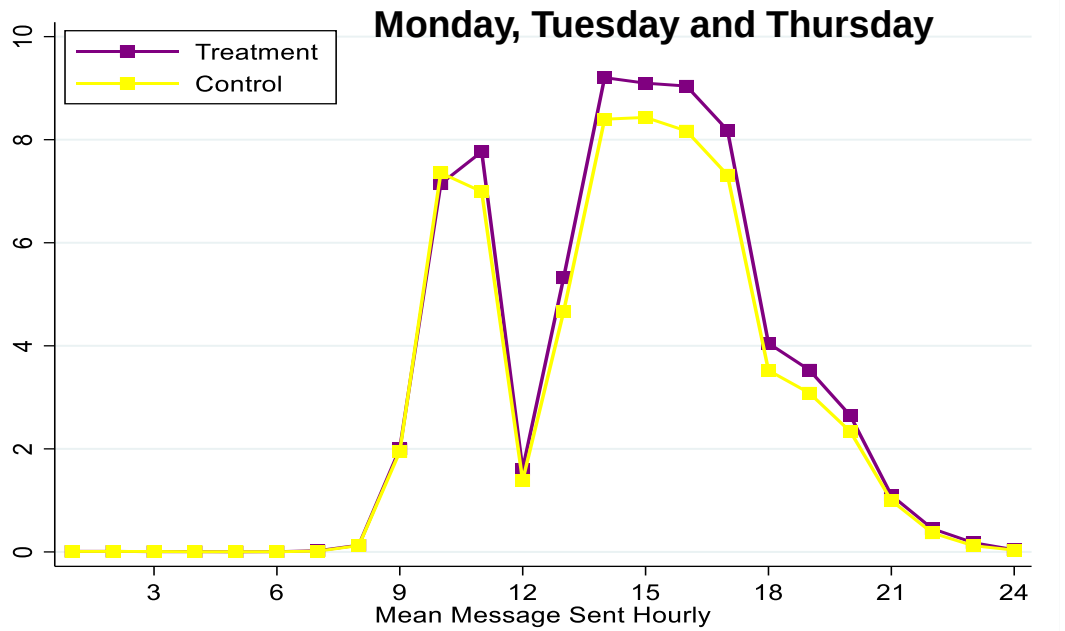
For more details, please refer to the FAQ below. If you have any other questions, please consult the Organization and talents Development Center for details.

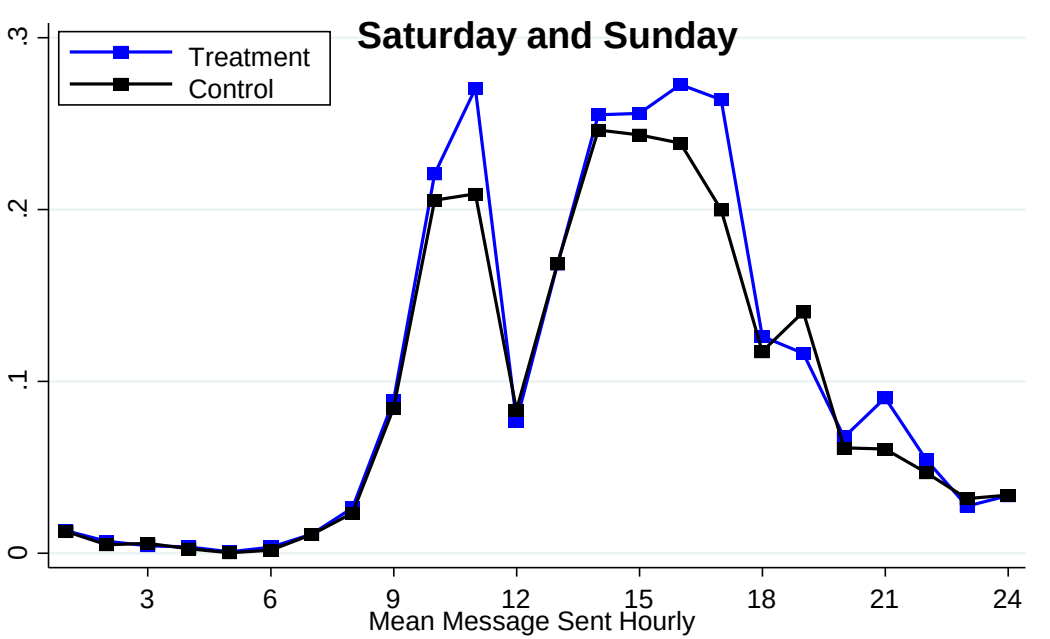
FAQ:

1. How long will the trial last?
The official trial period is from August 9, 2021, to January 30, 2022.
2. Can I start working from home if I choose to participate?
The project team will conduct scientific sampling from the employees who have chosen "willing" to participate, and there will be half of the employees were selected as the "experimental group" and the other half were selected as the "control group".
3. When will I know if I have been selected as the "experimental group"?
The project team will officially announce the sampling results from August 4th to 6th. The "experimental group", will sign the corresponding documents to ensure that you are in the experimental period. If there are no special circumstances, please participate in the whole process of the experiment.
4. How is the attendance calculated during the home office period?
During the test period, the employees of the "experimental group" will be uniformly set. For special classes, workdays that cannot be clocked in due to working from home are counted as normal attendance. In case of taking sick leave or annual leave, please log in to the attendance system normally submit a leave application within .
5. Will working from home affect my assessment?
No, the work goals of working from home are the same as working in the company, but you can arrange the office space more flexibly, the goals will not change, and the assessment method will not change. Participate in year-end assessments.
6. I have a desktop but no laptop, can I still apply for working from home?
Yes. You only need a home computer and network at home.

Appendix A2 :Individual messages over hours

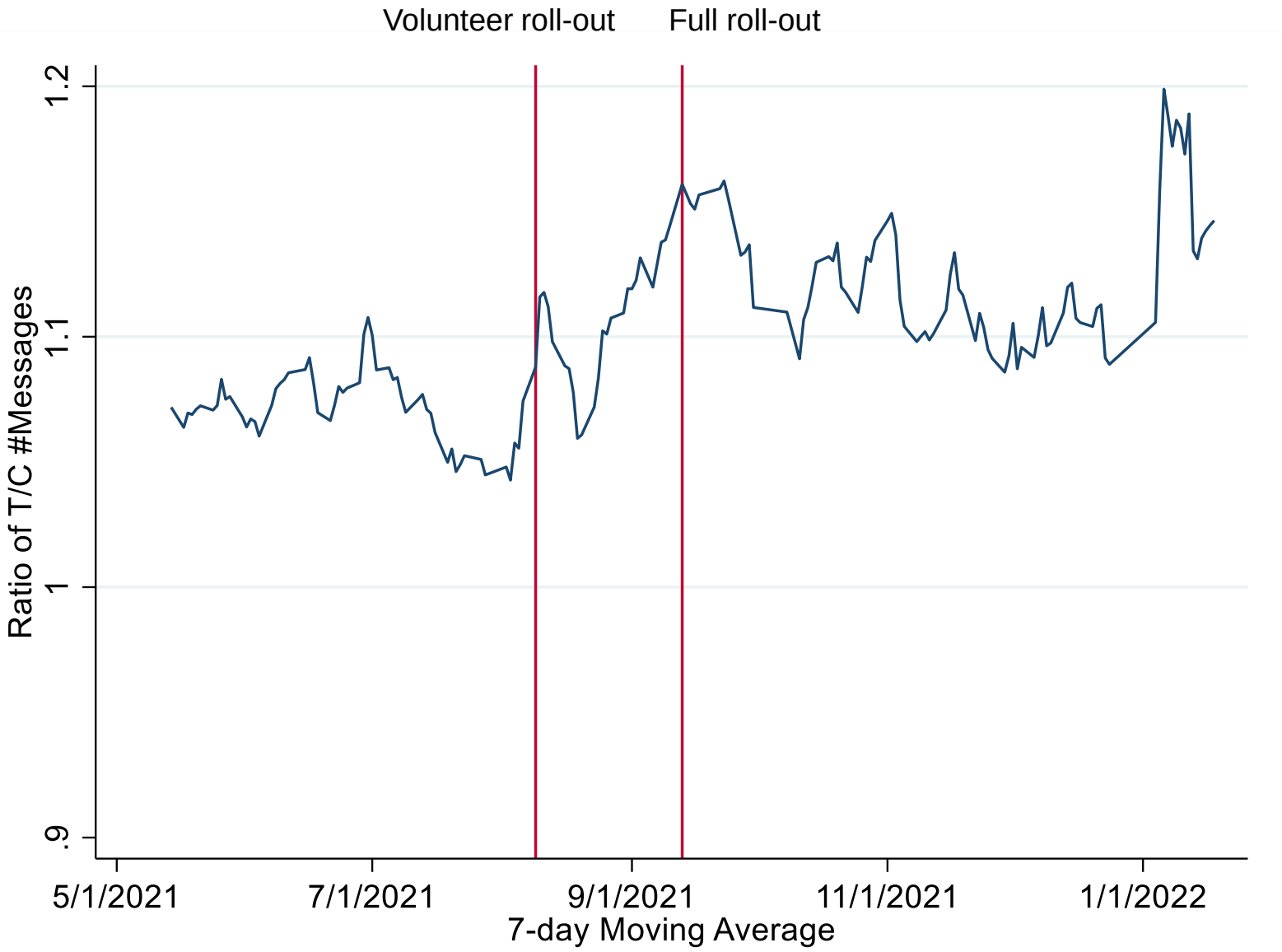






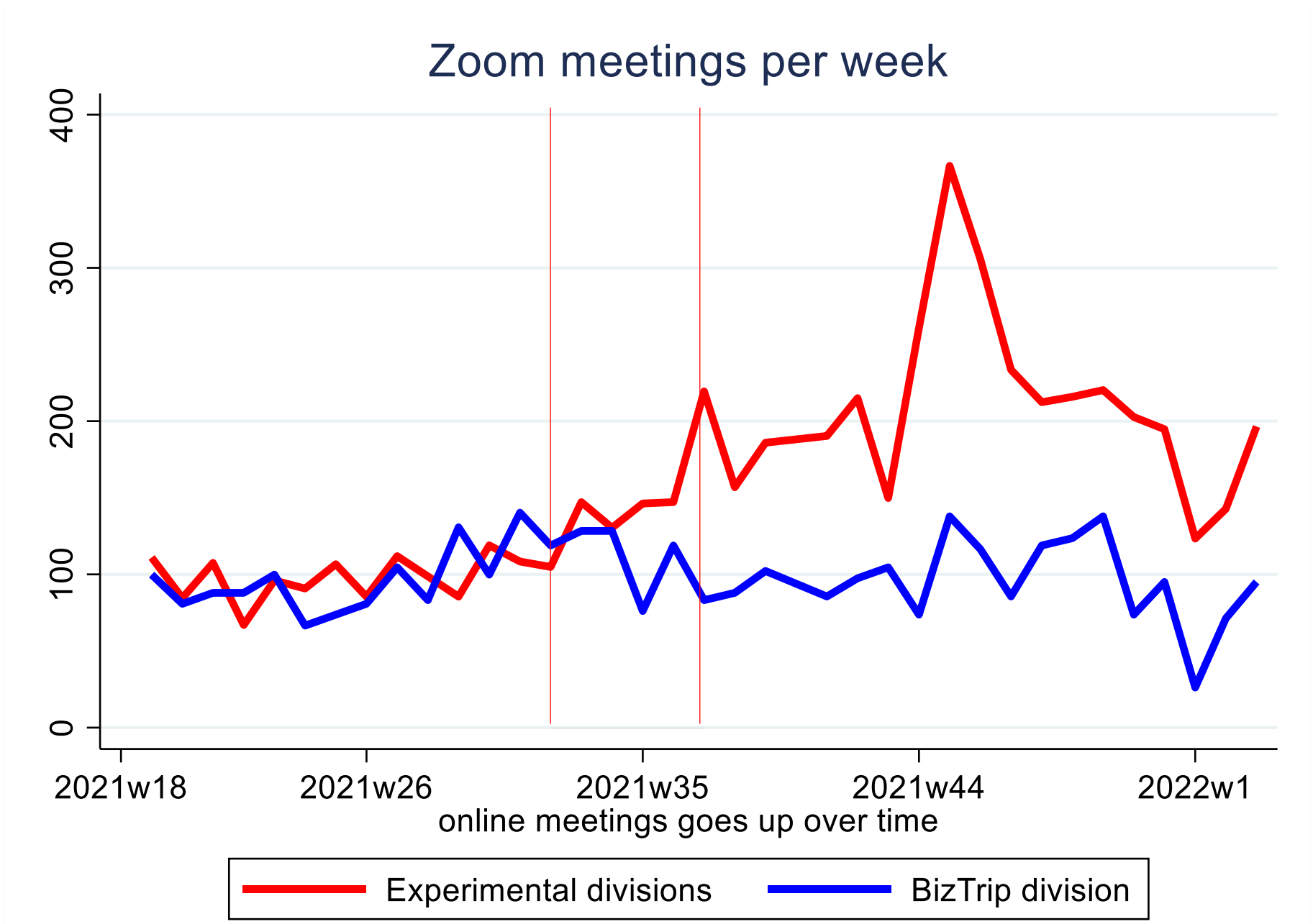
Notes: Data for 1612 employees from August 9th 2021 (volunteers) and September 13th (non-volunteers) to January 23rd 2022.

Appendix A3: The increase in messaging by treatment employees happened rapidly



Notes: Data for 1612 employees from August 9th 2021 (volunteers) and September 13th (non-volunteers) to January 23rd 2022.

Appendix A4: Experimental divisions saw a rise in Zoom meetings



Notes: Data for 1612 employees from August 9th 2021 (volunteers) and September 13th (non-volunteers) to January 23rd 2022. The experimental divisions are the Airfare and IT divisions that were involved in the randomized control trial to WFH, while the business trip division was not involved.

Appendix A5: No robust significant performance heterogeneity

Y: H2 Performance Grade	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Treat	-0.0556	-0.0470	-0.0636	-0.0252	-0.0686	-0.0117	0.0106	1.598	-0.0499
	(0.0431)	(0.0592)	(0.0516)	(0.0732)	(0.104)	(0.0681)	(0.0620)	(3.48)	(0.0518)
Treat-manager		0.0428							
		(0.0604)							
Treat*Treat-manager		-0.0207							
		(0.0863)							
Volunteer			-0.0808						
			(0.0670)						
Treat*Volunteer			0.0286						
			(0.0939)						
Tenure				-0.0151***					
				(0.00578)					
Treat*Tenure				-0.00601					
				(0.00853)					
Commute					-0.0883**				
					(0.0377)				
Treat*Commute					0.00787				
					(0.0536)				
Female						-0.127**			
						(0.0607)			
Treat*Female						0.0636			
						(0.0876)			
Children							-0.0431		
							(0.0605)		
Treat*Children							-0.151*		
							(0.0860)		
Messages								0.0636**	
								(0.0254)	
Treat*Messages								0.0119	
								(0.035)	
Business Function									0.0665
									0.0670
Treat*Business-F									-0.0228
									(0.0936)
N	1507	1507	1507	1507	1507	1507	1507	1507	1507

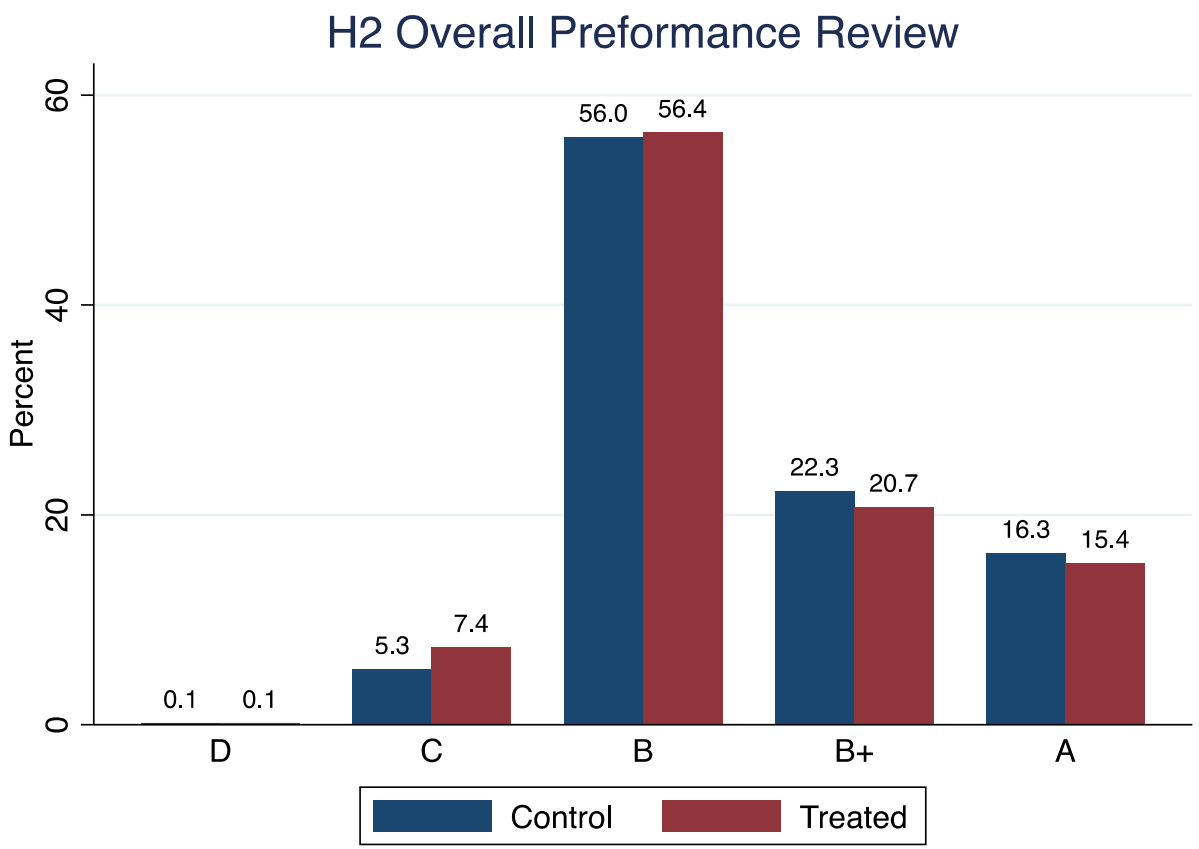
Notes: Number of observations is 62169, where a unit is person-day. Age is measured in years, commute in hours, level from 1 (most junior) to 7 (most senior), team treated is a share from 0 to 1, and messages is messages per hour. All others are binary definitions. Data from August 9th to January 23rd for 1612 employees.

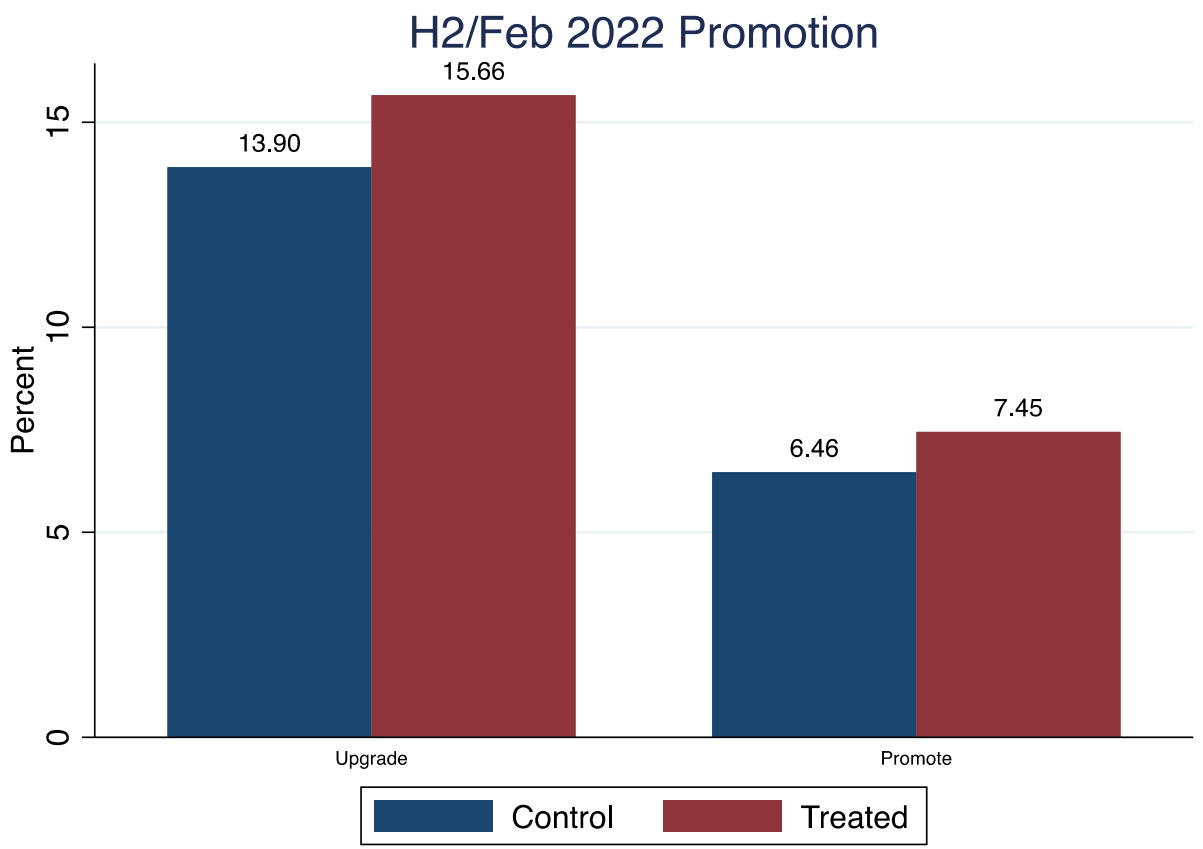
Appendix A6: No robust significant performance heterogeneity

Y: Promotion	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Treat	0.0373	0.0512	0.0395	0.0434	-0.0306	0.0136	0.0199	-2.051	0.0448
	(0.0292)	(0.0387)	(0.0358)	(0.0521)	(0.0736)	(0.0480)	(0.0456)	(2.50)	(0.0379)
Treat manager		0.0792*							
		(0.0405)							
Treat*Treat-manager		-0.0342							
		(0.0589)							
Volunteer			-0.0155						
			(0.0425)						
Treat*Volunteer			-0.00651						
			(0.0620)						
Tenure				-0.0214***					
				(0.00363)					
Treat*Tenure				-0.00238					
				(0.00525)					
Commute					-0.0589**				
					(0.0252)				
Treat*Commute					0.0330				
					(0.0370)				
Female						0.00579			
						(0.0422)			
Treat*Female						-0.0369			
						(0.0605)			
Children							-0.207***		
							(0.0394)		
Treat*Children							0.0116		
							(0.0571)		
Messages								0.0421**	
								(0.0189)	
Treat*Messages								-0.0275	
								(0.0251)	
Business Function									-0.0492
									(0.0459)
Treat*Business-F									0.0339
									(0.0652)
N	1507	1507	1507	1507	1507	1507	1507	1507	1507

Notes: Number of observations is 62169, where a unit is person-day. Age is measured in years, commute in hours, level from 1 (most junior) to 7 (most senior), team treated is a share from 0 to 1, and messages is messages per hour. All others are binary definitions. Data from August 9th to January 23rd for 1612 employees.

Appendix A7: No impact of treatment on performance review of promotions





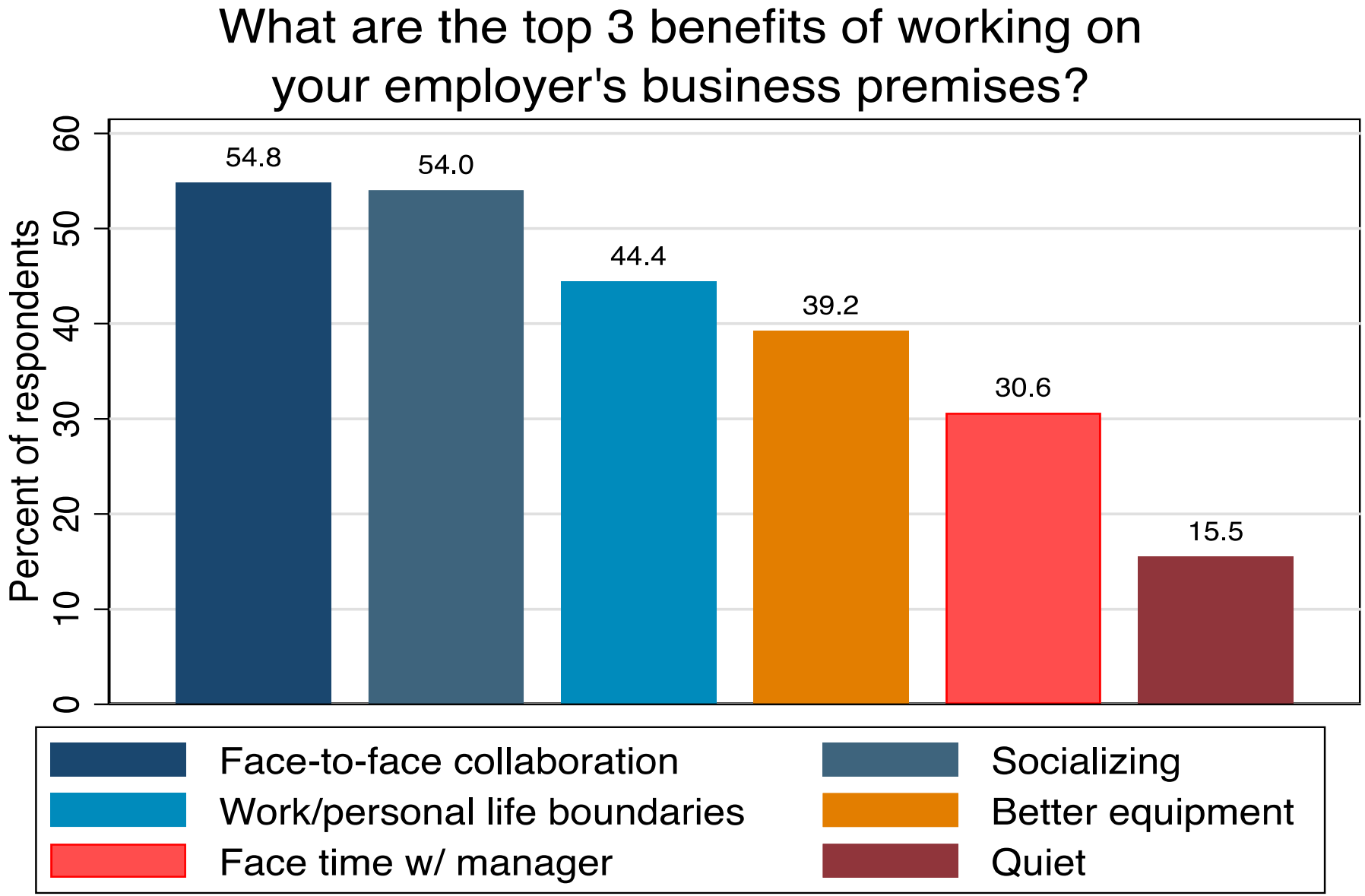
Notes: Results from 1507 employees.

Appendix A8: Treatment employees saw a reduction in non-working days, particularly those with children

	(1)	(2)	(3)	(4)	(5)	(6)
Non-working day	Overall	Monday	Tuesday	Wednesday	Thursday	Friday
treat	-0.787	1.550*	0.747	-1.942***	0.387	-5.642***
	(0.540)	(0.813)	(0.701)	(0.669)	(0.723)	(0.884)
children	1.609***	1.050	1.629**	1.306	1.778**	2.416**
	(0.584)	(0.797)	(0.747)	(0.796)	(0.791)	(1.076)
treat#children	-1.259*	-1.830*	-1.254	-1.017	-0.423	-1.634
	(0.711)	(1.103)	(0.989)	(0.969)	(1.077)	(1.296)
_cons	5.130***	4.793***	3.700***	4.163***	3.885***	9.552***
	(0.462)	(0.595)	(0.527)	(0.570)	(0.549)	(0.752)
N	33990	7723	7723	6182	6181	6181

Notes: The dependent variable is percentage of days, so -0.787 in column (1) means almost 0.8% less days were missed (about 2.3 given ≈250 working days in a year) for employees without children and 2% less days for those with children (0.787+1.259). Standard errors clustered by individual.

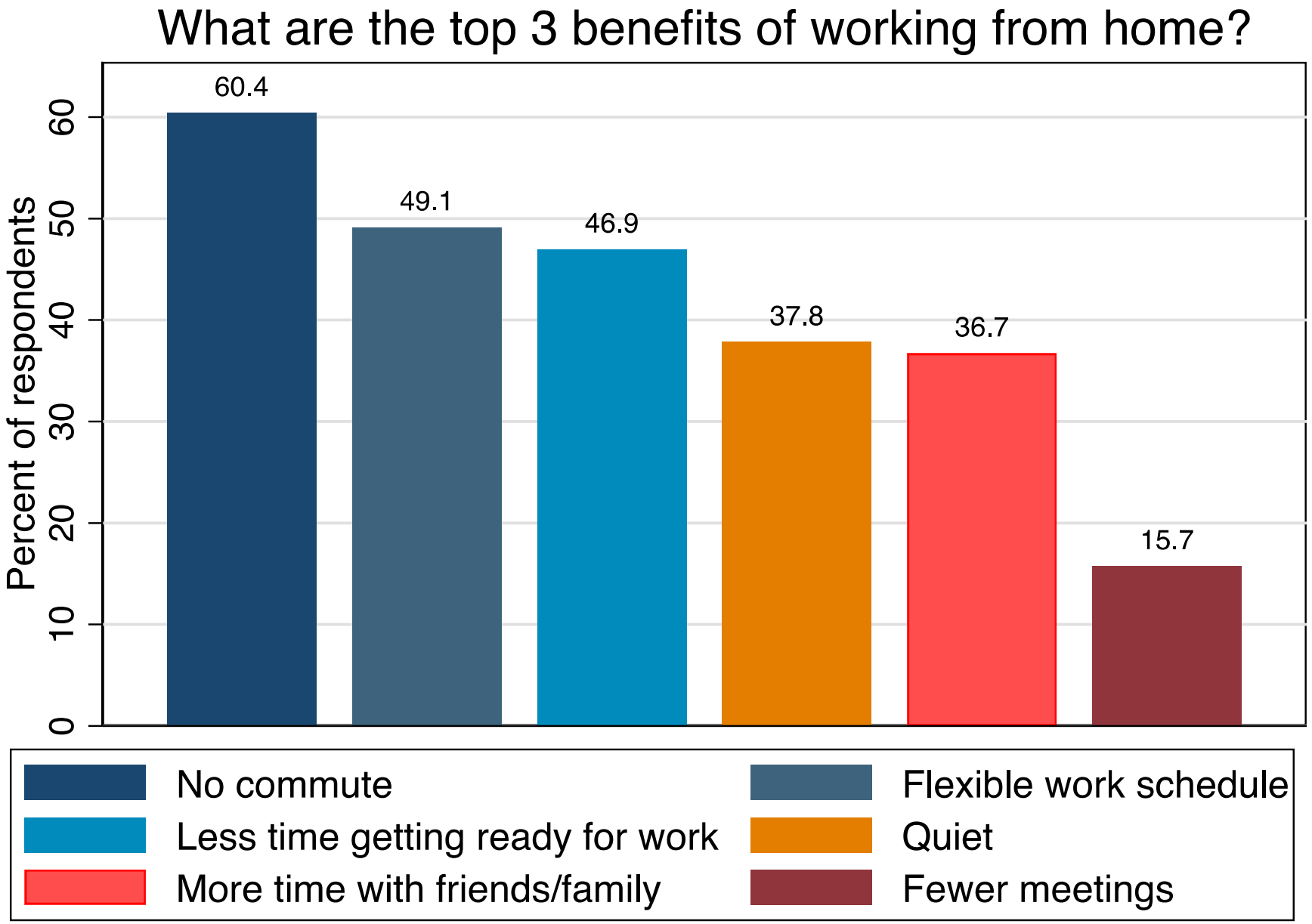
Appendix A9: US employees report the main benefits of being in the office is time with colleagues



Notes: The sample includes respondents to the February 2022 SWAA who passed the attention check questions and worked from home at some point since the start of the COVID-19 pandemic. The SWAA samples US residents aged 20 to 64 who earned $10,000 or more in 2019. **N = 2,973.**

Source www.wfhresearch.com

Appendix A10: US employees report the main benefits of WFH are reduced commute and more flexible work schedules



Notes: The sample includes respondents to the February 2022 SWAA who passed the attention check questions and worked from home at some point since the start of the COVID-19 pandemic. The SWAA samples US residents aged 20 to 64 who earned $10,000 or more in 2019. **N = 2,973.**

Source www.wfhresearch.com