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Smart-working: Work Flexibility Without Constraints *

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Abstract

Does removing the constraints of time and place of work increase the utility of workers and firms? We design a randomized experiment on a sample of workers in a large Italian company: workers are randomly divided into a treated group that engages in flexible space and time job (which we call "smart-working") one day per week for 9 months and a control group that continues to work traditionally. By comparing the treated and control workers, we find causal evidence that the flexibility of smart-working increases the productivity of workers and improves their well-being and work-life balance. We also observe that the effects are stronger for women and that there are no significant spillover effects

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within workers of a team.
JEL codes: J16, J22, J24, L2, M54

1 Introduction

The outbreak of the 2019 novel coronavirus is threatening the growth of several parts of the world, including China, the world's fastest growing major economy, and Lombardy, the most productive Italian region. To contain the spread of the coronavirus and curb the contagion, a new organizational model of work, called "smart-working", is becoming increasingly important: workers can work outside their workplace and with a flexible time schedule, thanks to the use of the technology. The flexibility of where and when to work is used today to continue the work activities and avoid the collapse of the economy.

Smart-working is a fully flexible work arrangement, with the capacity to adapt quickly and intelligently to different situations. Smart workers agree with their supervisors to perform their work activities for a defined period of time outside of the company's physical workplace and according to a personalized time schedule. During this period, there are no specific constraints on the time or location of work. Due to the use of technology, smart workers may perform the same duties and activities as those of ordinary workers and achieve the same set targets and results while choosing a workplace and time schedule that are more convenient for both the activity to be performed and their personal needs. Time and space flexibility creates a new work organization, which is based upon results rather than workplace presence and work during particular hours.

Despite its massive use in recent weeks, we still know very little about the economic effects of smart-working in normal times. The available evidence, which consists only of case studies, management surveys on specific samples of workers and ex post descriptive analyses, does not allow us to appropriately identify the economic effects of smart-working. This paper fills this research gap and provides causal evidence that smart working is economically desirable. We design a randomized experiment to show that removing the constraints on

the time and space of work without altering the wages, for a limited period of working activity, improves the productivity, well-being and work-life balance of individuals.[1]

Work flexibility is not a new concept. The majority of European employees (3 out of 4 on average) have access to some work flexibility. According to a recent survey conducted on US professionals (Dean and Auerbach, 2018), 47% of the interviewees reported having work flexibility. However, almost all the workers in the sample (96%) said that they want flexibility. A recent report by Gallup (Gallup, 2017) based on interviews with more than 195,600 employees found that flexibility plays a major role in an employee's decision to take or leave a job.

Work flexibility is a multidimensional concept. The traditional practice of working from home under the same wage conditions and control of the employer, which is known as telecommuting, is now used by approximately 17% of workers in Europe (Eurofound, 2017) and 16% of workers in the US (US Bureau of Labor Statistics, 2019). In their experiment on Chinese employees in a call-center (a routine job), Bloom et al. (2014) show that telecommuting can be beneficial for employees' productivity and their work-life balance, although at the cost of feeling isolated, which, in the long run, may risk reducing the benefits of this practice. However, telecommuting is only one way and one dimension of work flexibility, which is mainly based on replacing the workplace with the home, but maintaining the rigid control of the employer on the location of the work and the precise hours. Telecommuting is compatible with a limited number of jobs, mainly routine jobs. New and more complex forms of flexibility have begun to spread, including flexible location and flexible work times. In the US, approximately 52% of office employees have some choice over their work times (Gallup, 2017). Approximately one-third of the employees in Europe can choose between several fixed working schedules or independently set their working hours. These individuals are more likely to be employees with university degrees who are working in high-skilled jobs.

[1] In our experiment, we introduce one day per week of smart-working, which is the standard use in normal times. The current health emergency requires smart-working for entire weeks, making our results not directly comparable with the current situation.

Both flexible place and flexible time are highly appreciated by workers. According to the Sixth European Survey on Working Conditions carried out by the European Foundation for the Improvement of Living and Working Conditions (Eurofound, 2017), workers appreciate having control and freedom over where and when to work, i.e., the possibility of working without the control of the employer at a place that is different from both the office and home, as well as a flexible time schedule. More than 20% of the workers (men and women) interviewed by the survey reported that their working hours do not fit with their family and social commitments. While working from home does not change this perception in a statistically significant way, having some freedom to set one's start and finish times and arrange breaks during the working day increases the perception that one's working hours fit in with their family and social commitments by approximately 20%. The report by Gallup confirms that the flexibility of hours is of growing importance and suggests that one's home is only one possible alternative to the workplace. Approximately 37% of the surveyed employees declared they would change their job for benefits related to a flexible working location (for part of their working week), and more than half of office workers (54%) said that they would leave their job for one that offers flexible work time (Gallup, 2017). Among the millennials, these reported percentages increased to 50% and 63%, respectively. Millennials want benefits that are directly related to their lives and those of their family members, and they are willing to switch jobs to secure them. Flexible work locations and hours are for them a priority, which is a fact that will impose a re-organization of work for employers wanting to compete for a modern workforce.

After decades of experience with telecommuting, there is a growing consensus among major international organizations, such as the OECD and the European Commission (OECD, 2016), that an effective improvement of work-life balance and productivity, which are the two major goals of work organizations, passes through more complex and different flexible work arrangements, based on the removal of the constraints on the location and scheduling of work.

Flexible work arrangements are introduced through individual or collective

bargaining, which, in several countries, are regulated by laws (Hegewisch et al., 2009). Such laws give the employees the "right to request" flexible working. In some cases, this is targeted specifically at the parents of young children (Australia, Finland, Norway and Sweden); in others, it is guaranteed to all employees, irrespective of the reason (Belgium, France, Germany, Netherlands, and the United Kingdom). Employees can also appeal to the courts in case employers refuse such a request. The "right to request" legislation in New Zealand, the United Kingdom and the Netherlands covers flexible working rights for employees in a comprehensive manner, including the scheduling of hours and the location of work. Recently, in 2017, Law 81 in Italy introduced an appropriate regulatory framework for the implementation of smart-working, defined as a "new method of forming a subordinated employment relationship without precise constraints on time or location of work and with the use of technological tools in the workers' duties and activities". Italy provides an interesting context for our analysis; while the country is characterized by a general low flexibility in work organization, firms started to show some level of interest in smart-working as early as ten years ago, well before Law 81, although this approach was limited to very small groups of workers (typically, fewer than ten).

Smart-working is associated with a trade-off. On the one hand, there are potential gains from the flexible work locations and hours, which go beyond those associated with telecommuting. By working from home, telecommuting allows workers to reduce their commuting costs and firms to optimize their costs. The reduction in costs is higher with smart-working than telecommuting, since the last one requires inspections and a constant monitoring of the workers at distance.[2] Moreover, home is only one possible alternative to the office, and not necessarily the more convenient alternative; the conflict between work and family may even become more visible when employees work

[2]Firms may reduce lighting costs, summer and winter climatization costs, corporate canteen costs, cleaning costs, etc. In some cases, the place of work itself becomes "smart" as offices become flexible spaces where workers perform part of their activities and have free access to all technologies; such spaces often have novel physical layouts, including, e.g., mindfulness zones and areas for team-working and communicating. The extreme, though not common, case is the "no fixed desk" office.

from home for caring purposes. It may also be the case that, for the same reduction of commuting time, the double gain of improving work-life balance and increasing productivity may be better obtained when workers work at a library, at a park, at a difference place close to their residence, or at a location that may change without the control of the employer, instead of home, where their family duties may interfere with their job activity. Moreover, removing the fixed daily start and finish times gives employees the possibility of better managing their time according to their preferences; they can enjoy long or short breaks for personal or family reasons, and they can adapt their work hours to life changes without altering their compensation. This increases their satisfaction and work-life balance, which ultimately makes this arrangement desirable to workers. In parallel, firms may optimize by rewarding these employees based on effective productivity rather than on the particular hours worked. Firms may also gain from the retention of talent and the reduction of days of absence, thus increasing their competitiveness. Additionally, time flexibility in the labor market for all workers (men and women) contributes to reducing the rewards of long hours, work at particular hours and inflexible schedules, which are considered a major driver of gender pay gaps (Bertrand, 2018) and may thus represent a step towards the "last chapter of the grand gender convergence" (Goldin, 2014).

On the other hand, smart working raises concerns about the organizational process, the productivity of workers and their well-being. Some of these concerns are shared with the telecommuting experience; for example, working outside the workplace may reduce the commitment of workers, who can then take advantage of the flexibility to take part in activities different from work. Moreover, by reducing interactions between workers and between workers and supervisors, there is a risk of a reduction in productivity, particularly in jobs with high interactions. Finally, blurring the boundaries between work and home may increase the hours of overtime, the levels of employee stress and worsen work-life balance. These concerns are even stronger in the case of smart working, when the location of work can be changed by the employee without the control of the employer. Moreover, the lack of rigid daily start and finish times can amplify the reduction of worker commitment, reduce

their regular activity (in absence of strict rules on time) and increase the risk of overworking.

How the introduction of smart work addresses this trade-off is an open question that we address empirically. We design a randomized experiment to study the causal effects of the introduction of smart working in a large traditional company in the multi-utility sector in Italy. The company has never used this approach before. Following the methodology of randomized control trials (RCTs), we select a sample of 310 workers (containing both white- and blue-collar workers) and randomly divide it into two groups; the workers in the first group (the treated group) have the option to work "smart" (i.e., with no constraints on the place or time) one day per week for 9 months in agreement with their supervisors, while the workers in the second group (the control group) continue to work traditionally. We are interested in three major outcomes: productivity, well-being and work-life balance. We use objective measures of workers' performance calculated monthly by the firm (e.g., the number of dossiers processed during the month) and the number of days of leave of each worker. We complement this information with questionnaires administered to each worker and to his/her supervisor both before and after the treatment. The questions posed in the questionnaires capture several dimensions of self-assessed productivity, well-being and work-life balance. Given the randomization of the two groups, we are able to identify the causal effect of the treatment on our outcomes of interest.

Our results show that, for the same number of hours of work, workers involved in smart working increase their productivity compared to that of workers who continue working traditionally; this outcome is true whether productivity is captured by an objective measure or if it is measured according to several specific productivity traits (e.g., compliance with deadlines) reported by the same worker or by the supervisor. Smart workers are also more satisfied with their social life, free time and life in general. They claim to be more able to focus, make decisions, appreciate their daily activities, overcome problems and experience reduced stress and loss of sleep. Interestingly, both men and women spend more time engaged in household and care activities. We also

observe that the effects are stronger for women and that there are no significant spillover effects within workers of a team.

Our results suggest that promoting smart working is an effective way to increase productivity and improve well-being and work-life balance. Moreover, we provide evidence that by removing the rigidity related to particular hours of work, smart working may contribute to the reduction of gender gaps in the labor market (Goldin, 2014). The high flexibility of smart-working—flexible time schedules, flexible places of work and flexible periods of flexible work to be used during the workweek—makes it a very appealing option for both employers and employees of a large category of jobs.

Our results are consistent with the idea of smart-working representing the removal of a constraint that is desirable for employees and useful for employers. In the presence of rigid work hours, when workers choose their amount of work hours, they face an implicit constraint on the hours of the day that can be dedicated to the work activity. This constraint may be binding for those workers who gain utility from taking a break to adapt to their personal and family needs; such workers have to choose whether to work part-time and hence decrease their wages, to not meet their needs or to be absent from work. Any option is costly. The removal of the time constraint increases the utility of these workers such that they can still work full-time and accommodate their needs by choosing a personalized time schedule. Their increased satisfaction and better time management may also increase their productivity during working hours. To the extent that employers value the output of the workers rather than the work at specific hours, smart-working represents a net gain.

The paper is organized as follows. The next section presents a literature review, section three describes the experiment, section four presents the data, section five describes the empirical strategy, section six shows the results, section seven discusses heterogeneous and spillover effects within teams, section eight presents additional analyses and considers robustness, section nine contains the discussion and conclusion. A set of appendixes complements the analysis of the main text.

2 Literature Review

Previous studied have analyzed the relationship between different management practices and productivity (see literature reviews in Walker (1887), Leibenstein (1966), Syverson (2011), Gibbons and Henderson (2013), and Bloom and Sousa-Poza (2013)). However, few studies have performed randomized experiments that can identify the causal effects of managerial procedures on productivity. Dutcher (2012) performs lab-based experiments exploring routine and non-routine tasks with and without remote monitoring, and observes that the more routine ones are negatively affected by mimicking a home-based environment. The author conjectures that the effect depends on the lack of peer and manager effects, which have been shown to be important in low-level tasks in field environments by Falk and Ichino (2006), Bandiera et al. (2005), and Mas and Moretti (2009). Kelly et al. (2014) examines the impact of a work-life balance training program randomized across branches of a large firm, observing significant reductions in employees' work-family conflicts, and improved family time and schedule control.

Bloom et al. (2014) perform a randomized experiment on a sample of call center employees of a large Chinese travel agency, randomly assigned to two groups: telecommuters and office workers. The researchers observe that telecommuters have higher productivity than do the other workers but, consistent with the prediction of previous studies of routine tasks, feel isolated. Thus, when telecommuters are given the opportunity to again choose between telecommuting or not, they prefer to come back to their workplace. This result is consistent with the evidence provided by Mas and Pallais (2017) who observe that the majority of workers of a call center do not value scheduling flexibility. Many of them, especially women with young children, instead value working from home. These papers consider a very specific work environment, namely, call centers, where all workers perform similar and routine-based tasks. However, as suggested by Dutcher (2012), work flexibility may affect the performance of routine and non-routine tasks differently. Non-routine jobs may take full advantage of flexibility, as they require a higher individual concentration than do routine tasks and are less exposed to isolation risks. However, there is

no previous causal evidence of this for non-routine jobs. Moreover, as we have already emphasized, current flexible work arrangements go beyond telecommuting, by including flexible time schedule, flexible place of work and a flexible period of flexible work to be used during the workweek. Yet, there exists no causal evidence on smart-workers. Similarly, randomized experiments in firms involving a variety of job types in a developed economy are very rare.

The economic consequences of smart-working on workers' productivity have not been analyzed before, probably because productivity is difficult to measure and smart-working is a relatively new approach. Attempts to measure productivity based on objective indicators such as absenteeism (Koopman et al., 2002) and output per hour (Golden, 2012) show a positive relationship with flexible work arrangements. Self-declared productivity is also positively related to flexibility (see Riedmann et al. (2006)). However these studies provide descriptive evidence on the implementation of smart-working and may suffer from endogeneity concerns. The main reason is that they cannot control for other variables affecting productivity and cannot establish whether smart-working increases productivity, or whether companies with high productivity are more likely to introduce smart-working. The latter may also affect productivity through changes in workers' well-being and work-life balance, which are therefore important to analyze in parallel.

Labor sociologists (Kelly and Moen, 2007, Schieman et al., 2009) have studied the relationship between flexibility and work-life balance. As reviewed by Chung and Meuleman (2017), the evidence on this relationship is mixed: on the one hand, flexibility may reduce work-family conflicts (Chung, 2011, Kelly et al., 2011), while, on the other hand, it can create spillovers from work to home, blurring the boundaries between the two and increasing overtime hours of workers with negative impact on work-life balance (Golden and Wiens-Tuers, 2006). The latter effect tends to be dominant for high-skill workers in large companies, which also offer performance-related pay and other arrangements that motivate workers to work longer and harder. A gender divide emerges: while flexibility is used by women for family-friendly purposes, it is used by men for performance purposes. The evidence shows that women are more likely

to stay employed after the birth of their first child and increase their capacity to work when family duties multiply and thus enjoy better work-life balance. Men instead increase their work intensity and performance-related payments with no changes in family arrangements, and earn incremental income. Thus, traditional gender roles risk being strengthened further by work flexibility. Chung (Chung, 2011) analyzes data for 28 European countries and shows that flexibility can have different impacts in different contexts: it is more beneficial for workers in job cultures with more hours worked (overtime), where men and women use it for family-friendly purposes, and the flexibility stigma is not strong. Other related outcomes, such as health (Kelly and Moen, 2007, Moen et al., 2013) and stress (Halbesleben and Buckley, 2004, Moen et al., 2016) outcomes, have been investigated, with results showing a positive relationship between schedule control and organization of work.[3] There are two main drawbacks in these studies: it is difficult to claim causality, and there is no precise measurement of productivity.

The managerial implications of flexible work have also been explored in relation to performance (Leslie et al., 2012): flexibility may increase performance if workers are "happy" to control their own work schedules and work more effectively, with fewer days of sickness and leave. However, existing contributions mainly entail descriptive evidence and case studies of major companies across the world that allow smart-working, and do not provide causal evidence.

3 Experiment

We design and implement a randomized experiment to explore the effects of smart-working on productivity, well-being and work-life balance of workers. We focus on Italy, where smart-working is regulated by Law 81/2017 that includes specific provisions to encourage the use of smart-work as a way to promote work-life balance and to enhance competitiveness. The law includes protection of health and safety of workers and guarantees equal remuneration

[3] A large body of literature has studied nonstandard work schedules and their impact on well-being and family conflicts (Liu et al., 2011). Smart-working one day per week, however, is difficult to compare to a nonstandard schedule.

of workers. The organizational details are left to an agreement between the employer and the employee.[4] According to the law, smart-work may be engaged in over continuous periods, on some days of the week or during some hours of the day, as agreed by the workers and the company. Personnel protection for both private- and public-sector employees is regulated by the National Institute for Insurance against Accidents at Work (INAIL).

We approached a large Italian company in the multi-utility sector and signed an agreement to design and implement smart-work as a pilot experiment. The company is listed on the Italian Stock Exchange and has 4131 workers engaged in various tasks. Workers are divided into blue- and white-collar types. Workers perform non-routine tasks. Blue-collar workers perform tasks related to technical, electrical and mechanical installations and maintenance, while white-collar workers work at a desk and perform several types of procedures, write and conclude contracts, perform transactions, etc. While both time and space flexibility are available to white-collar workers, for blue-collar workers smart-work is mainly characterized by being done on a flexible time schedule.

We designed the experiment in agreement with the firm's senior management, who assented to all of our requests and recommendations. We randomized the sample after data had been anonymized by the company. We had complete access to the data used for the analysis and direct access to the surveys administered for the experiment. We also had daily contacts with the managers in charge of the experiment at the company and the management team.

Figure 1 shows the Consolidated Standards of Reporting Trials flow (CONSORT) that summarizes the flows of the experiment[5]. We adopt the intention-

[4]During 2017 and 2018, smart-working was also one of work-life balance measures that gave companies rights to a tax relief.

[5]Randomized controlled trials can be affected by two major complications: noncompliance and missing outcomes (Gupta, 2011). The more suitable approach is to perform an intention-to-treat (ITT) analysis, which includes all randomized subjects. It ignores noncompliance, protocol deviations, withdrawal, and anything that happens after randomization. The resulting estimate of the treatment effect is generally conservative because of dilution due to noncompliance. Full reporting of any deviations from random allocation and missing responses is essential in the assessment of the ITT approach, as emphasized in

to-treat approach (ITT), which we now explain step by step.

First, we extract our sample of analysis from the population of 4131 workers. We choose to oversample women, workers younger than 46, workers with children under the age of three and workers with relatives who need special care, which gives them the right to reduce the number of hours worked, according to Italian Law 104/92 (Legislation on Support for the Disabled). In agreement with the firm, we decided to oversample these groups because survey evidence suggests that women and individuals with family care duties (caring for children, disabled relatives, etc.) are expected to need and benefit more from smart-working (see Giammatteo (2009)). In fact, the firms was particularly interested in improving working conditions of these categories and their work-life balance, expecting this to reflect also into their productivity.

Using these criteria, we selected 345 workers and asked them about their willingness to join the program. The proportion of those who did not agree was 10%, which in experiments of this type is considered a reasonable number (Jacobsen et al., 2012, Jørgensen et al., 2014). As a consequence, our final sample consists of 310 workers. Among them, 86% are white-collar workers and 14% are blue-collar workers. There are no seasonal workers. Table 1 summarizes the characteristics of our workers, and compares them with those of the total population of workers at the firm. Appendix E provides detailed information on the job description of each worker in our sample, covering both white-collar and blue-collar workers.[6]

Afterwards, we randomly split the above 310 workers into two subgroups, consisting of 200 and 110 workers, respectively: the first group was to engage in smart-working (the treated group) and the second continued to work according

CONSORT (Moher et al., 2001)

[6]Table E.3 in Appendix E illustrates the responses of white- and blue-collar workers to questions in the pre-experiment questionnaire related to dimensions considered crucial for flexible jobs (see Goldin (2014)): time pressure (proxied by the answer to the question "do you comply with the predetermined deadlines of your responsibilities at work?"), contact with others and interpersonal relationships (proxied by the answer to the question "do you feel like having a useful role in your work life?") and freedom to make decisions (proxied by the answer to the question "do you feel capable of making decisions?").

to the preexisting arrangements (the control group).[7]

Based on the experience of other companies that have already implemented smart-working and after an assessment of the company, we choose to define the treatment as one day of smart-working (flexible place and time of work, chosen by the worker) per week, not allowed to be subdivided, and to be planned in agreement with the company on a weekly basis for 9 months starting on October 2016. Given their flexibile schedule during this day, workers' availability is guaranteed within the working day. The day of smart-work does not need to be the same for all workers and can change from one week to another. However, most workers (98 %) choose Friday as a smart-work day. The total number of smart-working days amounts to 4595 days for 200 employees involved and 130 supervisors.

Smart-workers use the same IT equipment, perform the same tasks, and are compensated under the same pay system as are workers belonging to the control group. The only difference between the two groups is the flexible arrangement of time and place for one day per week. Computer equipment was provided for the duration of the treatment to treated group's workers who did not have it. The respective workers knew that they would have the computer only for the duration of the experiment; thus, we do not expect this to affect their perceived status.

The randomization of workers, performed by us in agreement with the firm, is based on gender (male and female), age groups (27-45 and 46-68) and type of job (white-collar and blue-collar). The combinations of these characteristics result in 8 strata. For each stratum, we randomly assign 65% of the individuals to the treated group and the remaining 35% to the control group.

In Table 2, we compare treated and control groups' workers. The table confirms that the two groups are not significantly different in any of the observable characteristics, namely, gender, age, whether the worker benefits from Law 104 or has a relative who benefits from it, whether the worker has children and if

[7]As each treated worker had to be provided with a computer and a maximum of 200 computers were available due to budget constraints, we decided to maximize the number of treated workers. As a consequence, treated and control groups had different sizes.

he/she has children younger than 3 years old.

Within the treatment group, 191 workers received the treatment, while 9 did not receive it: only 5 workers declined to participate after their random allocation into the treatment group, 3 workers died, and 1 worker retired. Within the control group, 2 workers left during the experiment, 1 worker was fired and 1 worker declined to participate. These very small numbers do not pose a concern for the validity of the experiment. Instead, the attrition rate is important, i.e., the failure to follow up: 18 of treated group's workers were not observed after the treatment because they did not reply to the second questionnaire. The respective number increases to 43 for control group's workers. To ensure that the attrition rate is not problematic in our experiment[8], in Table 3 we present balance tests for observable characteristics of respondents and non-respondents to the post-treatment questionnaire. There are no significant differences, apart from a small difference in gender. In Table 4, we also show balance tests for the intention to treat, i.e. means of the same observable characteristics of workers respondent after the treatment and those who did not, separately for the treated and control groups. Again, we observe no significant differences. In the next section, we will introduce our outcome variables and describe balance tests of pre-treatment outcomes for treated and control workers, including a comparison between respondents and non-respondents to the post-treatment questionnaire to exclude biases from the attrition.

Each worker is matched with his/her supervisor. There are 130 supervisors because some of them supervise more than one worker. Ten supervisors also participate in the experiment, of which 8 in the treated group and 2 in the control group. Among supervisors, 75% are male, and the rest are female. For both male and female supervisors, we have an equal split between the two age groups: under 46 and 46 or above.

During the experiment, workers did not know whether the treatment would be temporary; this prevents possible anticipation effects. Interestingly, after the

[8]In a comprehensive review of methodological issues related to presence of attrition rates, Akl et al. (2012) shows that balance tests of respondents and non respondents are appropriate to reduce estimation biases and minimize the lack to follow-up

end of the experiment, given the positive results obtained, the company informed us of its decision to continue and gradually expand the implementation of smart-working. In this subsequent process, the firm gave priority to workers who did not participate in our experiment. Only 60 workers of our sample of 310 workers had the opportunity to apply for participation in the new round of smart-working, of which 80% belonged to our treatment group.

During the nine months, the experiment was constantly monitored through meetings with the company, weekly reporting on the use of smart-working and an internal meeting of the company every 3 months with the target population.

The protocol used has been registered in the American Economic Association's Randomized Control Trial registry. The experiment has been approved by the Ethics Committee at Bocconi University.

4 Data collection

Data are obtained from both the firm and questionnaires administered to workers in both the treatment and control groups and their supervisors before and after the treatment. The firm provides some baseline information for each worker in our sample, as has already been mentioned, namely, gender, age, number and ages of children, whether the worker or a relative needs special care according to Law 104 and the type of work performed by the worker. We also know whether the individual works in a team with other coworkers and with a common supervisor.

4.1 Objective Productivity

Measuring productivity is a difficult task, especially for workers who are not physically present at the workplace. We thus decide to rely on three different measures: objective productivity, self-reported and reported by supervisors. In this section, we describe our measure of objective productivity, while the other two will be introduced in the next section.

The firm provides monthly days of leave (i.e., days off, sick leave, or special leave), the number of hours worked, and a monthly numeric indicator of objective productivity for each worker, built from the results of each worker in his/her own tasks. This is a monthly indicator collected for the entire duration of the experiment from the month prior to testing (September 2016) to the last full trial month (June 2017).[9] This indicator computed by the firm is unavailable for only 6% of workers in our sample. For the remaining workers, the indicator used is a specific number that represents the respective worker's level of performance. More specifically, for 84.5% of them, the indicator corresponds to an absolute number, while for the other 15.5%, it is measured as a numeric change with respect to the measurement of the previous period. The measurement is homogeneous over time for the same individual but varies across individuals, as it depends on the specific job of each worker. Both the absolute number and the change reflect the exact number of executed tasks (e.g., the number of procedures completed, the number of contracts concluded, the number of transactions performed, etc.), or the evaluation of the employee on a scale reported by the supervisor, or the compliance with deadlines (yes or no).

Since we are interested in the effect of treatment over the entire period (which ensures that the effect does not depend on possible periods of peaks in job duties during the year), we consider cumulative variations of the objective indicator as follows. We consider each monthly variation; the variations can be positive, negative or null. We sum all variations and create a dichotomous variable that has the value of 1 if that sum is positive, thus indicating an overall improvement of productivity over the treatment period, and is zero otherwise. Subsequently, we perform a logistic regression for this dichotomous variable.

For example, consider a worker who has to perform a set of procedures. His/her

[9] According to our knowledge of the operation of the firm and information received by the managers, September is an ordinary month in terms of productivity of workers. As the new working arrangements may take some time to fully stabilize, we also rerun the analysis, considering October 2016 as the month preceding testing. This adjustment does not change results.

productivity is measured on the basis of how many procedures he/she is able to complete during a month. In the reference month of September, he/she completed 68 procedures, while the respective number was 14 in October, 79 in November, 105 in December, etc. We calculate for each month from October to June the difference as a percentage with respect to the value as of September. Next, we sum all of these percentages. A positive value of this final sum indicates an improvement of productivity over the examined period. If there are more tasks assigned to the same worker, we consider the overall sum for all tasks. We proceed similarly if a task is measured by the number of concluded contracts or that of performed transactions or another quantitative metric. As another example, consider a worker who receives an evaluation on the scale from 1 to 10 every month. If the evaluation in the reference month of September is equal to 6 and in the following month is equal to 8, the change in the latter month is positive and equal to 2. We sum the changes between the evaluation of each month and the evaluation of September and create a dichotomous variable that has the value of 1 if that final sum is positive and is 0 otherwise.

We present several figures that visually show the evidence we will analyze. Figure 2 shows for each month of the treatment period the percentage of treated and control groups' workers whose productivity increased relative to that in the previous month. In each month, the percentage for treated group's workers is higher than that for the control group's workers. This suggests that the difference between treatment and control is not only an impact of the introduction of flexible work, probably related to the change, but continues over time.

To understand whether the change in productivity varies over time during the experiment, in Figure 3 we show the objective productivity of treated and control groups' workers after 3, 6 and 9 months. The difference is not statistically significant after 3 months but appears after 6 months.

Finally, Figure 4 compares the average numbers of days of leave requested monthly by treated and control groups' workers over the period of the experiment. Interestingly, starting from the same point, after one month the total

amount of days of leave of the treated group is consistently lower than that of the control group.

4.2 Questionnaires

We designed questionnaires to collect data on productivity, well-being and the work-life balance. Workers and supervisors in both the treated and control groups were asked to complete one questionnaire before the experiment (the pre-treatment questionnaire) and another one afterwards (the post-treatment questionnaire). The questionnaires include questions related to productivity, well-being and the work-life balance. In the post-treatment questionnaire, the treated group also answered questions related to their evaluation of the policy. Questionnaires are shown in Appendix F.

Productivity assessed by the questionnaires includes self-reported productivity and that reported by supervisors. Self-reported productivity includes 5 outcomes: a measure of output, i.e., the capacity to attain the assigned goals, efficiency at work, i.e., the capacity to attain the assigned goals within an appropriate time, proactivity at work, i.e., the capacity to take initiative appreciated by others; availability to answer emails or work outside working hours and capacity to comply with predetermined deadlines. The respondents are asked to evaluate each outcome on a scale from 1 to 5, where 1 corresponds to "Very Low", and 5 corresponds to "Very High". Productivity reported by the supervisor includes the same 5 outcomes. They are consistent with measures used by existing case studies, reports, and toolkits focused on flexible work and productivity (see Golden (2012), Pruchno et al. (2000), Kossek and Michel (2011), etc.).

The well-being assessment includes standard questions drawn from the British Household Panel Survey (Taylor et al. (1993)). These questions are widely used in the literature on economics of happiness (see reviews in Van Praag et al. (2003) and Luhmann et al. (2012)). Respondents are asked to indicate the extent of their satisfaction on a scale from 1 to 7, where 1 corresponds to "highly dissatisfied" and 7 corresponds to "highly satisfied" with the following 7 dimensions: income, health status, home, job, social life, free time, and life

overall. Respondents also have to report on a scale from 1 (much less than usual) to 5 (much more than usual) their ability to deal with the following 7 aspects of their lives: staying focused (referred to as "FocusedOn" in the tables), losing sleep due to any concerns, feeling that they play a useful role in their work life, being able to make decisions, appreciating the daily activities in a regular day, feeling stressed, and feeling unable to overcome difficulties.

The work-life balance assessment asks about satisfaction with working hours, how working hours adapt to private life and the feeling of being able to balance work with personal and family life. Workers are also asked to quantify the time devoted to household activities per day (cleaning and housekeeping) in two-hour ranges from "Less than 2 hours" up to "More than 6 hours" and to quantify the time dedicated to taking care of others (children, elderly, or other family members).

We provide first insights on the well-being and work-life balance indicators through a visual analysis. Figure 5 and Figure 6 display kernel density functions for the treated and control groups before and after the treatment with reference to two specific outcomes: satisfaction with social life and ability to deal as usual with stress. Interestingly, while the pre-treatment kernel densities of treated and control groups overlap almost completely, they diverge after treatment, which thus suggests the emergence of an effect of the intervention.

The questionnaires also ask for the home-to-work distance in kilometers.

Finally, they contain questions about the commitment of workers to the company. The questions are: "How attached do you feel to the company?", "Do you believe your work is sufficiently recognized?" and "Do you have a sense of moral responsibility towards the company?"

Table 6(panel a) shows the results of the t-test for the difference between the means of treated and control groups for each outcome variable measured before the treatment (i.e., using data from the pre-treatment questionnaire). It confirms that the starting point is the same for treated and control groups, i.e., the two groups are balanced before the treatment, which confirms the

validity of our randomization. The same result is obtained when we consider only respondents (in both treated and control group) to the post-treatment questionnaire (panel b). To further insure that the attrition rate is not problematic for our results, we also show balance tests of pre-treatment outcomes for respondents and non respondents (to the post-treatment questionnaire) within the treated group (panel c) and the control group (panel d).

Table 7 summarizes the outcome variables from the post-treatment questionnaires, related to the different dimensions of productivity, well-being, work-life balance and commitment to the company.

Additionally, we check that the difference between the number of hours worked by treated and control groups' workers before and after the experiment is not statistically significant, confirming that any possible effect of treatment on the outcome variables does not depend on a change in the number of hours worked (Table 5).

5 Empirical strategy

We estimate the effect of treatment (i.e., of smart-working) on our indicators of productivity, well-being and work-life balance.

One of the measures of productivity is the improvement of objective productivity, a dichotomous outcome that has the value of 1 if the sum of the monthly productivity changes is positive, and is zero otherwise. We run a logistic regression to estimate this outcome and report the odds ratio of improvement for treated group's workers compared to those of the control group.

We use an ordinary least squares (OLS) model to estimate the effect of treatment on the other indicators of productivity (number of days of leave, self-reported productivity and productivity reported by the supervisor) and on the indicators of well-being and work-life balance. For each of these indicators, we estimate the following equation at the individual level:

$$y_{i,POST} = \alpha + \beta TREATMENT_i + \delta X_i + \gamma y_{i,PRE} + \varepsilon_i \qquad (1)$$

where $y_{i,POST}$ is the specific measured outcome for individual i post-treatment according to the dimensions of productivity, well-being and work-life balance, as summarized in Table 7, $TREATMENT_i$ is a dummy variable that has the value of 1 if individual i has been assigned to the treatment group and is 0 if he/she belongs to the control group, $y_{i,PRE}$ is the specific outcome for individual i measured before treatment according to the three mentioned dimensions (productivity, well-being and work-life balance), X_i are individual control variables, and finally, ε_i is an error term. Given the randomization, there should be no need to add control variables to measure the average treatment effects. However, control variables are included to improve the accuracy of estimates. Control variables are: the age of respondent (AGE) and its square ($AGESQUARED$), gender, captured by a dummy variable $MALE$ that has the value of 1 if the respondent is male and 0 if the respondent is female, two dummy variables ($LAW104WORKER$ and $LAW104RELATIVES$) that capture the use of Law 104 for the worker or for a relative, respectively, two dummy variables related to children, namely, $CHILD$ that has the value of 1 if the worker has at least one child and is 0 otherwise, and $YOUNGCHILD$ that has the value of 1 if at least one of the children of the worker is aged 3 or below and is 0 otherwise, a dummy variable $TEAM$ that is equal to one if the worker works in a team and is 0 otherwise, and the distance between the worker's residence and the workplace in kilometers (KM).

Since, as has already been mentioned, we oversample some characteristics of the population (female, people under the age of 46, subjects with children under the age of three and workers with a relative protected by Law 104), using weighting is recommended to make the analysis of the sample representative for the target population. We thus create a set of weights that is the inverse of the probability of inclusion of each stratum of the oversampled categories. In what follows, we report all analysis results using these weights.

We also use a difference-in-differences model to estimate the effect of treatment on the treated group, as opposed to the control group. The model and the results of these estimates are reported in Appendix D. They are consistent

with what is presented in the following sections of the main text.

6 Results

We present results according to the three dimensions we investigate: productivity, well-being and work-life balance.

6.1 Productivity

The first dimension we consider is productivity. As explained, we consider three measures of productivity: objective, self-reported by the worker and reported by the supervisor. In each table and for each outcome, the first column reports the average treatment effect, and the second column includes control variables. The coefficients of the control variables are shown in Appendix A.

Starting from the indicator of objective productivity, Table 8 panel a, columns 1 and 2 show a significant increase of objective productivity for the treated group after treatment. The odds ratio for treated workers is twice the odds ratio for the control group. Second, we consider days of leave. Results of OLS estimates of Equation 1 are reported in Table 8 in columns 3 and 4. The treatment reduces the number of days of leave (the reduction is by 5.6 days over the entire period of the experiment). This likely occurs because smart-workers can better organize their time than can non-smart-workers and are less in need of asking for leave due to sickness or other reasons (e.g., if they need to visit a doctor or have to pick up children from daycare centers or assist elderly parents, etc.).[10]

Overall, panel a of Table 8 suggests an increase of productivity associated with smart-working. What drives this increase in productivity? It is difficult

[10]Note that for objective measures we work with a sample size that differs from that for the other outcomes. This is due to the different source of data, which is obtained directly from the firm rather than from questionnaires. The percentage of missing data points is higher because the analyzed sample has different missing values from those in the information supplied by the firm.

to test exactly what happens to smart-workers that has a positive effect on their objective productivity. It might be that smart-workers spend less time at lunch or on coffee breaks or bathroom breaks, as it has also been observed for telecommuters (see Bloom et al. (2014)). Other possible reasons that could explain the increase of productivity of smart-workers relate to the time saved in commuting or in taking children to and picking children up from school, which could allow workers to start working earlier, or to be more focused on their jobs during the smart-working day. However, we cannot appropriately test for this.

Another interesting possibility is that, due to smart-working, workers become more attached to the company, and thus are also more productive. According to the "Hawthorne effect", treated workers have a positive feeling toward the firm, which allows them to use smart-working and reciprocate by working harder (see Falk and Kosfeld (2006)). In other words, they work more efficiently because they feel an obligation to the company. To test the existence of this effect, we rely on the information on workers' commitment to the company. Table 16 reports the results of estimating equation 1 using as the dependent variable the answers to the following questionnaire's questions: "How attached do you feel to the company?", "Do you believe your work is sufficiently recognized?" and "Do you have a sense of moral responsibility towards the company?" Results show that treatment is associated with a greater sense of moral responsibility. The other two dimensions of commitment are instead not statistically significant. These results indicate some evidence of the existence of the "Hawthorne effect".

Additional insights into the mechanisms at work will be drawn from the analysis of heterogeneous effects across workers with different characteristics, which we explore in sections 6.4 and 7.

Next, we consider self-reported productivity that includes the five outcomes described in section 4.2: output ("production"), efficiency, proactivity, availability to respond to emails, and compliance with deadlines. Panel b of Table 8 shows results of estimating equation 1 obtained by using these five measures as the dependent variable. The average treatment effect is positive and sig-

nificant for all measures except availability to respond to emails, and remains significant (apart from productivity) if control variables are included.[11]

Finally, we estimate equation 1 using as the dependent variable the same five outcomes while instead using the answers of the supervisor of each worker. The respective results are shown in panel c of Table 8, which confirms that smart-workers increase their compliance with deadlines compared to results for the control group; this finding also holds if workers are assessed by supervisors. We note that the number of observations in this analysis is smaller because supervisors did not always respond.

6.2 Well-being

The second dimension we consider is well-being. As anticipated, we measure well-being in two ways. First, workers are asked to self-assess on a scale from 1 to 7 their personal satisfaction with respect to seven variables: income, health status, home, work, social life, free time, and life in general. Second, they are asked whether they are able to deal as usual on a scale from 1 to 5 (where 1 corresponds to "much less than usual" and 5 to "much more than usual") with seven aspects of their life: staying focused, losing of sleep due to any concerns, feeling that they play a useful role in their work life, being able to make decisions, appreciating the daily activities in a regular day, feeling stressed, and feeling unable to overcome difficulties.

Panel a of Table 9 shows the results of estimating equation 1 using as the dependent variable seven different measures of satisfaction, while panel b shows results for seven "satisfaction as usual" measures of well-being. Smart-working increases the individual satisfaction with social life, free time and life in general. When we include control variables, positive and significant effects are also observed for satisfaction with income, health and home.

Moreover, smart-workers are more capable than usual of dealing with all aspects of their lives (apart from playing a useful role): in panel b of Table 9,

[11]Note that, consistently with most of the literature on this topic, age has a nonlinear relationship with (self-declared) productivity: the latter increases up to a certain age and subsequently starts to decline.

the coefficients of treatment are positive and significant.[12]

6.3 Work-life balance

The third dimension we consider is the work-life balance, measured by four variables that correspond to satisfaction with four aspects: working hours, balance between working life and personal/family life, the amount of household activities (cleaning and housekeeping) per day and the amount of time dedicated to taking care of others (children, elderly, or other family members).

Panel a of Table 9 reports estimates of equation 1, where for each column the dependent variable is one of the above 4 measures of work-life balance. The table shows that treatment is associated with more time being dedicated to household and care activities.

6.4 Heterogeneous effects by gender

One of the most interesting yet expected consequences of the introduction of flexible work is the reduction of gender gaps (Goldin, 2014). Smart-working is expected to reduce gender gaps for at least two reasons. First, although smart-working does not target women, it may be particularly promising for women's employment because it promotes work-family balance, which is a major concern for employed women, who typically bear the double burden of work and family/care responsibilities. This is particularly true in Italy, where, according to the most recent data of the Italian National Institute of Statistics (Istat, 2018), women spend 3 hours per day more than men in domestic and unpaid care work, and more than 4 hours if we consider couples with children. The country exhibits the highest asymmetry in time use within couples across all European countries. Second, by promoting work-life balance and a more

[12]In Appendix A, we report the coefficients of covariates. Note that being a woman is significant when we measure satisfaction with income. As intuitively expected, age and the use of Law 104 are instead negatively related to satisfaction with health. Interestingly, workers with children are more satisfied with their income and health, but those with a young child are less satisfied with income and health. Workers who live farther from their workplace are more satisfied with their home and work.

efficient allocation of time, smart-working may increase the participation of men in housework and childcare.

In this section, we examine heterogeneous effects for men and women in our sample. Our balance tests for the covariates by gender, presented in Table 10, confirm that the subsamples of men and women are randomly divided, and thus our analysis by gender is expected to be informative.

Table 11 shows that the improvement of objective productivity and a reduction of the number of days of leave is driven by women. However, if productivity reported by supervisors is considered, the increase in availability and improved compliance with deadlines (the two dimensions that were overall significant) is more likely attributed to men. Table 12 shows that male smart-workers show a higher satisfaction with home, social life and free time, while female workers exhibit higher satisfaction with work and life in general. Considering the self-assessed comparison with the usual conditions, women feel more focused, lose less sleep and feel more useful than before the treatment (table 12, panel b). Yet men show a significant improvement in being able to "focus on" and appreciate daily activities, experiencing less stress and feeling more able to overcome difficulties (table 12, panel b). Interestingly, considering the indicators of work-life balance (table 12, panel c), we observe that men claim to spend significantly more time in household work and care activities after the introduction of smart-working. In other words, as anticipated, and against the stereotype that men may use job flexibility for performance purposes and women for work-family balance, we find causal evidence that smart-working increases participation of men in household and care activities, which is a fundamental step towards more gender equality. Women are more satisfied with working hours and the impact of work on women's private life. Smart-working contributes to the reduction of gender gaps through both a better work-life balance for women and greater participation of men in housework and care activities.

This result suggests that smart-working should be particularly appealing to workers with children. As the treated and control groups are balanced with respect to the number of children (see Table C.1 in Appendix C) in addition to

other factors, we investigate heterogeneity between workers with and without children. We observe no heterogeneous effects in productivity. The results seem to suggest that, as expected, while smart-working is beneficial for the well-being of all individuals, it is particularly appreciated by workers with children who have strong work-life balance needs (see Tables C.3 and C.4 in Appendix C).[13]

7 Heterogeneous and spillover effects by team

Other interesting yet expected consequences of the introduction of flexible work are the different effects of smart-working for workers in teams and workers not in teams and the possible spillover effects from treated group's workers to control group's coworkers in the same team. The literature, though limited to low-skill jobs, suggests that workers who observe their peers increase their efforts and productivity (Mas and Moretti, 2009). Thus, smart-working, by introducing one day of remote and flexible working, may produce a negative effect on productivity of control group's workers of the same team. This negative spillover effect characterized also telecommuting (Bloom et al. (2014)).

In this section, we first consider working in a team as a dimension of heterogeneity. We know whether each worker – both in the treated group and in the control group – works in a team and are able to identify the coworkers in the same team. Approximately 70% of workers work in teams. The characteristics of workers in the two subgroups – of those working in teams and of those not working in a team – are balanced across the treated and control groups (see Table 13).

Working in a team does not seem to be significantly related to productivity measures (Appendix A). However, we are interested in possible differential effects of smart-working for workers in teams and workers not in a team. In

[13]Our randomized experiment allows us to also analyze heterogeneous effects by age and type of job, for which, however, we do not have clear expectations. This analysis is available upon request. Unfortunately, we are unable to analyze heterogeneous effects by work-to-home distance because there is no division in balanced subgroups according to this dimension.

Table 14, we add the team variable and the interaction between team and treatment to the baseline scenario. Smart-working increases the objective productivity of workers but does not do so differently for workers in teams and workers not in a team. Self-reported productivity and productivity reported by supervisors are unaffected by working in a team, showing that there are no significant spillover effects of productivity on team workers. A different result is obtained for the number of days of leave, which significantly increases for smart-workers in teams. Treated group's workers not in a team show a decrease by more than 18 days in the number of days of leave, which is reduced to 1.154 days (17.825-18.979=-1.154) for treated workers in teams. The latter seem to be able to enjoy more days of leave than do those not in a team, without altering their objective productivity.

Second, we consider the possible spillover effects from treated group's workers to control group's workers of the same team. We consider workers in the control group and compare the performance of those who had at least one member of their team included in the treated group and that of the others. In panel a of table 17, we do not observe a significant difference of self-reported productivity for these two groups. No significant difference is detected either if we compare workers in the control group in a team with more than 40% of treated group's members and the other workers (panel b). Similarly, we consider the subsample of individuals in the control group and compare their outcomes before and after the treatment of their colleagues (Table 18). Again, we consider control workers in a team with at least one treated group's worker (panel a) and those in a team with more than 40% of treated group's workers (panel b). Both panels show that there are no significant negative spillover effects.[14]

8 Additional analysis and Robustness tests

We perform several robustness checks to address potential concerns as to the interpretation of our results.

[14]Overall, the absence of spillover effects is a validation of our experiment because it confirms that treatment and control groups are clearly separated.

A typical concern in research using questionnaires relates to the reliability of answers when questionnaires are quite long, as in our case. Scholars of survey methods have underscored that when individuals answer a long questionnaire, at a certain point they often start answering automatically (see Pintrich et al. (1991)). For this reason, we introduced several questions about a similar topic but using a reverse scale. The obtained results reassure against this concern: respondents answered carefully, as questions with a positive meaning but asked in a negative way were correctly answered negatively.

Since our dataset is very rich and allows us to include a large number of control variables that could potentially influence the dependent variables, we use the method of stepwise selection of covariates to select the best model to estimate. Results, available upon request, are very similar to what we presented in our main tables.

As a further analysis, we perform the same regressions without weights. Similar results are obtained. This demonstrates stability of our results and confirms that the extracted sample is representative of the firm's workers even though we have over- or under-sampled some characteristics. Results of the unweighted analysis are available upon request.

Another typical concern with a randomized experiment of this type is that it is difficult to identify whether the significant effects observed for the treatment group depend on the improvement of the treated group or a worsening performance of the control workers who are dissatisfied with having being excluded from the treatment, though randomly. Since we still observe a performance gap between treatment and control groups – in productivity, well-being and work-life balance dimensions – our estimated treatment effect is likely to be downward-biased.

As a further test, in table 19 we consider various features of the control group and compare for each feature its average performance before and after treatment even if control group's workers had not been subject to it. The t-tests show that there are no statistically significant differences in the outcomes of the control group before and after treatment, apart from three outcomes (com-

pliance with deadlines, household activities and care activities). Yet, for these three outcomes the direction of the change is positive, i.e., workers in the control group increase rather than decrease their performance after the policy's implementation. Thus, the increased productivity of the treated group's workers cannot be confounded by a worsening performance of the control group.

Finally, to confirm our results, we produce bounds for the estimates of several outcome variables as proposed by Lee (2009) (Appendix B). We consider the outcomes on which smart-working has a strong significant impact: satisfaction with social life, free time and life in general, feeling "as usual" with respect to staying focused and appreciating daily activities, losing less sleep and feeling less stressed, and experiencing better work-life balance of household and care activity. The upper and lower bounds of these estimates have the same sign, and 95% confidence intervals for the bounds only barely include zero.

9 Discussion and Conclusion

We have established a causal link between the introduction and use of smart-working and several economic outcomes that capture workers' productivity, well-being and work-life balance. The three sets of outcomes together suggest interesting insights.

First, smart-workers claim to be more satisfied with their free time and social life. Does this mean that they reduce the extra paid work hours and thus their earnings? Although we do not have data on earnings to directly test this effect, we note that smart-workers also claim to be more satisfied with their incomes, suggesting that there is no negative effect of smart-work on earnings.

Second, the observed increase in productivity means that, for the same pay, smart-workers put more effort into their jobs than do non smart-workers. Smart-workers are more focused and more active. This may be the result of different and more effective organization of their time, including a reduction of commuting time and a better use of time within the household. This effect is captured by the work-life balance indicators that show that smart-workers spend more time in household and care activities. We also note that

the corresponding increase in well-being indicators suggests that the increase in productivity goes beyond different and better time management. The fact that job satisfaction increases even if workers apply more effort means that smart-workers have a positive perception of the new form of work organization: they are ready to exchange more effort for more flexibility to maintain or even increase their job satisfaction.

Our study will have substantial policy implications. Smart-working is a recent approach that is rapidly spreading and is now regulated in several countries. Removing the constraints of space and time of work looks a promising way for a more efficient organization of working. Moreover, our results are stronger for women. Consistently with the view of Goldin (Goldin, 2014), our results suggest that the flexibility introduced by smart-working may contribute to reducing gender gaps at work.

Smart-working also appears to be a promising way to promote work-life balance, which is becoming a significant issue in modern societies. Interestingly, this result was not obvious, as previous analyses have warned about the risk of over-working related to flexible work arrangements, with all the possible negative consequences (involving stress, well-being, health, etc.). Ex-post evaluations such as those performed by previous studies are, however, unconvincing, as they may hardly infer causality. Random assignment as in the approach we used in our study is a way to guarantee the direction of causality and unbiased estimates. In other words, having based our analysis on a randomized experiment, we can ensure that we have established an internally valid identification of the effects of smart-working.

The spread of coronavirus is accelerating the use of smart-working as the only way for firms to respond to this disruptive event. This will also be an opportunity to reimagine work organization after the crisis. In this case, our results will have useful applications.

It is difficult to assess the extent to which our results can be generalized to other contexts. This is a common concern for all randomized field trials in economic and policy research. However, our experiment was performed in a

developed country, for a large set of jobs, and in a context quite representative of the current conditions in many other countries. While this is the first study of this type, future studies will assess whether the same results apply also to other contexts, where smart-working is indeed discussed and implemented, but no causal evidence of its economic effects exixts.

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10 Figures

Figure 1: Flowchart of participants' progress through the phases of the trial

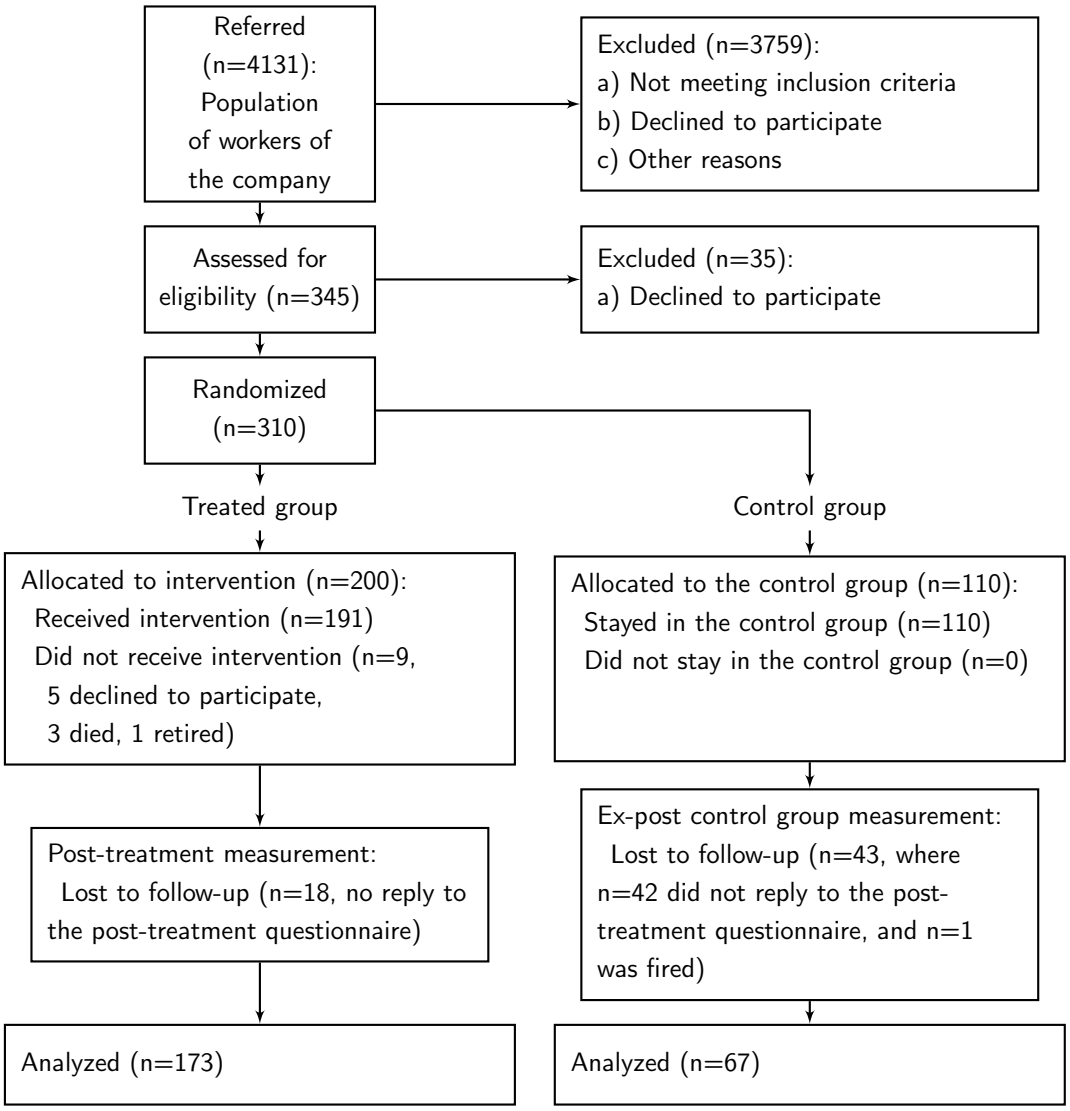


Figure 2: Percentage of treated and control group workers whose objective productivity increased with respect to the previous month (for each month of the treatment, October - June)

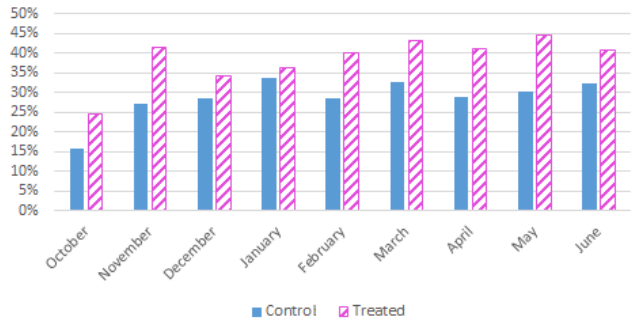


Figure 3: Objective productivity of treated and control group workers after 3, 6 and 9 months

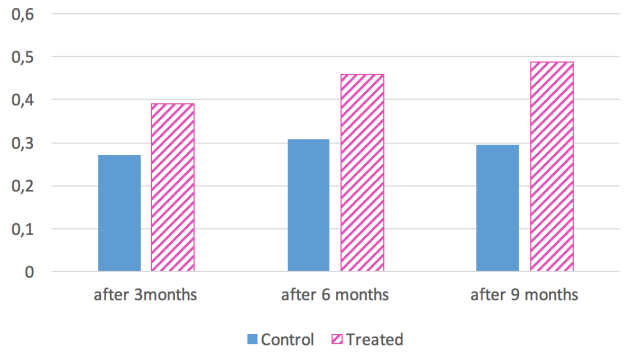


Figure 4: Days of leave

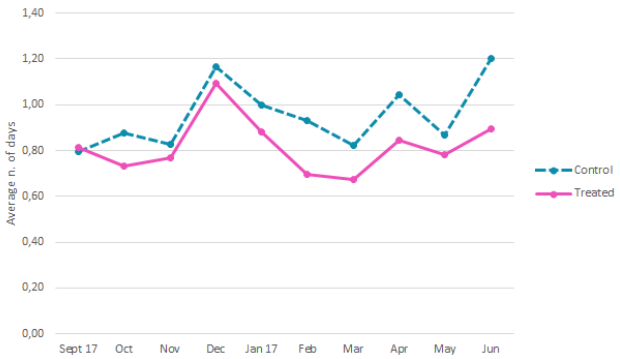


Figure 5: Kernel density plots for work-life balance

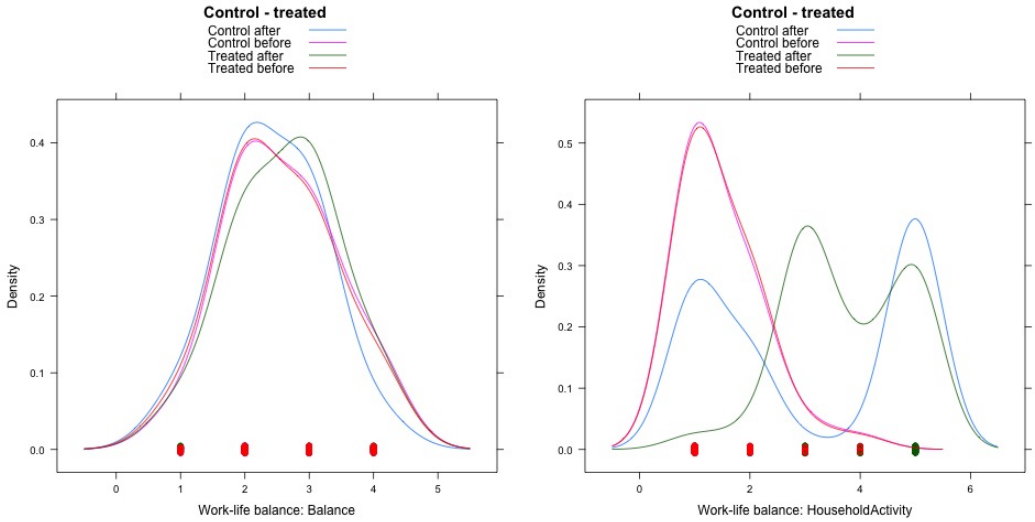
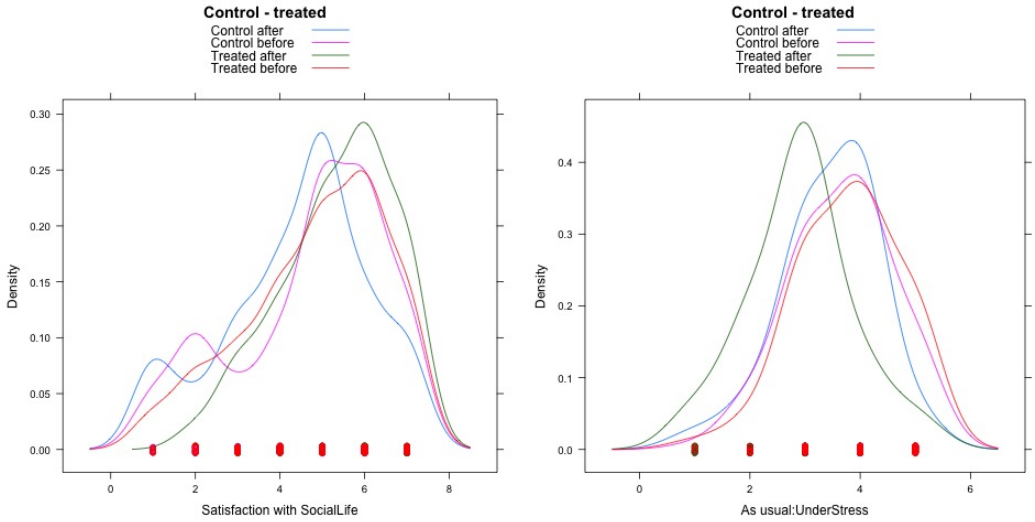


Figure 6: Kernel density plots for satisfaction with social life and for stress status



11 Tables

Table 1: Comparison between the sample and the population

Variable		Population	Sample
Gender	Male	3146	174
	Female	985	136
Age group	Under 46	1686	186
	46 or above	2445	124
Young Child	Yes	338	108
	No	3793	202
Familiar with 104	Yes	525	88
	No	3606	222

Table 2: Balance tests - Treated and Control groups (means of observable characteristics)

Variable	Treated	Control	Test Statistic	p-value
Obs.	191	110		
Age	43.27	43.51	-0.2602	0.7949
Male	0.555	0.564	-0.1453	0.8846
Law104Worker	0.0367	0.0182	0.9041	0.3667
Law104Relatives	0.283	0.264	0.3557	0.7223
Child	0.754	0.773	-0.3671	0.7138
Young Child	0.298	0.291	0.1372	0.8909

Notes: Two-sample t-test for a comparison between means. Significance: * indicates $p<0.05$.

Table 3: Balance tests for the attrition rate: means of observable characteristics of respondents and non-respondents to the post-treatment questionnaire

Variable	Respondents	Non-Respondents	Test Statistic	p-value
Obs.	240	61		
Age	43.3	43.59	-0.2661	0.7903
Male	0.525	0.6885	-2.309	0.02162 *
Law104Worker	0.0375	0	1.536	0.1255
Law104Relatives	0.2708	0.2951	-0.3773	0.7063
Child	0.7625	0.7541	0.1369	0.8912
Young Child	0.2708	0.3934	-1.879	0.06128

Notes: Two-sample t-test for a comparison between means. Significance: * indicates $p<0.05$.

Table 4: Balance tests for the intention to treat: means of observable characteristics of respondents and non-respondents to the post-treatment questionnaire for treated and control groups

Treated Group				
Variable	Respondents	Non-Respondents	Test Statistic	p-value
Obs.	173	18		
Age	43.29	43.06	0.1241	0.9014
Male	0.5376	0.7222	-1.501	0.135
Law104Worker	0.04046	0	0.8667	0.3872
Law104Relatives	0.2775	0.3333	-0.4987	0.6186
Child	0.7514	0.7778	-0.2456	0.8063
Young Child	0.2832	0.4444	-1.423	0.1565
Control Group				
Variable	Respondents	Non-Respondents	Test Statistic	p-value
Obs.	67	43		
Age	43.31	43.81	-0.3485	0.7282
Male	0.4925	0.6744	-1.89	0.0614
Law104Worker	0.02985	0	1.14	0.2569
Law104Relatives	0.2537	0.2791	-0.2917	0.771
Child	0.791	0.7442	0.5679	0.5713
Young Child	0.2388	0.3721	-1.504	0.1356

Notes: Two-sample t-test for a comparison between means. Significance: * indicates $p<0.05$.

Table 5: Time worked (in minutes)

Variable	Treated		Control		Test Statistic	p-value
	Obs.	Mean	Obs.	Mean		
Minutes-Pre	190	525.911	109	521.615	0.652	0.515
Minutes-Post	173	524.087	67	526.127	-0.286	0.776

Notes: Two-sample t-test for a comparison between means. Significance: * indicates $p<0.05$.

Table 6: Balance tests of pre-treatment outcomes

Panel a.						
Variable	Treated		Control		Test Statistic	p-value
	Obs.	Mean	Obs.	Mean		
Objective productivity						
Improvement	169	0.249	100	0.160	1.027	0.3055
Days of leave	192	3.201	109	2.837	0.6868	0.4928
Self-reported productivity						
Production	191	3.874	110	3.773	1.125	0.2615
Efficiency	190	3.905	110	3.727	2.066	0.03971 *
Proactivity	190	3.821	110	3.736	0.9669	0.3344
Email	190	1.995	110	1.945	0.5468	0.585
Deadlines	190	4.611	110	4.545	1.059	0.2907
Well-being						
Income	188	4.117	108	4.148	-0.1797	0.8575
Health	190	4.653	110	4.818	-0.8062	0.4208
Home	190	5.121	108	5.25	-0.7047	0.4816
Work	189	4.831	108	5.037	-1.252	0.2114
SocialLife	188	4.856	107	4.738	0.5786	0.5633
FreeTime	187	3.107	109	3.174	-0.3214	0.7482
LifeInGeneral	190	4.989	109	5.009	-0.1252	0.9004
Satisfaction as usual						
FocusOn	190	2.958	110	3.209	-2.398	0.01711 *
LoseLessSleep	190	2.579	110	2.682	-0.7876	0.4316
UsefulRole	190	3.047	110	3.218	-1.489	0.1376
MakeDecisions	190	3.2	110	3.327	-1.208	0.2282
AppreciateDailyActivities	190	3.011	110	3.127	-1.239	0.2162
LessStress	190	2.579	110	2.682	-0.7876	0.4316
NotOvercome	190	2.211	110	2.355	-1.326	0.1857
Work-life balance						
WorkingHours	190	2.637	110	2.627	0.08019	0.9361
Balance	190	2.463	110	2.418	0.456	0.6488
HouseholdActivity	190	1.489	110	1.473	0.1977	0.8434
CareActivity	190	2.079	110	2.118	-0.3371	0.7363

Panel b. Respondents to the post-treatment questionnaire						
Variable	Treated		Control		Test Statistic	p-value
	Obs.	Mean	Obs.	Mean		
Self-reported productivity						
Production	173	3.879	67	3.776	0.9634	0.3363
Efficiency	173	3.895	67	3.687	2.05	0.04147 *
Proactivity	173	3.808	67	3.746	0.5861	0.5584
Email	173	1.983	67	1.970	0.1134	0.9098
Deadlines	173	4.610	67	4.552	0.7939	0.428
Well-being						
Income	170	4.112	67	4.328	-1.083	0.2799
Health	172	4.657	67	4.836	-0.7106	0.4781
Home	172	5.116	67	5.358	-1.108	0.2691
Work	171	4.789	66	5.061	-1.367	0.1729
SocialLife	170	4.829	64	4.500	1.308	0.1921
FreeTime	170	3.071	66	2.803	1.076	0.2829
LifeInGeneral	172	4.959	66	4.833	0.6476	0.5179
Satisfaction as usual						
FocusOn	172	2.988	67	3.164	-1.436	0.1522
LoseLessSleep	172	2.570	67	2.597	-0.1785	0.8585
UsefulRole	172	3.052	67	3.343	-2.159	0.03189*
MakeDecisions	172	3.233	67	3.299	-0.5273	0.5985
AppreciateDailyActivities	172	3.035	67	3.239	-1.804	0.07245
LessStress	172	2.570	67	2.597	-0.1785	0.8585
NotOvercome	172	2.186	67	2.328	-1.079	0.2817
Work-life balance						
WorkingHours	172	2.640	67	2.552	0.6098	0.5426
Balance	172	2.465	67	2.418	0.3927	0.6949
HouseholdActivity	172	1.506	67	1.448	0.5724	0.5676
CareActivity	172	2.128	67	2.134	-0.04639	0.963

Panel c. Treated group						
Variable	Respondents		Non-respondents		Test Statistic	p-value
	Obs.	Mean	Obs.	Mean		
Objective productivity						
Improvement	154	0.253	0.200 15		0.4531	0.6511
Days of leave	173	3.312	18	2.315	0.8948	0.372
Self-reported productivity						
Production	173	3.879	18	3.833	0.2344	0.8149
Efficiency	173	3.895	18	4.000	-0.5971	0.5512
Proactivity	172	3.808	18	3.944	-0.7272	0.468
Email	172	1.983	18	2.111	-0.6762	0.4998
Deadlines	172	4.610	18	4.611	-0.005098	0.9959
Well-being						
Income	170	4.112	18	4.167	-0.1531	0.8785
Health	172	4.657	18	4.611	0.1037	0.9175
Home	172	5.116	18	5.167	-0.13065	0.8963
Work	171	4.789	18	5.222	-1.263	0.2082
SocialLife	170	4.829	18	5.111	-0.6919	0.4899
FreeTime	170	3.071	17	3.471	-0.9629	0.3369
LifeInGeneral	172	4.959	18	5.278	-0.9391	0.3489
Satisfaction as usual						
FocusOn	172	2.988	18	2.667	1.494	0.1368
LoseLessSleep	172	3.430	18	3.333	0.3682	0.7131
UsefulRole	172	3.052	18	3.000	0.2144	0.8305
MakeDecisions	172	3.233	18	2.889	1.551	0.1227
AppreciateDailyActivities	172	3.035	18	2.778	1.273	0.2045
LessStress	172	2.570	18	2.667	-0.3682	0.7131
NotOvercome	172	2.186	18	2.444	-1.143	0.2544
Work-life balance						
WorkingHours	172	2.640	18	2.611	0.1154	0.9083
Balance	172	2.465	18	2.444	0.1006	0.9199
HouseholdActivity	172	1.506	18	1.333	0.99	0.3235
CareActivity	172	2.128	18	1.611	2.184	0.03017 *

Panel d. Control group						
Variable	Respondents		Non-respondents		Test Statistic	p-value
	Obs.	Mean	Obs.	Mean		
Objective productivity						
Improvement	60	0.2	40	0.1	1.335	0.185
Days of leave	67	2.861	42	2.798	0.07408	0.9411
Self-reported productivity						
Production	67	3.776	43	3.767	0.06205	0.9506
Efficiency	67	3.687	43	3.791	-0.7178	0.4745
Proactivity	67	3.746	43	3.721	0.1881	0.8512
Email	67	1.970	43	1.907	0.4428	0.6588
Deadlines	67	4.552	43	4.535	0.1706	0.8648
Well-being						
Income	67	4.328	43	3.854	1.701	0.09182
Health	67	4.836	43	4.791	0.1444	0.8855
Home	67	5.358	43	5.073	0.9885	0.3252
Work	67	5.061	43	5.000	0.2295	0.8189
SocialLife	67	4.500	43	5.093	-1.724	0.08769
FreeTime	67	2.803	43	3.744	-2.58	0.01123 *
LifeInGeneral	67	4.833	43	5.279	-1.922	0.05725
Satisfaction as usual						
FocusOn	67	3.164	43	3.279	-0.6673	0.506
LoseLessSleep	67	3.403	43	3.186	0.9729	0.3328
UsefulRole	67	3.343	43	3.023	1.814	0.07252
MakeDecisions	67	3.299	43	3.372	-0.4429	0.6587
AppreciateDailyActivities	67	3.239	43	2.953	2.026	0.04521 *
LessStress	67	2.597	43	2.814	-0.9729	0.3328
NotOvercome	67	2.328	43	2.395	-0.3819	0.7033
Work-life balance						
WorkingHours	67	2.552	43	2.744	-0.9789	0.3298
Balance	67	2.418	43	2.419	-0.004328	0.9966
HouseholdActivity	67	1.448	43	1.512	-0.4567	0.6488
CareActivity	67	2.134	43	2.093	0.214	0.831

Notes: Two-sample t-test for a comparison between means. Significance: * indicates $p<0.05$.

Table 7: Summary statistics of outcome variables (post-experiment questionnaire)

Statistic	Obs.	Mean	St. Dev.	Min	Max
Commitment to the company					
Attachment	238	4.273	0.830	2	5
Work recognized	238	1.853	0.740	1	3
Responsibility	238	1.059	0.339	1	3
Objective productivity					
Improvement	240	0.399	0.491	0	1
Days of leave	240	40.930	30.459	7	151
Self-reported productivity					
Production	240	3.971	0.699	2	5
Efficiency	240	3.942	0.718	3	5
Proactivity	240	3.892	0.752	2	5
Email	240	2.079	0.842	1	4
Deadlines	240	5.129	1.126	3	5
Productivity reported by supervisors					
Productivity	231	3.623	0.840	1	5
Efficiency	231	3.615	0.831	1	5
Proactivity	231	3.468	0.864	1	5
Availability	231	3.606	0.878	1	5
Deadlines	231	4.351	0.765	1	5
Well-being: satisfaction with ...					
Income	230	4.296	1.504	1	7
Health	233	4.970	1.604	1	7
Home	237	5.359	1.608	1	7
Work	235	5.034	1.408	1	7
SocialLife	234	5.094	1.488	1	7
FreeTime	234	3.637	1.794	1	7
LifeInGeneral	236	5.246	1.202	1	7
Well-being: satisfaction as usual					
FocusOn	238	3.483	0.825	1	5
LoseSleep	238	2.950	1.005	1	5
UsefulRole	238	3.332	0.920	1	5
MakeDecisions	238	3.399	0.744	1	5
AppreciateDailyActivities	238	3.471	0.767	1	5
UnderStress	238	3.059	0.935	1	5
NotOvercome	238	2.647	0.863	1	5
Work-life balance					
WorkingHours	238	2.840	0.989	1	5
Balance	238	2.584	0.795	1	4
HouseholdActivity	238	3.592	1.352	1	5
CareActivity	238	4.471	1.595	1	5

Table 8: Productivity

	Panel a. Objective productivity			
	Improvement		Days of leave	
	Logit		*OLS*	
	(1)	(2)	(3)	(4)
Treated	2.059**	2.211**	−6.002*	−5.659*
			(3.522)	(3.088)
Controls		✓		✓
Observations	195	195	202	202
R^2			0.014	0.282

Notes: The table shows results of a LOGIT estimate for the dependent variable "Improvement" and an OLS estimate for the dependent variable "Days of leave". Both are objective measures of productivity. "Treated" is a dummy variable that has the value of 1 if the individual has been assigned to the treated group and is 0 if he/she belongs to the control group. The regression includes (the respective coefficients are not shown in the table) individual controls for age, squared age, being a law 104 worker ("law 104 worker"), having law 104 relatives ("law 104 relatives"), having a child ("child"), having a young child ("young child"), distance from home to the workplace in km ("km"), being in a team ("team"), and dependent variable pre-treatment. Significance: *p<0.1, **p<0.05, and ***p<0.01.

	Panel b. Self-reported productivity									
	Productivity		Efficiency		Proactivity		Email		Deadlines	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Treated	0.142	0.104	0.249**	0.182**	0.346***	0.308***	−0.009	0.014	0.204***	0.149**
	(0.104)	(0.091)	(0.103)	(0.092)	(0.108)	(0.102)	(0.113)	(0.094)	(0.075)	(0.075)
Controls		✓		✓		✓		✓		✓
Observations	240	239	240	237	240	237	240	237	212	209
R^2	0.124	0.365	0.024	0.270	0.041	0.198	0.00003	0.358	0.034	0.141

	Panel c. Productivity reported by supervisors									
	Productivity		Efficiency		Proactivity		Availability		Deadlines	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Treated	0.161	0.098	0.029	−0.022	−0.218	−0.089	0.043	0.316**	0.227*	0.441***
	(0.145)	(0.138)	(0.131)	(0.138)	(0.137)	(0.140)	(0.154)	(0.159)	(0.122)	(0.126)
Controls		✓		✓		✓		✓		✓
Observations	173	150	173	150	173	150	173	150	173	150
R^2	0.007	0.422	0.0003	0.338	0.015	0.389	0.0004	0.381	0.020	0.371

Note: The table shows results of an OLS estimate. The dependent variables are 5 measures of productivity (self-reported and reported by the supervisors). "Treated" is a dummy variable that has the value of 1 if the individual has been assigned to the treated group and is 0 if he/she belongs to the control group. The regression includes (the respective coefficients are not shown in the table) individual controls for: age, squared age, law 104 worker, law 104 relatives, child, young child, km, team and dependent variable pre-treatment. Significance: *p<0.1, **p<0.05, and ***p<0.01.

Table 9: Well-being and work-life balance

Panel a. Satisfaction with...

	Income		Health		Home		Work		SocialLife		FreeTime		LifeInGeneral	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Treated	0.059	0.320*	0.266	0.435**	0.283	0.499***	−0.144	0.181	0.624***	0.559***	0.759***	0.834***	0.404**	0.356**
	(0.213)	(0.169)	(0.232)	(0.180)	(0.214)	(0.180)	(0.202)	(0.192)	(0.209)	(0.170)	(0.251)	(0.214)	(0.161)	(0.140)
Controls		✓		✓		✓		✓		✓		✓		✓
Observations	230	225	233	230	237	234	235	230	234	227	234	229	236	232
R^2	0.0003	0.390	0.006	0.434	0.007	0.340	0.002	0.182	0.037	0.422	0.038	0.349	0.026	0.303

Note: The table shows results of an OLS estimate. The dependent variables measure satisfaction with 7 dimensions of life on a scale from 1 (highly dissatisfied) to 7 (highly satisfied). "Treated" is a dummy variable that has the value of 1 if the individual has been assigned to the treated group and is 0 if he/she belongs to the control group. The regression includes (the respective coefficients are not shown in the table) individual controls for: age, squared age, law 104 worker, law 104 relatives, child, young child, km, team and dependent variable pre-treatment. Significance: *p<0.1, **p<0.05, and ***p<0.01.

Panel b. Satisfaction as usual

	FocusOn		LoseLessSleep		UsefulRole		MakeDecisions		AppreciateDailyActivities		LessStress		Overcome	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Treated	0.447***	0.441***	0.356**	0.366**	0.040	0.147	0.210*	0.243**	0.510***	0.497***	0.638***	0.607***	0.346***	0.270**
	(0.122)	(0.121)	(0.142)	(0.144)	(0.138)	(0.137)	(0.109)	(0.108)	(0.107)	(0.108)	(0.128)	(0.123)	(0.130)	(0.126)
Controls		✓		✓		✓		✓		✓		✓		✓
Observations	238	235	238	234	238	235	238	235	238	235	238	234	238	234
R^2	0.054	0.117	0.026	0.057	0.0004	0.133	0.016	0.089	0.088	0.132	0.095	0.202	0.029	0.095

Note: The table shows results of an OLS estimate. The dependent variable indicates if respondents have been able to deal with 7 aspects of their life on the scale from 1 (much less than usual) to 5 (much more than usual). "Treated" is a dummy variable that has the value of 1 if the individual has been assigned to the treated group and is 0 if he/she belongs to the control group. The regression includes (the respective coefficients are not shown in the table) individual controls for: age, squared age, law 104 worker, law 104 relatives, child, young child, km, team and dependent variable pre-treatment. Significance: *p<0.1, **p<0.05, and ***p<0.01.

Panel c. Work-life balance

	WorkingHours		Balance		HouseholdActivity		CareActivity	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Treated	0.112	0.203	0.138	0.250**	0.784***	0.774***	1.865***	1.948***
	(0.144)	(0.129)	(0.118)	(0.099)	(0.183)	(0.188)	(0.199)	(0.197)
Controls		✓		✓		✓		✓
Observations	238	235	238	235	238	235	238	235
R^2	0.003	0.262	0.006	0.361	0.072	0.087	0.272	0.338

Notes: The table shows results of an OLS estimate. The dependent variables are measures of work-life balance on a scale from "less than 2 hours" to "more than 6 hours". "Treated" is a dummy variable that has the value of 1 if the individual has been assigned to the treated group and is 0 if he/she belongs to the control group. The regression includes (the respective coefficients are not shown in the table) individual controls for age, squared age, law 104 worker, law 104 relatives, child, young child, km, team and dependent variable pre-treatment. Significance: *p<0.1, **p<0.05, and ***p<0.01.

Table 10: Balance Test by gender - Treated and Control groups (means of observable characteristics)

	Male				*Female*			
Variables	Treated	Control	Test Statistic	p-value	Treated	Control	Test Statistic	p-value
Obs.	107	63			Obs.	85	48	
Age	43.19	43.17	0.01047	0.9917	43.28	44.25	-0.6724	0.5025
Law104Worker	0.009346	0.03175	-1.069	0.2868	0.07059	0	1.895	0.06031
Law104Relatives	0.2897	0.2381	0.7286	0.4673	0.2824	0.2917	-0.1133	0.9099
Child	0.785	0.8254	-0.6322	0.5281	0.7176	0.6875	0.3642	0.7163
Young Child	0.3084	0.3333	-0.3352	0.7379	0.2824	0.2292	0.665	0.5072

Note: Two-sample t-test for a comparison between means. Significance: * indicates p<0.05.

Table 11: Productivity (by gender)

	Objective Productivity		*Self-reported Productivity*					*Productivity reported by Supervisors*				
	Improvement	Days of leave	Production	Efficiency	Proactivity	Email	Deadlines	Production	Efficiency	Proactivity	Availability	Deadlines
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Treated	1.079	−2.535	0.108	0.272**	0.510***	−0.031	0.133	0.147	0.070	−0.079	0.374**	0.594***
		(3.569)	(0.127)	(0.109)	(0.120)	(0.112)	(0.091)	(0.159)	(0.158)	(0.160)	(0.182)	(0.142)
Female	0.247**	11.040*	0.299	0.369**	0.517***	−0.168	−0.134	0.355	0.579*	0.158	0.454	0.737***
		(6.063)	(0.198)	(0.169)	(0.188)	(0.175)	(0.140)	(0.297)	(0.296)	(0.301)	(0.340)	(0.266)
Treated*Female	4.424*	−13.199*	−0.165	−0.300	−0.685***	0.154	0.052	−0.225	−0.414	−0.058	−0.244	−0.677**
		(7.168)	(0.238)	(0.203)	(0.226)	(0.210)	(0.158)	(0.330)	(0.328)	(0.334)	(0.378)	(0.295)
Constant	0.001*	−20.651	−5.805***	−1.163	1.380	5.057***	2.270**	2.462	3.800**	−0.408	−1.783	3.083**
		(43.584)	(1.424)	(1.343)	(1.485)	(1.412)	(1.046)	(1.653)	(1.614)	(1.683)	(1.848)	(1.460)
Observations	243	203	239	237	237	237	209	150	150	150	150	150
R^2		0.297	0.366	0.277	0.230	0.359	0.142	0.423	0.343	0.388	0.383	0.391

Note: The table shows results of an OLS estimate. The dependent variables are the objective measure of productivity (columns 1-2), measures of self-reported productivity (columns 3-7) and measures of productivity reported by supervisors (columns 8-12). "Treated" is a dummy variable that has the value of 1 if the individual has been assigned to the treated group and is 0 if he/she belongs to the control group. "Female" is a dummy variable that has the value of 1 if the individual is a female. Treated*Female is the interaction term of our interest. All regressions include (coefficients are not shown in the table) individual controls for age, squared age, law 104 worker, law 104 relatives, child, young child, km, and dependent variable pre-treatment. Significance: *p<0.1, **p<0.05, and ***p<0.01.

Table 12: Well-being (by gender)

	Panel a. Satisfaction with:						
	Income	Health	Home	Work	SocialLife	FreeTime	LifeInGeneral
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Treated	0.205	0.344	0.529**	−0.014	0.464**	0.865***	0.154
	(0.199)	(0.216)	(0.213)	(0.225)	(0.198)	(0.255)	(0.166)
Female	0.101	−0.125	0.352	−0.332	−0.328	0.213	−0.436*
	(0.316)	(0.335)	(0.336)	(0.357)	(0.333)	(0.421)	(0.261)
Treated*Female	0.414	0.306	−0.106	0.713*	0.362	−0.110	0.701**
	(0.382)	(0.402)	(0.404)	(0.429)	(0.392)	(0.492)	(0.313)
Constant	1.545	4.247	1.258	1.733	2.552	−1.137	−0.425
	(2.537)	(2.718)	(2.662)	(2.835)	(2.520)	(3.200)	(2.099)
Observations	225	230	234	230	227	229	232
R^2	0.393	0.435	0.340	0.192	0.424	0.349	0.318

	Panel b. Satisfaction as usual:						
	FocusOn	LoseLessSleep	UsefulRole	MakeDecisions	AppreciateDailyActivities	LessStress	Overcome
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Treated	0.278*	0.166	−0.064	0.208	0.452***	0.665***	0.433***
	(0.144)	(0.170)	(0.160)	(0.129)	(0.127)	(0.145)	(0.153)
Female	−0.465**	−0.254	−0.514**	−0.297	−0.011	0.238	0.284
	(0.226)	(0.267)	(0.247)	(0.203)	(0.200)	(0.229)	(0.240)
Treated*Female	0.570**	0.591*	0.729**	0.119	0.158	−0.068	−0.201
	(0.272)	(0.322)	(0.298)	(0.245)	(0.241)	(0.274)	(0.288)
Constant	2.220	6.221***	1.993	1.391	2.356	2.808	4.775**
	(1.867)	(2.097)	(2.017)	(1.660)	(1.598)	(1.818)	(1.901)
Observations	235	236	235	235	235	235	235
R^2	0.122	0.070	0.156	0.087	0.133	0.227	0.124

	Panel c. Work-life balance			
	WorkingHours	Balance	HouseholdActivity	CareActivity
	(1)	(2)	(3)	(4)
Treated	0.049	0.144	0.694***	1.883***
	(0.153)	(0.119)	(0.223)	(0.239)
Female	−0.478*	−0.311*	−0.389	−0.090
	(0.243)	(0.188)	(0.352)	(0.372)
Treated*Female	0.538*	0.361	0.284	0.216
	(0.289)	(0.223)	(0.424)	(0.457)
Constant	1.503	2.802*	2.833	2.876
	(1.931)	(1.452)	(2.779)	(2.931)
Observations	235	235	235	235
R^2	0.271	0.358	0.086	0.329

Note: The table shows results of an OLS estimate. The dependent variables shown in panel a measure satisfaction with 7 dimension of life; variables in panel b indicate if respondents have been able to deal (as usual, less or more) with 7 aspects of their life, and variables in panel c measure work-life balance. "Treated" is a dummy variable that has the value of 1 if the individual has been assigned to the treated group and is 0 if he/she belongs to the control group. "Female" is a dummy variable that has the value of 1 if the individual is a female. Treated*Female is the interaction term of our interest. All the regressions include (coefficients are not shown in the table) individual controls for age, squared age, gender, law 104 worker, law 104 relatives, child, young child, km, and dependent variable pre-treatment. Significance: *p<0.1, **p<0.05, and ***p<0.01.

Table 13: Balance Tests by team - Treated and Control groups (means of observable characteristics)

	Team				*No Team*			
Variables	Treated	Control	Test Statistic	p-value	Treated	Control	Test Statistic	p-value
Obs.	135	75			Obs.	56	35	
Age	43.3	42.89	0.3813	0.7034	43.2	44.83	-0.9561	0.3416
Male	0.563	0.64	-1.086	0.2789	0.5357	0.4	1.257	0.2119
Law104Worker	0.02963	0.01333	0.7397	0.4603	0.05357	0.02857	0.5607	0.5764
Law104Relatives	0.2815	0.2267	0.8631	0.3891	0.2857	0.3429	-0.5693	0.5706
Child	0.7481	0.7867	-0.6255	0.5323	0.7679	0.7429	0.2681	0.7892
Young Child	0.2889	0.3067	-0.2694	0.7879	0.3214	0.2571	0.6474	0.519

Note: Two-sample t-test for a comparison between means. Significance: * indicates p<0.05.

Table 14: Productivity (by team)

	Objective Productivity		*Self-reported Productivity*					*Productivity reported by supervisors*				
	Improvement	Days of leave	Production	Efficiency	Proactivity	Email	Deadlines	Production	Efficiency	Proactivity	Availability	Deadlines
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Treated	1.347*	−18.979***	0.192	0.326*	0.311	−0.193	0.202	0.327	−0.136	−0.338	0.165	0.338
		(5.889)	(0.171)	(0.171)	(0.192)	(0.177)	(0.159)	(0.230)	(0.232)	(0.233)	(0.265)	(0.211)
Team	1.426**	−11.062*	0.033	0.027	−0.127	−0.238	0.044	0.208	−0.266	−0.363	−0.096	−0.227
		(5.825)	(0.173)	(0.173)	(0.195)	(0.179)	(0.165)	(0.254)	(0.257)	(0.258)	(0.294)	(0.235)
Treated*Team	0.846	17.825**	−0.124	−0.203	−0.005	0.290	−0.068	−0.341	0.189	0.379	0.195	0.159
		(6.921)	(0.203)	(0.203)	(0.229)	(0.211)	(0.178)	(0.284)	(0.287)	(0.288)	(0.327)	(0.260)
Constant	0.237	10.841	−0.719	−1.345	1.347	5.510***	2.187**	2.073	3.732**	−0.134	−1.109	3.241**
		(44.382)	(1.366)	(1.376)	(1.548)	(1.443)	(1.065)	(1.621)	(1.604)	(1.652)	(1.822)	(1.458)
Observations	196	203	238	237	237	237	209	158	158	158	158	158
R^2		0.309	0.284	0.278	0.204	0.363	0.142	0.440	0.338	0.412	0.383	0.368

Note: The table shows results of an OLS estimate. The dependent variables are the objective measure of productivity (columns 1-2), measures of self-reported productivity (columns 3-7) and measures of productivity reported by supervisors (columns 8-12). "Treated" is a dummy variable that has the value of 1 if the individual has been assigned to the treated group and is 0 if he/she belongs to the control group. "Team" is a dummy variable that has the value of 1 if the individual belongs to a team and is 0 if he/she works alone. Treated*Team is the interaction between the two previous variables. All the regressions include (coefficients are not shown in the table) individual controls for: age, squared age, gender, law 104 worker, law 104 relatives, child, young child, km, dependent variable pre-treatment. Significance: *p<0.1, **p<0.05, and ***p<0.01.

Table 15: Well-being (by team)

	Panel a. Satisfaction with:						
	Income	Health	Home	Work	SocialLife	FreeTime	LifeInGeneral
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Treated	0.158	0.255	0.399	−0.527	0.532	0.861**	0.317
	(0.320)	(0.333)	(0.336)	(0.354)	(0.324)	(0.407)	(0.265)
Team	−0.058	−0.098	0.114	−0.705**	−0.095	−0.013	−0.0004
	(0.325)	(0.342)	(0.341)	(0.357)	(0.330)	(0.414)	(0.269)
Treated*Team	0.231	0.257	0.145	0.996**	0.035	−0.039	0.056
	(0.382)	(0.402)	(0.401)	(0.420)	(0.385)	(0.485)	(0.316)
Constant	1.713	4.666*	1.081	3.224	2.744	−1.130	−0.214
	(2.604)	(2.802)	(2.722)	(2.898)	(2.590)	(3.302)	(2.176)
Observations	225	230	234	230	227	229	232
R^2	0.392	0.435	0.345	0.203	0.422	0.349	0.303

	Panel b. Satisfaction as usual:						
	FocusOn	LoseLessSleep	UsefulRole	MakeDecisions	AppreciateDailyActivities	LessStress	Overcome
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Treated	0.315	0.830***	−0.261	0.437**	0.386*	0.716***	0.053
	(0.231)	(0.269)	(0.251)	(0.204)	(0.202)	(0.229)	(0.239)
Team	0.092	0.474*	−0.433*	0.289	−0.161	0.239	−0.048
	(0.232)	(0.273)	(0.254)	(0.207)	(0.205)	(0.232)	(0.242)
Treated*Team	0.176	−0.696**	0.579*	−0.273	0.157	−0.096	0.457
	(0.274)	(0.320)	(0.299)	(0.243)	(0.240)	(0.272)	(0.283)
Constant	2.360	5.477**	2.804	0.919	2.671	2.390	4.905**
	(1.927)	(2.147)	(2.076)	(1.696)	(1.639)	(1.861)	(1.926)
Observations	235	236	235	235	235	235	235
R^2	0.119	0.076	0.148	0.094	0.134	0.234	0.151

	Panel c. Work-life balance			
	WorkingHours	Balance	HouseholdActivity	CareActivity
	(1)	(2)	(3)	(4)
Treated	0.548**	0.375**	0.818**	2.141***
	(0.242)	(0.186)	(0.355)	(0.371)
Team	0.248	−0.062	−0.108	−0.178
	(0.245)	(0.188)	(0.361)	(0.379)
Treated*Team	−0.484*	−0.176	−0.063	−0.272
	(0.288)	(0.221)	(0.423)	(0.443)
Constant	1.046	2.937**	3.017	3.024
	(1.989)	(1.486)	(2.849)	(2.983)
Observations	235	235	235	235
R^2	0.271	0.363	0.087	0.339

Note: The table shows results of an OLS estimate. The dependent variables register in panel a measures of satisfaction with 7 dimension of life, in panel b if respondents have been able to deal as usual (or less or more) with 7 aspects of their life, in panel c measures of work-life balance. "Treated" is a dummy variable that has the value of 1 if the individual has been assigned to the treated group and is 0 if he/she belongs to the control group. All the regressions include (coefficients are not shown in the table) individual controls for: age, squared age, gender, law 104 worker, law 104 relatives, child, young child, and km. Significance: *p<0.1, **p<0.05, and ***p<0.01.

Table 16: Commitment to the company

	Dependent variable:					
	Attachment to the company		Work recognized		Responsibility towards the company	
	(1)	(2)	(3)	(4)	(5)	(6)
Treated	−0.161	−0.041	0.162	0.105	0.131**	0.139**
	(0.122)	(0.101)	(0.101)	(0.091)	(0.059)	(0.057)
Controls		✓		✓		✓
Observations	238	234	238	234	238	234
R^2	0.007	0.383	0.011	0.264	0.021	0.155

Note: The table shows results of an OLS estimate. The dependent variables are 3 measures of commitment to the company. "Treated" is a dummy variable that has the value of 1 if the individual has been assigned to the treated group and is 0 if he/she belongs to the control group. The regression includes (coefficients are not shown in the table) individual controls for: age, squared age, law 104 worker, law 104 relatives, child, young child, km, team and dependent variable pre-treatment. Significance: *p<0.1, **p<0.05, and ***p<0.01.

Table 17: Spillover effects of self-reported productivity from treated to control workers of the same team: comparison between control workers in a team with treated workers and without

	Panel a					
	At least 1 treated		None treated		Test Statistic	p-value
	Obs.	Mean	Obs.	Mean		
Production	40	3.9	7	3.857	0.1364	0.8921
Efficiency	40	3.9	7	3.714	0.6078	0.5464
Proactivity	40	3.875	7	3.429	1.489	0.1434
Deadlines	26	1.077	3	1	0.4825	0.6334
	Panel b					
	More than 40%		40% or less		Test Statistic	p-value
	Obs.	Mean	Obs.	Mean		
Production	34	3.941	13	3.769	0.6912	0.493
Efficiency	34	3.912	13	3.769	0.5859	0.5609
Proactivity	34	3.912	13	3.538	1.569	0.1237
Email	34	2.176	13	1.846	0.9193	0.3628
Deadlines	21	1.095	8	1	0.8855	0.3837

Table 18: Spillover effects from treated to control workers of the same team: comparison between before and after treatment outcomes for control workers in a team with treated workers and without.

Panel a. Subgroup of controls, working in a team with at least one treated worker						
Variables	Before		After		Test Statistic	p-value
	Obs.	Mean	Obs.	Mean		
				Self-reported productivity		
Production	65	3.754	40	3.9	-0.9893	0.3248
Efficiency	65	3.754	40	3.9	-0.972	0.3333
Proactivity	65	3.692	40	3.875	-1.253	0.213
Email	65	2	40	2.075	-0.4214	0.6743
Deadlines	65	4.492	26	4.923	-3.907	0.0001818***
				Well-being		
Income	65	4.2	39	4.282	-0.2732	0.7853
Health	65	4.908	37	4.649	0.7657	0.4457
Home	63	5.19	39	5.154	0.1194	0.9052
Work	63	5.127	38	4.921	0.7749	0.4403
SocialLife	63	4.698	39	4.231	1.325	0.1883
FreeTime	65	3.092	38	3	0.2566	0.798
LifeInGeneral	64	4.984	39	4.872	0.4823	0.6306
				Satisfaction as usual		
FocusOn	65	3.277	39	3.256	0.1294	0.8973
LoseLessSleep	65	2.646	39	2.718	-0.3258	0.7453
UsefulRole	65	3.369	39	3.051	1.662	0.09967
MakeDecisions	65	3.4	39	3.385	0.08989	0.9286
AppreciateDailyActivities	65	3.2	39	3.103	0.6871	0.4935
LessStress	65	2.323	39	2.564	-1.399	0.1649
Overcome	65	3.015	39	3.077	-0.348	0.7286
				Work-life balance		
WorkingHours	65	2.692	39	2.718	-0.135	0.8929
Balance	65	2.415	39	2.513	-0.6194	0.537
HouseholdActivity	65	1.477	39	3.205	-6.637	1.573e-09***
CareActivity	65	2.2	39	3.41	-4.427	2.405e-05***

Panel b. Subgroup of controls, working in a team with more than 40% of treated workers

Variables	Before		After		Test Statistic	p-value
	Obs.	Mean	Obs.	Mean		
			Self-reported productivity			
Production	54	3.741	34	3.941	-1.276	0.2053
Efficiency	54	3.704	34	3.912	-1.3	0.1972
Proactivity	54	3.667	34	3.912	-1.552	0.1243
Email	54	1.981	34	2.176	-0.9877	0.326
Deadlines	54	4.463	21	4.905	-3.535	0.000711 ***
			Well-being			
Income	54	4.296	33	4.242	0.1669	0.8678
Health	54	4.963	32	4.656	0.8512	0.3971
Home	52	5.154	34	5.152	0.007092	0.9944
Work	52	5.115	32	4.844	0.9335	0.3533
SocialLife	52	4.769	33	4.212	1.458	0.1487
FreeTime	54	3.315	32	2.969	0.8707	0.3864
LifeInGeneral	53	4.962	33	4.788	0.6767	0.5004
			Satisfaction as usual			
FocusOn		3.315		3.303	0.06779	0.9461
LoseLessSleep	54	2.778	33	2.697	0.3401	0.7346
UsefulRole	54	3.426	33	3.182	1.183	0.24
MakeDecisions	54	3.426	33	3.545	-0.7245	0.4707
AppreciateDailyActivities	54	3.204	33	3.182	0.1382	0.8904
UnderStress	2.315	54	2.606	33	-1.525	0.131
NotOvercome	54	3	33	3.091	-0.4644	0.6436
			Work-life balance			
WorkingHours	54	2.685	33	2.697	-0.05618	0.9553
Balance	54	2.389	33	2.515	-0.6974	0.4875
HouseholdActivity	54	33	1.5	3.212	-5.932	6.262e-08 ***
CareActivity	54	2.185	33	3.242	-3.443	0.0008964***

Table 19: Difference of the means before/after Control group

Variables	Before		After		Test Statistic	p-value
	Obs	Mean	Obs	Mean		
			Self-reported productivity			
Production	108	3.769	67	3.925	-1.415	0.1587
Efficiency	108	3.722	67	3.91	-1.632	0.1045
Proactivity	108	3.741	67	3.806	-0.5841	0.5599
Email	108	1.944	67	2.075	-0.9431	0.3469
Deadlines	108	4.556	40	4.95	-4.657	7.138e-06***
			Well-being			
Income	106	4.16	65	4.154	0.02886	0.977
Health	108	4.843	63	4.635	0.7915	0.4298
Home	106	5.283	65	5.046	1.002	0.3177
Work	106	5.038	65	4.985	0.247	0.8052
SocialLife	105	4.752	64	4.422	1.203	0.2307
FreeTime	107	3.178	64	2.984	0.6749	0.5007
LifeInGeneral	107	5.019	66	4.818	1.035	0.3019
			Satisfaction as usual			
FocusOn	108	3.204	66	3.136	0.5264	0.5993
LoseSleep	108	2.685	66	2.682	0.02031	0.9838
UsefulRole	108	3.222	66	3.182	0.2729	0.7853
MakeDecisions	108	3.324	66	3.288	0.2694	0.7879
AppreciateDailyActivities	108	3.13	66	3.136	-0.06097	0.9515
LessStress	108	2.343	66	2.545	-1.478	0.1412
Overcome	108	3.037	66	3.227	-1.362	0.175
			Work-life balance			
WorkingHours	108	2.62	66	2.591	0.1959	0.8449
Balance	108	2.417	66	2.576	-1.283	0.2013
HouseholdActivity	108	1.481	66	3.136	-8.381	1.808e-14***
CareActivity	108	2.12	66	3.288	-5.522	1.218e-07***