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Working or Shirking From Home?

An Empirical Case Study of Home Office Performance and Implications for the Future of Work

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Abstract

In 2020, the Covid-19 pandemic required hundreds of thousands of Norwegian employees to primarily work from home. Many companies are now considering their future practice of home office. We report the results from analyzing performance and survey data of call center representatives at a major company in the Nordic bank and insurance market. In the period from early January to late August 2020, we find that home working led to a decrease in the time spent on handling each call. Thus, there was a small increase in productivity relative to the time actively spent on performing work tasks. On the other hand, our findings also imply that the employees had more and/or longer breaks when working from home. These effects equalized each other with the result being that there was no significant difference in terms of daily productivity (total number of calls handled). Moreover, we also find that working from home led to a small decrease in the quality of the work.

The effects of working from home did not vary between characteristics such as age, gender and experience. Rather, the effects seemed to depend largely on employees' individual preferences and motivation. We also find that employees understood whether they performed better or worse at home. Interestingly, there were no correlations between how they performed and their preferred use of home office. The latter was determined by other factors that were not directly related to performance, such as commuting time, living arrangements and age. We believe that our findings will apply to other jobs which share the same characteristics as the work design of call center representatives.

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1 Introduction

1.1 Motivation

In recent decades, information technology has immensely changed the way we work. An important development has been the enabling of allowing employees to work remotely. Technology has provided both the means by which home workers can stay connected to the office, and the means by which they can perform their work (Handy & Mokhtarian, 1996). In 2004, 14% of Norwegian employees had the opportunity to work from home (Arbeidslivslovutvalget, 2004). A little more than a decade later, in 2017, this share had more than doubled, to 35% (Nergaard, Andersen, Alsos, & Oldervoll, 2018). With an increasing share of the workforce at home, it is becoming more important for managers and employees alike to assess the impact of this practice and how to organize the work life in the future.

In early 2020, the Covid-19 pandemic began spreading worldwide at an increasing rate. On March 12, Norwegian authorities introduced the strictest and most intrusive actions since WW2 to help prevent the spread of the virus. This included recommendations and guidelines for practicing home office to reduce physical contact between people in the workplace and between travelers on public transport. Accordingly, many companies decided to close down their offices and send their employees home. In April, reportedly four out of ten Norwegian employees were required to work from home. For highly paid and educated workers, this share accounted for as much as 73% (Mamelund, Ingelsrud, & Steen, 2020). Some companies gradually reopened their offices before and during the summer, but with limited capacities. At the end of October, however, Norway experienced a second wave of Covid-19 cases, which again led to a closure of offices. Consequently, in the period from March to December 2020, hundreds of thousands of Norwegian employees were either required or encouraged to primarily work from home. As such, the pandemic drove a natural experiment on the practice of home office and how this affects both companies and individuals.

The question is now, what should we do in the future? After having the majority of the workforce home for several months, many companies are faced with this question. Several of them have experienced great benefits of practicing home office. For example, Telenor reported in June that they from that point onward would allow their around 20 000 employees to freely choose where to work from (Stoltz & Tollersrud, 2020). Five months later, however, they said they will require their employees to be at the office at least two days a week due to negative effects they observed in the longer term (Finstad, 2020b). Other large Norwegian companies also report that they will continue practicing home office to different extents, while emphasizing that it also has its downsides (Ertesvåg & Bamvik, 2020). Interviews with more than 200 Norwegian top managers reveal that while over 40% believe home office has worked well during the pandemic, only 22% believe that the need for allowing employees to work from home will be greater after the pandemic than it was before (Finstad, 2020a).

There are some objective benefits of allowing employees to work from home. Companies may save office costs and employees will have greater flexibility, which in turn may attract greater talent. With fewer people traveling to work, there could also be substantial environmental benefits as we have already seen in major cities during the pandemic. There are, on the other hand, also several downsides that have emerged by having employees home for a long period. Telenor changed their minds as many employees, with time, reported lower motivation and creativity. It also became challenging to distinguish between work and private life, and many felt increased need for social interactions (Finstad, 2020b). Recent research also shows that working from home has led to both physical and mental challenges among many employees (Berglihn, 2020).

Apparently, there are divided opinions regarding the future use of home office. When companies now are considering what to do, there are many important questions that arise, particularly concerning performance. Are employees sufficiently independent and motivated to work from home without compromising productivity and quality? What determines whether an employee is going to perform better at home or not? How does home office affect the well-being and job satisfaction of employees and how may this affect their performances in the long term?

A survey conducted by the Institute of Transport Economics (2020) shows that 74% of Norwegian employees believe they are equally or more productive when working from home. Also, interviews among administrative employees reveal that only 17% believe they are more productive at the office (Vartdal, 2020). This is, however, only their *perceived* performance and does not necessarily express how working from home affects their *actual* performance. Relatively little research has been done on the relationship between home office and performance, as it is both time consuming and potentially very costly to carry out experiments for this matter. Thus, the working situation caused by the Covid-19 pandemic gave us a golden opportunity to perform a quantitative analysis of how working from home affects actual performance. This could potentially have several important implications for many companies now questioning how to move forward.

1.2 Research question

To analyze effects of working from home, we use performance data of call center representatives at a large Nordic bank and insurance company. The observations range from the beginning of January to the end of August 2020. During this period, the employees have had a fairly similar distribution of working days at home and in the office. Their work tasks are characterized by being highly individual and standardized with a direct link between effort and performance. Each employee's performance is therefore easy to measure and compare, even when working away from the office. We have also conducted a survey among the representatives about their experiences from and attitudes toward working from home. Combined with the performance data, their self-reported outcomes enable us to holistically assess the practice of home office. The aim of this thesis is to investigate the following research question:

How does working from home affect actual performance and what implications does this have for the future of individual and standardized work?

In this thesis we will first present relevant literature and theory (section 2). Then, we will explain our research in regards to both work and research design, and present our hypotheses (section 3). Next, we will give an overview of the data foundation and how we select the data used in the analysis (section 4). Further, we will describe the empirical methodology (section 5) before presenting our results (section 6). Section 6 is twofold; the first part presents how home office affects performance in terms of productivity and quality, while the second part presents results related to the employees' experiences of working from home. Next, we will discuss our findings in light of literature and theory, and what implications our results have for the future of work (section 7). Finally, we will present our conclusion (section 8).

Before continuing, we find it appropriate to consider the use of terms that are synonymous with "home office". In literature and media, there are great variations in what term is used to describe a situation in which an employee is working from home. Examples are "remote work", "telework" and "telecommuting". Although all of these are synonymous with "home office", the explicit meaning of the terms is only that an employee is working from a place other than the office. In this thesis, we will thus use the terms "working from home", "home office" or "home working" about employees performing their work from home.

2 Literature review and theory

2.1 Literature review

Bloom et al. (2015) performed the first randomized experiment on working from home and, as such, provided evidence to supplement prior case-studies and surveys. It involved a controlled experiment within a large Chinese firm in which volunteer call center employees were randomly assigned to work in the office or from home for nine months. The employees working from home significantly increased their performance. This was mainly due to working more minutes per shift (increase of 9.2%) and from making more calls per minute (increase of 3.3%), the former being attributed to fewer breaks and sick-days and the latter to a quieter working environment. The employees working from home also reported improved job satisfaction and their job attrition rates fell drastically.

A meta-analysis by Gajendran and Harrison (2007) also suggests that working from home is positively correlated with performance, both when objectively measured and supervisor-rated. Surprisingly, they could not find a significant correlation between actual and self-rated performance when working from home. The analysis also found that home office is positively associated with job satisfaction. However, Golden and Veiga (2005) found that this highly depends on the extent of working from home. The relationship is curvilinear, such that the level of job satisfaction increases only to a certain point, after which it decreases. This point (i.e. the extent of working from home that maximizes satisfaction) is given at 15.1 hours per week. They suggest that the curvilinear relationship may be due to the social and professional isolation employees are likely to face when working from home.

On the other hand, there is also evidence that greater professional isolation inhibits job performance, with the downturn being prominent only for employees with limited face-to-face interactions (Golden, Veiga, & Dino, 2008). The same study also found a negative correlation between professional isolation and employee turnover, which is consistent with the findings of Bloom et al. (2015). Gajendran and Harrison (2007) suggest that working from home is associated with significantly lower levels of work-role

stress and work exhaustion, which may also explain the lower turnover for employees working from home.

Working from home has also been associated with lower work-family conflict, defined as work interfering with family or family interfering with work (Allen, Golden, & Shockley, 2015). This is strongly related to work-life balance, described as measures to reduce conflicts when balancing a career and a family (Jang, Park, & Zippay, 2011). Gajendran and Harrison (2007) found a small, beneficial relationship between working from home and work-family conflict, with the relationship being significant only when working from home for 2.5 or more days per week. They also found that the relationship is stronger among employees with more experience with working from home. Moreover, Buzza (2017) found that millenials (i.e. people born between 1980 and 1995) are significantly more attracted to jobs with high levels of work-life balance. There is, however, no correlation between work-life balance and productivity (Bloom, Kretschmer, & Reenan, 2009).

Furthermore, Golden (2006) found that working from home inhibits co-worker relationships. In contrast, Gajendran and Harrison (2007) found that working from home does not significantly affect the relationship between co-workers, but has a positive effect on the relationship between employees and their supervisors. This may partially explain why they also found that home workers do not perceive diminished career prospects relative to those working from the office. There are, however, mixed findings in research on this topic (Glass, 2004; Leslie, Park, & Mehng, 2012; Weeden, 2005). In fact, in the experiment by Bloom et al. (2015), one downside of working from home was that the rates of promotion fell by about 50%. This was one of the main reasons why two thirds of the home workers decided to return to the office after the experiment.

2.2 Theory

In addition to previous studies on working from home, we also find it appropriate to introduce two acknowledged and established theories that will provide additional aspects when discussing our findings. First, we will explain the principal-agent problem which describes a conflict of interest between a principal and its agent when the principal does not have sufficient information about the agent's effort. This is highly relevant when

employees are working from home as it becomes challenging for their managers to supervise them directly. Second, we will introduce Herzberg's two-factor theory which accounts for factors that are essential for employee motivation. We will use this theory as a framework when discussing what determines whether an employee is going to perform better or worse when working from home.

2.2.1 Principal-agent problem

There is more uncertainty associated with having employees work from home as it becomes more challenging for supervisors to observe their effort. Therefore, many managers may be hesitant or reluctant to allow this (Allen et al., 2015). For example, a study of patent examiners showed that the group of employees working from home were repeatedly lying about their working hours (Rein, 2014). Results from such kind of studies are closely related to what is known as principal-agent theory.

The principal-agent problem was first conceptualized by Jensen and Meckling (1976). It describes a conflict of interest between the owner (principal) and the control (agent) of a task. The principal wants its agent to place a high level of effort into the task, while the agent will maximize its own utility given the observable requirements. Central to the theory is the fact that the principal is only able to observe an indication of the result and not the agent's effort explicitly. As a result, asymmetric information, a situation in which the agent possesses more information about its effort than the principal, may occur.

Asymmetric information entails agency costs which can be divided into two subgroups: (1) *deviation costs* as the acts of the agent are inconsistent with the wishes of the principal, and (2) *system costs* as the principal attempts to reduce the deviation costs. The latter may include costs related to changes in organization, monitoring systems or incentive programs (Bragelien, 2016).

2.2.2 Herzberg's two-factor theory

Several studies suggest a positive correlation between the employees' motivation and their performance (Lines, 2011; Manzoor, 2011; Taylor-Bianco & Schermerhorn, 2006). Changing the location of work and thus the working conditions and environment, may naturally have an impact on their motivation. A study by Knight and Westbrook (1999), based on Herzberg's two-factor theory of motivation (1959), found that the factors were equally useful in explaining motivation for employees working from home as for those working from the office.

Herzberg's two-factor theory seeks the root of motivation in the workplace. The model distinguishes between motivating factors and hygiene factors. Motivating factors will stimulate motivation and make the employees work harder, but will not cause dissatisfaction if not present. Hygiene factors, on the other hand, will not contribute to increased motivation, but if not present, they may cause dissatisfaction and potentially inhibit motivation. Herzberg's two-factor theory states that, with the purpose of increasing job attitudes and productivity, managers have to consider both sets of factors and be able to separate them. The different factors are listed in Table 2.1 below.

Table 2.1: Factors in Herzberg's two-factor theory

Motivating factors	**Hygiene factors**
Achievement	Working conditions
Recognition	Co-worker relations
Responsibility	Policies and rules
Work itself	Supervisor quality
Advancement	Salary
Personal growth	

3 Research

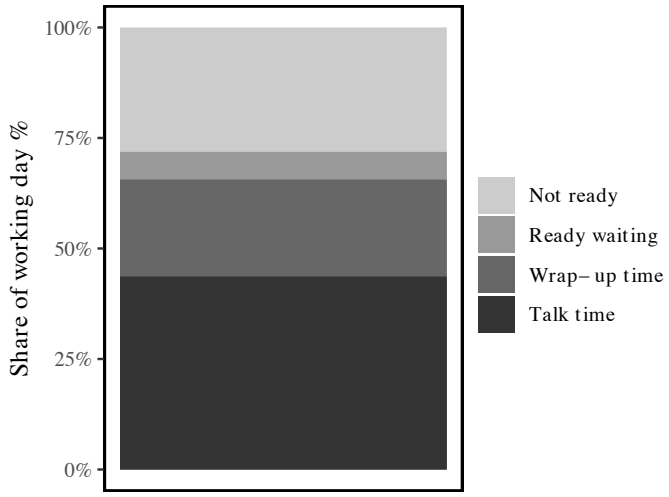
3.1 Work design

Our research is based on data about 107 call center representatives ("agents") in the Norwegian unit of a major company in the Nordic bank and insurance market. The main task of these agents is to answer and process customer inquiries. Incoming customer calls are automatically allocated between agents using a call queuing system. Another system automatically creates schedules for the agents' working days, facilitating an equal distribution of workload and sufficient capacity for incoming calls. When a customer calls, there is usually some queue on the phone line before the incoming call is assigned to an available agent. If there are multiple agents available, the call is allocated to the agent who has been available the longest.

The working day of each agent is divided into four parts: *talk time*, *wrap-up time*, *ready waiting time* and *not ready time* [1]. Figure 3.1 on the next page shows how these parts, on average, are distributed during a normal working day. *Talk time* is when the agent is in a conversation with a customer and is usually between two and six minutes per call. After each call, the agent spends some time registering a summary of the essentials of the conversation. This period is denoted as *wrap-up time*, and is usually between one and three minutes per call. Together, *talk time* and *wrap-up time* make up the *handling time*, which is then the total time the agent spends on handling an inquiry. *Ready waiting time* is when the agent is ready to answer calls, but has to spend some time waiting for the next customer inquiry. Due to generally high demand per agent, this time usually constitutes a very small share of the working day. *Not ready time* is when the agent is having a break or for another reason is not able to process calls. This also includes what is denoted as "administration time", which is time assigned to an agent in order to finish more challenging, non-standardized inquiries that require more time.

[1] The four parts are explained in more detail in Table 4.2 in section *4.3 Variable explanation.*

Figure 3.1: Allocation of time during a typical working day



A normal working day for each agent can generally be divided into these four, abovementioned categories. However, abnormal working days may occur. Such days are usually caused by technical issues or installations, or other events such as appraisal interviews or workshops. In our analysis, we exclude days that appear to be abnormal as they are likely to contain data that is not representative for an agent's typical working day (see *4.2 Data selection*).

The agents we evaluate are organized into six teams of 10 to 43 agents, with a mean of 17.8 and median of 13. Despite this organization of agents, the jobs do not involve any "teamwork", but are almost exclusively based on individual work. In addition, all teams have identical work tasks. However, we still use the term "team" as this is what the company refers to a group of agents operating under a common team leader. The role of each team leader is to follow-up the agents of their team, which includes team meetings as well as individual guidance, monitoring and motivation.

The full-time agents typically work five days a week with earnings composing solely of a fixed, hourly wage, independent of their performances. Their performances are still systematically monitored by their team leaders and the agents also have specific goals they are working to achieve. Although there are no incentives in the form of bonuses, the best performers can be recognized by being awarded the "employee of the month".

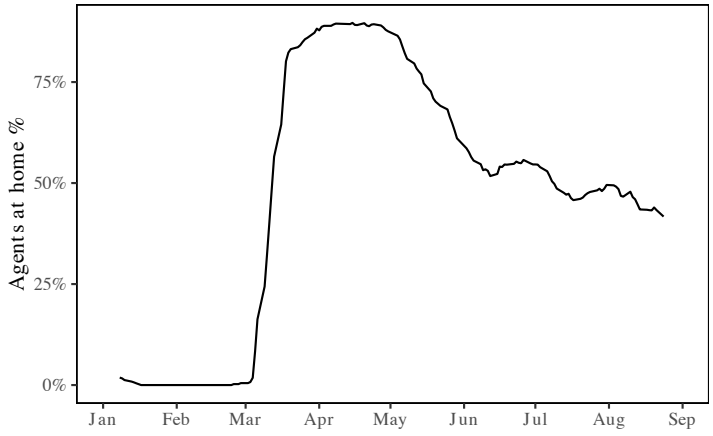
Around 40% of the agents work part-time. That is, these agents do not work fewer hours per day, but fewer full working days per week. The company's phone line is open from 8 AM to 5 PM on weekdays, and from 8 AM to 4 PM on Saturdays. As such, Saturday is viewed as another normal working day.

3.2 Research design

One major reason why relatively little quantitative research has been done on the effects of working from home, is the fact that it is challenging to carry out field experiments for this matter. Although it is in the interest of many companies, few have enough incentives to do so as it is very time consuming and potentially very costly. With the Covid-19 pandemic, many employees were either required or encouraged to work from home for a long period. In this way, it facilitated a natural experiment to examine the impacts of working from home.

Before the pandemic, the company's agents were almost exclusively working from the office. Figure 3.2 on the next page shows how the share of agents working from home changed from the beginning of January to the end of August, 2020. When Norway went into lockdown, the majority of the company's workforce was suddenly required to work from home, which is seen in the graph's extreme increase in mid-march. After some weeks, the agents were gradually allowed to return to the office. Strict rules regarding physical distances and infection control first set the office capacity to 25% before it was increased to 50%, which was current for the rest of the period. It should be emphasized that the graph shows the share of agents who have worked each day, not the share of the total number of agents. As the maximum office capacity is applicable to the whole unit, this explains why there are cases where the share of home workers is lower than 50%.

Figure 3.2: Share of agents working from home, 2020 (10 days moving average)



As seen in the graph above, the call center unit had a good distribution of working days at home and in the office. The decision on which agents who could work from the office on which days was mainly done by the team managers. By doing this, the company ensured an adequate distribution of working days at home and in the office for each agent. In some cases, individual considerations have been taken into account, allowing some of the agents to only work from home. For the analysis, we will also include observations from January and February when the agents were exclusively working from the office. By doing so, the analysis will be more robust as a result of more observations. Potential demand inequalities over time will be handled by using time fixed effects, which is described further in *5 Empirical methodology*.

In our study, the main focus has been to analyze how the agents perform when working from home compared to when they are at the office. The decision of focusing on a particular department, the company's call center, is due to their standardized and repetitive work tasks which are similar across all agents. There is also a direct link between their effort and how well they perform. Thus, the performances of the agents are easy to measure and compare, both between agents and work locations. Also, the agents' tasks are almost exclusively based on individual work and do not require as much interaction between employees as with other jobs that are more team-based.

We believe our research design is appropriate to analyze how working from home affects performance. First, the agents' tasks are individual-based and directly driven by demand

(i.e. incoming calls). This does not change when working from home as the centralized call queueing system ensures an equal distribution of workload, regardless of work location. Second, the agents have had appropriate gear and equipment from the company set up at their homes, such as external PC-screens and headphones. In that way, the agents' setup at home has been similar to the one they have at the office. For many, however, it has probably not been optimal as they may not have proper chairs and desks. Third, although it is challenging to directly supervise the agents at home, it is still just as easy to measure and compare their performances.

In addition to the company's call system data, we conducted an anonymous survey. The purpose of this survey was to acquire knowledge about the agents' own experiences from and attitudes toward working from home. Survey questions and statements were related to factors such as living arrangements, co-worker relationships, work environment and satisfaction. These were key aspects that were considered as plausible, explanatory variables for potential differences in performance, in addition to being closely related to Herzberg's motivating and hygiene factors. By analyzing survey responses, we could also identify what characterizes whether an agent wants to work primarily from home or the office, and if there is a correlation between the preferred use of home office and performance when working from home.

3.3 Potential biases

3.3.1 Hawthorne effect

The Hawthorne effect is a well-known bias referring to a reaction of individuals adapting their behavior as a result of being observed. It originates from studies showing that whatever changes in working conditions employees were exposed to, the result was increased productivity (McCarney et al., 2007). In our case, the study was carried out after the time period in which the observations were made. As such, the agents did not know that their performances would going to be subject to research. On the other hand, during the time of the observations many companies publicly expressed their considerations regarding the future use of home office. Therefore, it may be the case that the agents have temporarily put greater effort into their work at home to maintain the opportunity

to work from home in the future. And vice versa, that the agents' efforts may have been lower at home due to a wish to return to the office.

However, there are mainly two reasons why we consider Hawthorne effects to be unlikely. First, the choice of working from home has generally not been voluntarily. Consequently, all agents have had to work from home whether they have been motivated to do so or not, thus decreasing the likelihood of the agents being generally more motivated by having to work from home. Second, the company's call center has more than 100 agents, making each individual's impact on the overall performance marginal. Therefore, we assume there has been little incentives for the agents to manipulate the results.

3.3.2 Selection bias

Selection bias is about selecting a group of individuals such that it breaks with proper randomization. As a consequence, the sample may not be representative for the population as a whole. In our study, it is relevant to take into account a form of selection bias called self-selection bias. This may occur when individuals volunteer to enroll in a study, such that the motivation of the volunteers makes them significantly differ from the population (Nour & Plourde, 2019).

As explained, most agents were in the beginning of lockdown required to work from home. After some weeks, the office capacity was first set to 25% before it was later increased to 50%. Although individual preferences have been taken into account, the decision of work location has generally been made by the team leaders. Subsequently, most agents have had an adequate distribution of working days at home and at the office during the time of the observations. This greatly reduces the likelihood of self-selection bias. For the same reason, we also believe that spillover effects (i.e. results being affected by employees choosing their preferred location of work) have not been significant.

3.4 Hypotheses

Based on the work design in addition to relevant literature and theory, we can formulate hypotheses on how performance is affected when working from home. Both Bloom et al. (2015) and Gajendran and Harrison (2007) found an increase in productivity for employees working from home. Principal-agent theory, on the other hand, may imply the opposite. When supervision becomes more challenging, an agent may act inconsistently with the wishes of the principal. Also, Knight and Westbrook (1999) found that Herzberg's motivating factors were equally useful in explaining motivation when working from home. It is natural to assume that some of these, for example recognition and advancement, are more inhibited for home workers, while other factors may be more promoted.

Further, the work tasks of call center representatives are highly individual and standardized, in addition to being directly driven by demand. There is also a direct link between effort and performance, which is easy to measure, also when the agents are working from home. Therefore, only based on the work design, we may expect no significant differences in performance, regardless of workplace.

In summary, the literature suggests that there will be a productivity increase when working from home. The principal-agent theory may imply that performance should decrease, while Herzberg's two factor theory may pull in both directions. Also, as mentioned, the agents' work design indicate that there may be no significant differences. As such, based on our overall evaluation of literature, theory and work design, we have formulated the following two hypotheses:

Hypothesis I: *There is no difference in productivity when working from home.*
Hypothesis II: *There is no difference in quality when working from home.*

4 Data

4.1 Data foundation

The data generated by the call system is given at a daily, individual level for each agent, reaching from January 2 to August 31, 2020. The observations provide insights to the agents' performances as well as information about whether they were working from home or the office on a given day. A thorough explanation of the most important variables is given in *4.3 Variable explanation*.

The performance data is considered to be highly accurate and valid as it is automatically generated from the company's call system, and not manually registered by the agents, making the data registration person-independent. For the purpose of our research, the system generated data was combined with personal information from the company's HR-database. This includes information such as age, gender and working experience. In terms of anonymity, each agent was assigned an identity number which represented the primary key when we connected the databases.

In total, the data contains more than 10 000 observations for a total of 107 call center agents. Moreover, each observation contains around 60 variables, with a few of them overlapping each other. The dataset is a form of panel data as there are multiple observations per agent in the current time period. Many of the agents, however, are not observed every day, making the panel data *unbalanced*. We believe the main data creates a solid foundation for comparing the agents' performances at home against how they perform when working from the office.

Using the agents' identity numbers, we were also able to connect the responses from the survey with the main data, still maintaining anonymity. The survey was conducted in the period from November 2 to November 20, 2020. It got a total of 58 respondents out of 99 agents (eight agents did not receive the survey as they resigned/got promoted after August 31). Each agent responded once and were asked to look back on the period of home office from lockdown to the date of the response, to assess various effects of working from home relative to the office. During the time the survey was conducted, Norway

experienced a second wave of Covid-19 cases, again requiring most agents to work from home. As such, the majority of the agents have exclusively been working from home in the period preceding the survey. Therefore, although the survey was conducted two months after the last observation of the call system data, all agents have had their experiences of home office fresh in mind when responding.

The survey had a combination of questions and statements, which are all listed in *Appendix A3*. In regards to co-worker relationships, work environment and satisfaction, we used statements to which the agents indicated their levels of agreement on a five-point Likert scale, from "Strongly disagree" (1) through "Neither agree nor disagree" (3) to "Strongly agree" (5). This is one of the most common formats of multiple-indicator measures as it is easy to understand for respondents and likely to produce reliable results. As opposed to measures with one single indicator, this type of scale is more likely to capture the respondent's attitude as it increases the breadth of the statement that is being measured (Hardy & Bryman, 2004). Also, some of the statements are essentially repeated, but in a different form. When several questions or statements essentially measure the same, the answers of these should be highly correlated for each agent (Fowler, 1995). By adding such "traps", we can assess the validity of the responses and potentially identify respondents who have not paid close attention when answering.

4.2 Data selection

4.2.1 Handling NA-values

In some of the observations, NA-values are represented. For obvious reasons, these values cannot be included in the analysis. However, there is not any pattern in the occurrences of these NA-values, which could inhibit the validity of the analysis. They rather appear to occur randomly. This is what Little and Rubin (2002) label MCAR (missing completely at random). They suggest that, if we are sure about the randomness of the occurrences, then the observations containing NA-values can be ignored.

Our handling of NA-values is based on this principle. In the observations where such values are represented, they do not generally take place in all the variables for the specific agent

that day. For that reason, we do not want to permanently remove the whole observation, but only omit it when the variables containing NA-values are needed for a regression model. If an observation including an NA-value had been permanently removed, we would potentially have omitted valuable insights for analysis of other variables.

For the purpose of maintaining consistency and intuitiveness for the reader, a row omitted in one regression model is sometimes also omitted in some of the others. Six of the agents do not have demographic data and other personal information registered in the HR database. For those concerned, this applies to all their HR data. That is, if their gender is missing, their age and working experience is missing as well. Therefore, when including any of these variables to a regression model, the model will naturally be based on observations of fewer agents.

4.2.2 Handling outliers

An "outlier" is defined as an observation having an abnormal distance to the mean, where omission will have a significant influence on the results of the regression (Chatterjee & Hadi, 1986). Although outliers may affect the regression results, it does not mean they should be omitted without further inspection. This is because they do not necessarily have to weaken the results. They can potentially be legitimate extreme values and not data errors (Williams, 2016). If so, they may provide valuable insights to the model.

Abnormal logout times

In our dataset, there are some time registration errors that have been confirmed by the company. As for the time an agent logs out of the system (i.e. what time the shift ends) on a given day, there are a few abnormal registrations that have to be considered as errors. For these observations, the log out time goes far beyond the agents' typical working hours. One explanation is that some agents, occasionally, do not manually log out of the system at the time the shift ends. The system will then, after an indefinite time period, recognize the inactivity and automatically log the agent off. Not paying attention to these errors may cause problems to the analysis because of the frequent use of an agent's working hours as a part of our performance measures.

There are mainly two shifts during the day; the first lasts from 8 AM to 4 PM and the second from 9 AM to 5 PM. According to the company, an agent should in principle not work longer than to 5 PM as this is when the phone line closes. In some cases, however, the last shift may have late incoming calls, requiring the agents to work a little beyond the fixed working hours. With an average handling time of around 7.5 minutes per call, an agent should be able to both finish the call, write a summary and log out of the system within 15 minutes after the end of the shift. For that reason, all observations with a registered log out time after 5.15 PM are removed as we consider it likely that these log out times could be incorrect. Optimally, we would have corrected the incorrect log out times to their true values, but without further information about the agents' actual working hours, such a manipulation is not reasonable.

Abnormal number of calls

Furthermore, some agents have days where their total number of handled calls is distinctly low. These occurrences are, in consultation with the company, concluded to be a result of abnormal working days. As explained, such days may occur due to technical issues or occasional events such as appraisal interviews or workshops. In our analysis, we want to ensure that the work being considered is homogeneous and repetitive. That is, we want to examine observations that are representative for a typical working day. For that reason, we exclude observations that are likely to be abnormal days.

Per agent, the number of calls handled during a day is usually around 40. In consultation with the company, we can be quite sure that if an agent has handled under half of this, it is likely due to an unconventional working day. Therefore, we remove observations where the total number of calls handled (inbound and outbound) is less than 20. This decision is supported by Figure A2.3 in Appendix where we see a clear distinction between the number of observations under and over 20 calls per day.

Abnormal talk times

There was also a minor technical issue at home in the beginning of lockdown, causing some agents to not hear the customer during a conversation. In those cases, they had to end the conservation and call the customer back. As such, a few incoming calls are abnormally short. This may have decreased the average talk time per call on that respective day including the average customer score as some customers may have had their inquiries interrupted and not provided the service they expected. We solve this issue by removing all observations with talk time per call less than two minutes. This decision is supported by the histograms in Figure A2.1 and Figure A2.2 in Appendix showing more observations with abnormally short talk times at home including a notable increase in number of observations around 120 seconds, for both home and office workers.

Abnormal survey responses

Moreover, we also handle outliers in the survey data. As explained earlier, by examining statements similarly formulated we can identify potential irrational responses, in which the answer to one statement is not consistent with the answer to another. For example, the agents who report feeling more awake when working from home should not also report feeling more exhausted. Using this method, we identify two agents with generally very abnormal and irrational responses, which are subsequently excluded before analyzing the survey data. Beginning with the original 58 respondents, we are then left with 56.

Table 4.1: Summary statistics

	Mean	Median	Min	Max
Agents at work	61.92	62	41	86
Calls handled per day	37.61	37	20	106
Working time (hours)	7.34	7.60	2.44	10.41
Average talk time per call (minutes)	4.73	4.55	2.02	12.4
Average wrap-up time per call (minutes)	2.30	2.32	0.15	7.08
Average handle time per call (minutes)	7.05	6.9	2.82	14.35
Total ready waiting time per day (hours)	0.42	0.24	0	3.08
Total not ready time per day (hours)	2.49	2.42	0.26	6.35
Average customer score	4.67	4.83	1	5
TMK	72.54	83	-100	100
Adherence (%)	82.00	83.64	0	100
Missed calls (%)	3.11	0	0	19.17

4.3 Variable explanation

The data variables generated by the call system give valuable insights to the agents' performances. However, not all of them are necessarily intuitive to understand by their name. Table 4.2 below explains the most important and relevant variables in our analysis.

Table 4.2: Variable explanation

Productivity indicators	**Explanation**
Calls	The number of phone calls handled by an agent on a given day. This includes both inbound and outbound calls. Inbound calls are all incoming calls from customers, while outbound calls are cases where customers receive calls from agents. The latter may occur when there is a long queue on the line and the customer asks to be called back later.
Talk time	How much time an agent spends talking with customers on a given day. Most calls last between two and six minutes. In total, this time accounts for around 44% of a normal working day.
Wrap-up time	How much time an agent spends writing summaries of customer inquiries on a given day. This is usually between one and three minutes per call, and constitutes around 22% of a normal working day.
Ready waiting time	How much time an agent spends waiting for incoming calls (i.e. the time between ending an inquiry to answering a new call) on a given day. Due to generally high demand and queue on the line, this constitutes only around 6% of a normal working day.
Not ready time	How much time an agent is set to "not ready" on a given day. This is whenever the agent is having a break or for another reason is not available to answer incoming calls. Not ready time also includes "administration time", which is time assigned to an agent in order to finish more challenging inquiries that require more time. This time accounts for around 28% of a normal working day.

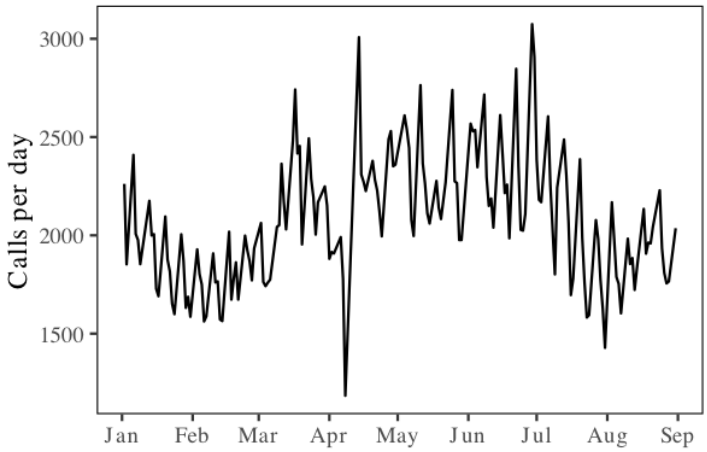
Quality indicators	**Explanation**
Average customer score	After each call, the customers will receive a text message where they are asked to rate their customer experience on a scale from 1 to 5, where 5 is the best. The average customer score is the average of all received scores of an agent per day.
TMK	TMK is a company-specific measure that the company uses as their preferred measure of customer satisfaction. For that reason, we will include it in the analysis as a supplement to the average customer score. TMK is calculated as the percentage of scores of 5's minus the percentage of 3's, 2's and 1's. A score of 4 is treated as neutral. Thus, TMK will be a number between 100 and -100. The company has a goal of an average TMK of 75.
Adherence	Each agent has a set schedule that they are meant to follow. How well they follow this schedule is represented in their adherence score, which is a number between 0 and 100. It emphasizes if the agents log on to the right time, if they are set as "ready" when they are supposed to, and so on. Failing to meet the schedule will have a negative impact on their adherence score. The company has a goal of an average adherence of 80.
Missed calls percentage	For each incoming call, the agent is given 18 seconds to answer. If the agent fails to answer the call within this time, the call is transferred to another agent who is available. For the agent not answering, this will be registered as a missed call. The percentage of missed calls is the share of incoming calls that are not answered on a given day.

5 Empirical methodology

5.1 Regresssion analysis with fixed effects

As explained, the observations constitute a form of panel data as each agent has been observed multiple times. To analyze the agents' performances, we thus use regression models suitable for handling panel data. The agents are different in terms of characteristics such as age, gender, talent and skill level. For each individual, we assume that such characteristics have been non-varying during the time of observations. Therefore, we consider fixed effects regressions to be most appropriate. Individual fixed effects control for omitted variables in panel data when these variables vary across groups, but remain static over time (Stock & Watson, 2020). As seen in Figure 5.1 below, the demand (i.e. total number of incoming calls) varies over time and also from one day to another. The demand is, however, equally distributed between the agents, regardless of whether they are working from home or the office. As such, the regressions should include time fixed effects as well. By using fixed effects regressions, we aim to isolate the effects on performance exclusively determined by work location.

Figure 5.1: Daily number of incoming calls, 2020



We have assessed whether to use a fixed effects model or a random effects model. One advantage with the random effects model is the ability to observe each time-invariant

variable's estimated impact in the regression. The disadvantage, on the other hand, is that the unobservable invariant characteristics will be a part of the error term. That may cause the regression to suffer from omitted variable bias. The consequences imply a need for an assumption that omitted variables are uncorrelated with the independent variables included in the model (Williams, 2018). If the assumption holds, the random effects model could be more efficient. In our case, we find this assumption to be unlikely, making a random effects model potentially suffer from omitted variable bias. The better model can also be decided with a Hausman-test for endogenity. It tests if the unique errors (μ_{it}) are correlated with the dependent variables, where the null hypothesis is they are not. With p-values < 0.05, we reject the null hypothesis, which supports our decision of using a fixed effects model.

In the data, there are observable variations both *across* the agents and *within* each agent. By only looking at the across-agent variation, we may encounter difficulties due to potential omitted variable bias. The key is then to focus on the within-agent variation. If we can claim that the omitted variable bias really is removed, we simultaneously assume that there are no changes over time within each agent that cannot be controlled for. That is, unobservable factors, such as for example talent and skills, are fixed and do not change during the period of observations. In a fixed effects model, the individuals serve as their own controls. As such, whatever effect an omitted variable may have on an individual's observation, the same effect will be present at other observations as well. Therefore, the effects will be fixed over time. (Williams, 2018)

For estimating the fixed effects model, we use the within estimator. This is computed in two steps. First, the individual-specific average is subtracted from each of the variables ($Y_{it} - \overline{Y_i}$). Then, these "demeaned" variables are used for estimating the regression (Stock & Watson, 2020). Mathematically, it can be expressed as follows:

$$Y_{it} - \overline{Y_i} = \beta_1(X_{it} - \overline{X_i}) + (\mu_{it} - \overline{\mu_i}) \implies \widetilde{Y}_{it} = \beta_1 \widetilde{X}_{it} + \widetilde{\mu}_{it} \tag{5.1}$$

where

$$\overline{Y}_i = \frac{1}{T}\sum_{t=1}^{T} Y_{it}, \overline{X}_i = \frac{1}{T}\sum_{t=1}^{T} X_{it}, \overline{\mu}_i = \frac{1}{T}\sum_{t=1}^{T} \mu_{it}$$

The fixed effects estimator, β, is then obtained by OLS regression of $\widetilde{Y}$ on $\widetilde{X}$.

5.2 Model design

We want to examine if the variation in the agents' performance measures is caused by their work location (Hypotheses I and II). As we have seen, the fixed effect coefficients will capture the across-agent variation, so that what we have left is the within-agent variation. The probability of omitted variable bias is then reduced. We will in the following present the structure of the regression model which will serve as our testing framework.

5.2.1 Individual fixed effects

The regression model for fixed effects can be written as below, where the dependent and independent variables are denoted Y_{it} and X_{it}, respectively. The dependent variable will represent the performance measures to be estimated. The subscript, i, refers to the agent being observed and the subscript, t, refers to the time (day) of the observation. Z_i describes unobservable variables that varies from one agent to another, but which is constant over time (invariant).

$$Y_{it} = \beta_o + \beta_1 X_{it} + \beta_2 Z_i + \mu_{it} \tag{5.2}$$

The goal is to estimate the effect of X on Y, given by β_1, holding the unobservable variable Z constant. With Z_i varying from one agent to another, but not over time within one agent, the regression model can be interpreted as having one intercept for each agent (Stock & Watson, 2020). These intercepts will absorb the effect of all omitted variables that change from one agent to the next. We can introduce α_i, where $\alpha_i = \beta_0 + \beta_2 Z_i$.

Then, the equation can be written as:

$$Y_{it} = \alpha_i + \beta_1 X_{it} + \mu_{it} \tag{5.3}$$

α_i (α_1 to α_{107}) represents the intercepts to be estimated for the different agents. The slope of the regression, β_1, will be the same for all agents, but the intercept will vary as a result of omitted variables that we remember as Z_i in Equation 5.2. The term α_i is then the individual fixed effects.

The fixed effects model requires a reasonable number of observations for each agent and the variation of the dependent variable must be sufficiently large for differences to be calculated. For the data used in our analysis, this requirement is satisfied.

5.2.2 Time fixed effects

Because the demand (i.e. incoming calls per day) is constant across the agents (equally distributed), but varies over time, time fixed effects are included (Stock & Watson, 2020). The combined individual and time effects regression to be used for the analysis can then be written as follows:

$$Y_{it} = \alpha_i + \lambda_i + \beta_1 X_{it} + \mu_{it} \tag{5.4}$$

The dependent variable, Y_{it}, represents the different performance measures. X_{it} is the explanatory variable, which will be a dummy variable equal to 1 if agent i was working from home at date t. β_1 is the estimated coefficient of the X_{it} variable (i.e. the effect on the performance measure of working from home). α_i and λ_i represents the individual and time fixed effects, respectively. Alternatively, we can write the model as:

$$Employee\ performance_{it} = \beta_1 \times Home_{it} + \alpha_i + \lambda_i + \mu_{it} \tag{5.5}$$

The model above will form the basis of our regression analysis on performance. In some regressions, we also have to include an interaction term. This will be described in the following section.

5.2.3 Interaction term

One of the core limitations of the fixed effects model is that we cannot estimate the coefficients of variables having little within-group variation. That will typically be time-invariant variables. However, we can rather estimate the effect of the interaction between a time-invariant variable and another independent variable. In our case, it will be to multiply the relevant variables with the dummy variable indicating if an agent has been working from home or at the office. The interaction term lets the effect on Y, by a change in X, to depend on the value of Z (Stock & Watson, 2020). Then, the equation can be written as follows:

$$Y_{it} = \alpha_i + \lambda_i + \beta_1 X_{it} + \beta_2 (X_{it} \times Z_i) + \mu_{it} \tag{5.6}$$

5.3 Survey analysis

5.3.1 Handling Likert-scale data

The data obtained from the survey is given in different formats. As explained, we used statements in which the agents indicated their levels of agreement on five-point Likert scales. There are disagreements among experts on whether these scales should be treated as continuous or categorical data. However, we find it most appropriate to handle them as categorical (Hardy & Bryman, 2004). The reason is that the difference between the five points are not necessarily perceived equally among the respondents. For example, the distance between "strongly agree" and "agree" may not be the same as the distance between "strongly disagree" and "disagree". All we can confirm is that the level of agreement or disagreement is higher, making the data ordinal.

Assuming the Likert scales to be ordinal has implications for what methodology to use in the analysis. By treating the variables as continuous in a linear regression, this will break with the assumptions about the form of the data presented above. This is because the traditional linear regression model estimates the coefficients by minimizing the sum of squares between the left and right hand side of the regression equation (Hardy & Bryman, 2004). One way to implement categorical data in a linear regression is to create a dummy

variable for *n-1* categories. Another approach when analyzing Likert-scale responses is to collapse the scale into dichotomous categories (Grimbeek, Bryer, Beamish, & D'Netto, 2005). This method is particularly supported in the case of a low number of respondents (DiStefano, Dexin, & Morgan, 2020). Percy (1976) concludes that the direction of the component is what is of importance, also supporting the decision of collapsing Likert scales.

As a result of a relatively low number of respondents in our survey, we collapse the Likert-scale responses to dichotomous categories when used in regressions. As such, "Strongly agree" and "Agree" are collapsed into one category being "Agree", while "Strongly disagree" and "Disagree" together constitutes the category "Disagree". When performing the regressions, these are used as dummy variables, so that the category included in the interaction term is represented by 1 while the two remaining categories are represented by 0. In all regression models including Likert-scale data, the results are also supported by regression models treating Likert scales as continuous. By doing so, we control if the assumption of Likert-scale data being ordinal rather than continuous, affects the conclusions.

5.3.2 Probit regression

By asking the agents about their preferred use of home office, we can examine what characterizes whether an agent wants to work more from home or the office. To analyze this, we find it appropriate to use a probit regression model. This model takes a binary variable as the dependent variable, which means the variable can only hold two possible values. The purpose of the model is to estimate the probability of an observation with specific characteristics to fall under either of the categories represented by the binary variable (Hanck, Arnold, Gerber, & Schmelzer, 2020).

The probit model uses the cumulative standard normal distribution function, Φ, to model the function. This gives us the following assumption:

$$E(X|Y) = P(Y = 1|X) = \Phi(\beta_o + \beta_1 X) \tag{5.7}$$

The β-coefficient represents the change in z in the z-quantile by a one-unit change in X.

$$\Phi(z) = P(Z \leq z), Z \sim N(0,1) \tag{5.8}$$

The effect of a change in β on z will be linear, but because Φ is a nonlinear function of X, the connection between z and Y will be nonlinear as well.

One main difference against a traditional linear regression model, is that the coefficients are given as multiplicative effects and not marginal (Fernihough, 2011). For interpretation and readability purposes, we convert the coefficients to marginal effects calculated at the mean. The estimated probit coefficients in the analysis are all estimated with use of the maximum likelihood estimator (MLE).

5.3.3 Correlation matrix

For analyzing correlations between survey responses, we also create a correlation matrix as seen in Figure A3.11 in Appendix. With ordinal data, parametric correlation tests such as Pearson will not be suitable as it requires the data to be continuous. Instead, we use a non-parametric test, Spearman's rho, which is applicable to ordinal data (Sullivan & Artino, 2013).

5.4 Standard errors and assumptions

In a regression model, *homoscedasticity* is present when the residuals have variance that is constant over time. If the variance is not constant, the residuals are *heteroscedastic*. Heteroscedasticity affects the estimation of the coefficients as it makes the coefficients less precise. The p-values also tend to be a little lower than their actual value, as a result of undetected increase in the variance of the coefficient estimates (Frost, 2017). Also, if X_{it} (i.e. values within an agent) is correlated over time, *autocorrelation* is present. In that case, the standard deviation of a variable may be biased and affect the efficiency of the model.

A way to include heteroskedasticity- and autocorrelation-robust standard errors in a fixed effects model, is by using a type of *HAR standard errors* (heteroscedasticity- and

autocorrelation-robust). In our regression models, we use the type called *clustered standard errors*. These account for heteroscedasticity across clusters (individuals) and allow for arbitrary autocorrelation within an individual. As a result, the model is valid even if heteroscedasticity and autocorrelation is not present. (Stock & Watson, 2020)

Due to the presence of heteroscedasticity, most of the regression models have clustered standard errors included. We test for heteroscedasticity by using the Breusch-Pagan test. In case of small chi-square values along with associated small p-values (< 0.05), the null hypothesis of equal error variances is rejected. In such cases, heteroscedasticity-robust standard errors are applied.

Beyond heteroscedasticity and autocorrelation, there are mainly four assumptions about the data in order for the time fixed effect regression to be valid (Stock & Watson, 2020). In all of our regression models, these assumptions are considered to be satisfied. The assumptions are summarized below.

Assumption 1	We assume that the error term has a conditional mean of 0 for all observations of X over time, within one individual: $$E(\mu_{it}\|X_{i1}, X_{i2}, ..., X_{iT}, \alpha_i) = 0$$ The requirement says that the conditional mean is not dependent on any of the observations of X for that specific individual.
Assumption 2	We assume that the distribution of the variables is the same across the individuals, but still independent of each other.
Assumption 3	We assume that observations with large outliers are unlikely.
Assumption 4	We assume that there is no perfect multicollinearity. This means that there are no variables within an individual which are perfectly correlated with each other.

6 Results

In the first part of the analysis, section *6.1*, we will present results of how working from home affects performance, in terms of both productivity and quality. In the second part, section *6.2*, we will present findings from the survey regarding the agents' own experiences from and attitudes toward working from home.

6.1 Impact on performance

For analyzing the effects home office has on the performance measures, we use the combined individual and time fixed effects model. We remember equation (5.5) as:

$$Employee\ performance_{it} = \beta_1 \times Home_{it} + \alpha_i + \lambda_i + \mu_{it}$$

6.1.1 Productivity

6.1.1.1 How productivity is measured

As the work tasks of the agents mainly consist of processing phone calls, it is essential to evaluate their performances at home based on the number of calls they are able to handle. The number of calls can be further broken down to the number of working hours and the number of calls per working hour. When evaluating the performance of an agent on a given day, it is important to also consider the duration of the agent's working day. With varying working hours, the number of processed calls must be seen in light of how much time the agent has to process the calls.

As such, we use *calls per working hour* as the main measure of productivity. The working day of an agent is, as explained earlier, divided into four parts (ref. *3.1 Work design*). Therefore, at any time of a working day, an agent is doing either one of these four "tasks". Productivity, in terms of calls per hour, can therefore be explained by how much time the agents spend on these different parts of the working day. As another measure of productivity, we will also consider *calls per handle time*. By doing this, we will find productivity relative to how much time the agents spend on actively performing their

work (i.e. to handle inquiries).

6.1.1.2 Results of productivity analysis

To test Hypothesis I, we first consider the daily number of processed calls. This can be divided into *calls per working hour* × *number of working hours*, and *calls per handle time* × *total handle time*. The regressions are summarized in Table 6.1 below.

Table 6.1: No difference in calls per hour, while increase in calls per handle time

	(1)	(2)	(3)	(4)	(5)
Dependent Variable	Calls	Calls per hour	Total hours	Calls per handle time	Total handle time
	log	log	log	log	log
Home	-0.007	-0.005	-0.002	0.026***	-0.033***
	(0.012)	(0.011)	(0.007)	(0.006)	(0.006)
Number of employees	107	107	107	107	107
Observations	7968	7968	7968	7968	7968

Notes: The regressions are run at individual level, with a full set of individual and time fixed effects. "Home" is the independent variable indicating an agent working from home. The regressions are run for the period of January 2 to August 31. All dependent variables are log-transformed due to skewness to make distribution more symmetric. All variables are recorded from the call system. Standard errors are clustered at the individual level. *** denotes 1% significance, ** 5% significance and * 10% significance.

As expected, there is no change in the number of working hours when the agents are working from home. We also find no significant difference in the main measure of productivity, calls per working hour. These effects add up to the total number of calls per day and explains why there is no difference in this number. On the other hand, home workers spend less time each day to handle phone calls, with a decrease in the total handle time of 3.2% (exp(-0.033)-1 = -3.2%). Thus, for the number of calls per handle time, there is a significant increase at home amounting to 2.6% (exp(0.026)-1 = 2.6%). Naturally, these effects also add up to the daily number of calls.

Further, we perform regressions for each of the four different parts that make up a working day. Table 6.2 below shows the output of each, individual regression. In this case, regressions (2) to (5) do, naturally, not add up to calls per hour as these are different units. However, as each working hour consists of at least one of the four different parts, we can use these regressions to understand what lies behind the number of calls per hour and why this measure has not changed significantly. As we want to explain the number of calls per *hour*, each measure is divided by the number of working hours. It should be mentioned that the wrap-up time per hour does not actually require log-transformation, but we do this in order to make the measures consistent. Without the transformation, we get similar effects and level of significance (see Table A1.1 in Appendix).

Table 6.2: Shorter handling counterbalanced by longer ready waiting and not ready time

Dependent Variable	(1) Calls per hour	(2) Talk time per hour	(3) Wrap-up time per hour	(4) Ready waiting time per hour	(5) Not ready time per hour
	log	log	log	log	log
Home	-0.005	-0.025**	-0.048**	0.103***	0.033***
	(0.011)	(0.012)	(0.023)	(0.036)	(0.009)
Number of employees	107	107	107	107	107
Observations	7968	7968	7968	7968	7968

Notes: The regressions are run at individual level, with a full set of individual and time fixed effects. "Home" is the independent variable indicating an agent working from home. The regressions are run for the period of January 2 to August 31. All dependent variables are log-transformed due to skewness to make distribution more symmetric. All variables are recorded from the call system. Standard errors are clustered at the individual level. *** denotes 1% significance, ** 5% significance and * 10% significance.

We find that home workers spend less time talking with each customer, with a decrease of 2.5% (exp(-0.025)-1 = -2.5%) in talk time per hour. In the case of wrap-up time per hour, how much time the agents spend on registering a summary of each inquiry, the decline is even greater with a decrease of 4.7% (exp(-0.048)-1 = -4.7%) for home workers. The biggest percentage effect is seen in the ready waiting time per hour with an increase of 10.8% (exp(0.103)-1 = 10.8%) when working from home. This, however, constitutes a

very small share of a typical working day. As for the not ready time per hour, which constitutes a much greater share, this is also significantly longer at home with an increase of 3.4% (exp(0.033)-1 = 3.4%).

Next, we perform regressions with an interaction term to examine how the home office's effect on productivity may depend on and vary between different agent characteristics. These characteristics include age, gender and working experience (from the HR database), as well as information about children, commuting time, housing size and education (from the survey). All characteristics are dummy variables except from age and working experience which are treated as continuous. We use the main productivity measure, calls per working hour, as the dependent variable. As seen in Table 6.3 on the next page, there are no significant differences for any of the agent characteristics regarding this measure. In addition, we perform similar regressions to examine whether productivity when working from home depends on the affiliation to any of the six teams. Neither in this case, we find any notable differences (see Table A1.2 in Appendix).

Table 6.3: Effect on productivity of working from home is equal across characteristics

Dependent Variable: log (Calls per hour)	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Characteristic:	Age	Female	Years of experience	Children	Commute > 20min	Own office	Minimum Bachelor
Home x Characteristic	-0.001	0.007	-0.001	-0.042	-0.007	-0.031	-0.038
	(0.001)	(0.009)	(0.01)	(0.025)	(0.027)	(0.025)	(0.023)
Home	0.017	0.008	0.005	0.012	0.0002	0.015	0.020
	(0.026)	(0.008)	(0.014)	(0.016)	(0.025)	(0.020)	(0.019)
Number of employees	101	101	101	56	56	56	56
Observations	7575	7575	7575	4707	4707	4707	4707

Notes: The regressions are run at individual level, with a full set of individual and time fixed effects. "Home" is indicating an agent working from home and "Characteristic" is used in the interaction term. The regressions are run for the period of January 2 to August 31. The dependent variable is log-transformed due to skewness to make distribution more symmetric. Calls per hour is from the call system. Characteristics are from the HR-database and survey. Standard errors are clustered at the individual level. *** denotes 1% significance, ** 5% significance and * 10 % significance.

6.1.2 Quality

6.1.2.1 How quality is measured

When evaluating the agents' performances, it is not adequate to only consider how they exploit their working hours, but also the quality of their work. TMK (i.e. the percentage of scores of 5's minus the percentage of 3's, 2's and 1's) and the average customer score imply quality in terms of how satisfied the customers are with each agent. Adherence and the percentage of missed calls imply quality in terms of how well the agents follow their set schedules and whether they deviate from their work tasks.

6.1.2.2 Results of quality analysis

Table 6.4 on the next page shows the regression output of each of the four quality measures we examine. In regards to both TMK (scale -100 to 100) and the average

customer score (scale 1 to 5), we find a significant decrease for home workers. Since the variables are not log-transformed, these estimates are absolute values. As for the adherence, we do not find any significant difference between home and office. In regards to the percentage of missed calls, however, we find a significant increase of 1.2 percentage points when working from home. Given the fact that the average percentage at the office is 2.4%, this effect constitutes an increase of about 50%.

Table 6.4: Small decrease in quality when working from home

Dependent Variable	(1) Customer satisfaction (TMK)	(2) Customer satisfaction (average score)	(3) Adherence	(4) Missed calls percentage
Home	-3.773***	-0.044**	-0.005	0.012***
	(1.423)	(0.019)	(0.006)	(0.004)
Number of employees	107	107	107	107
Observations	7609	7609	7930	7968

Notes: The regressions are run at individual level, with a full set of individual and time fixed effects. "Home" is the independent variable indicating an agent working from home. TMK is a measure from -100 to 100. Customer score ranges from 1-5. The regressions are run for the period of January 2 to August 31. All dependent variables are absolute changes. The variables are recorded from the call system. Standard errors are clustered at the individual level. *** denotes 1% significance, ** 5% significance and * 10% significance.

Also for the quality of work, we perform regressions with an interaction term to assess whether the performance at home depends on any agent characteristics. These variables are the same as for Table 6.4 above. As with productivity, we also find no significant effects on quality (customer satisfaction) for any of the agent characteristics. Nor do we find any significant differences regarding team affiliation (see Table A1.3 and Table A1.4 in Appendix).

6.2 Agents' self-reported outcomes

Combined with the performance data, the agents' self-reported outcomes enable us to holistically assess the effects of working from home. First, we present how the agents perceive their own performance at home and whether this coincides with their actual performance. Then, we report the agents' preferred use of home office in the future, and what characterizes those who prefer to exclusively work from the office.

6.2.1 Perceived performance at home

Analysis of data generated from the call system revealed understanding of the agents' actual performance when working from home. However, we were also interested in knowing how the agents themselves perceive their own performance to examine whether this correlates with how they actually perform at home. In the survey, we therefore asked them to respond to the statement "I perform better when working from home", to which they could choose one of five alternatives, from "Strongly disagree" to "Strongly agree". We did not specify what is meant by "performance", but assume that most agents had a general interpretation of the term, including both productivity and quality.

Figure 6.1: Agents' perceived performance when working from home

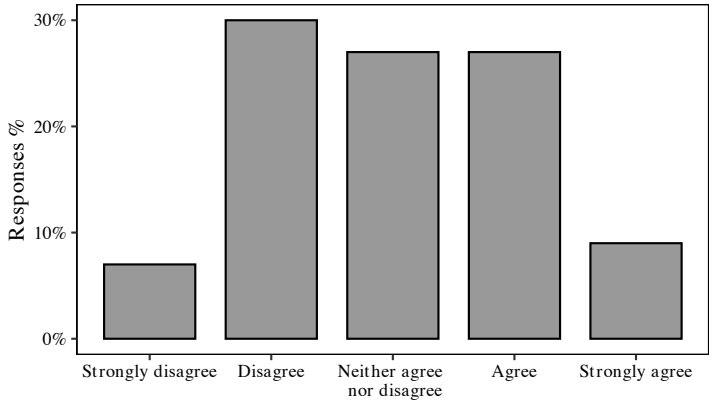


Figure 6.1 above summarizes how the agents responded to the statement. As seen, the agents have very divided opinions of their own performances. The cumulative percentage of agents who disagree with the statement (i.e. believe they perform worse) is about the

same as the cumulative percentage who agree (i.e. believe they perform better). Further, we can examine whether the agents who *believe* they perform better, *actually* do perform better when working from home. Table 6.5 below shows regressions with the main measure of productivity, calls per hour, as the dependent variable. To assess whether perceived performance has an effect on actual productivity, we include an interaction term with a dummy variable specifying whether the perceived performance when working from home has been better, worse or the same (ref. *5.3.1 Handling Likert-scale data*).

Table 6.5: Agents understand whether they are more or less productive at home

Dependent Variable: log (Calls per hour)	(1)	(2)	(3)
Response:	Perceived performance better	Perceived performance worse	Perceived performance the same
Home x Response	0.036***	-0.059**	0.016
	(0.012)	(0.026)	(0.013)
Home	-0.017	0.015	-0.010
	(0.010)	(0.016)	(0.010)
Number of employees	56	56	56
Observations	4707	4707	4707

Notes: The regressions are run at individual level, with a full set of individual and time fixed effects. "Home" is indicating an agent working from home and "Response" is used in the interaction term. The regressions are run for the period of January 2 to August 31. The dependent variable is log-transformed due to skewness to make distribution more symmetric. Calls per hour is from the call system and the responses are from the survey. Performance better equals 1 if the agent is "strongly agree" or "agree" to better perceived performance. Performance worse equals 1 if the agent is "strongly disagree" or "disagree". Performance the same equals 1 if the agent is "neither agree nor disagree". Standard errors are clustered at the individual level. *** denotes 1% significance, ** 5% significance and * 10% significance.

We find that the agents who believe they perform better when working from home (i.e. answering "Agree" or "Strongly agree" to the statement above) actually handle 3.7% (exp(0.036)-1 = 3.7%) more calls per hour at home than the agents not agreeing to the statement. Moreover, the agents who perceive their performance as worse have 5.7%

(exp(-0.059)-1 = -5.7%) lower productivity relative to those who do not. There is no significant difference for the agents believing their performance is equal, regardless of workplace. We have also performed a regression treating perceived performance as a continuous variable. As seen in Table A1.5 in Appendix, this give similar, significant results.

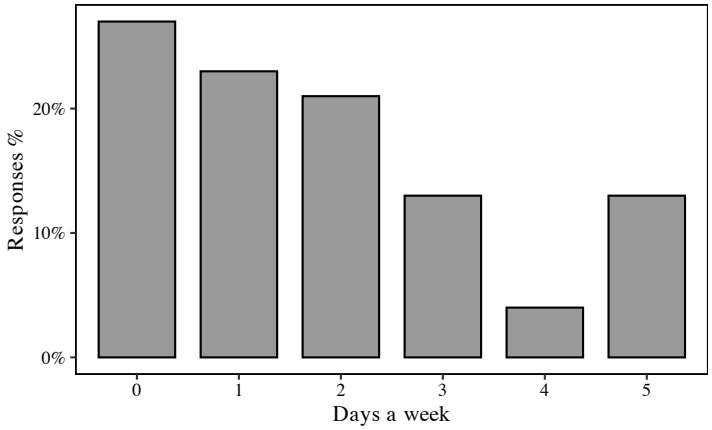
Next, we perform regressions to investigate whether perceived performance has a significant effect on actual quality. Using average customer score as the dependent variable, we find that the agents disagreeing to the statement "I perform better when working from home" have significantly lower scores. There is, on the other hand, no significant effect on this measure for those agreeing to the statement (see Table A1.6 in Appendix). When treating perceived performance as a continuous variable, we do not find a significant effect on average customer score (see Table A1.5 in Appendix).

As for the adherence score, we find significant effects both for the agents agreeing and for those disagreeing to the statement. The agents who perceive their performance at home as better, have significantly higher scores (i.e. they are better at following their schedules), and vice versa. When performing regressions on the percentage of missed calls, we also find significant effects both ways (see Table A1.7 and Table A1.8 in Appendix). In this case, when treating perceived performance as a continuous variable, we get significant effects for both adherence and the percentage of missed calls, as seen in Table A1.5 in Appendix.

6.2.2 Preferred use of home office

We were also interested in knowing the agents' preferred use of working from home, if they could freely choose this themselves. Thus, we asked them, on average, how many days per week they would prefer working from home in the future. They could choose one alternative from zero (0%) to five days (100%), and the responses are summarized in Figure 6.2 on the next page.

Figure 6.2: Agents' preferred use of home office in the future



As with perceived performance, there are also very divided opinions among the agents regarding their preferred use of home office. The vast majority (71%) wants to work more from the office and, surprisingly, more than a quarter of the agents (27%) does not want to work from home at all. 60% of the respondents will prefer a combination (i.e. 1 to 4 days a week at home). We see that the number of respondents decreases with increasing number of days, before there is a substantial increase from four to five days a week (i.e. to work exclusively from home). The average is 1.9 days a week, while the median is 2.

Further, we perform regressions to assess if there is a correlation between the preferred use of home office and the performance when working from home. We use calls per hour and average customer score as dependent variables, and the preferred number of days at home as a continuous variable in the interaction term. We find no correlation between the preferred use of home office and performance when working from home, neither in terms of productivity nor quality (see Table A1.9 in Appendix).

To investigate what characterizes the agents who want to work exclusively from the office, we find it appropriate to perform probit regressions with the preferred use of home office as the dependent dummy variable. The variable equals 1 if zero days is preferred and 0 if one or more days is preferred. Table 6.6 on the next page shows regressions with different combinations of agent characteristics.

Table 6.6: Some characteristics affect the probability of preferring the office

Dependent Variable: Prefer exclusively working from the office	(1)	(2)	(3)	(4)	(5)
Children	-0.108***		-0.087***	-0.096***	-0.032***
	(0.012)		(0.012)	(0.13)	(0.011)
Household member		-0.060***	-0.038**	-0.021	-0.040***
		(0.012)	(0.013)	(0.012)	(0.012)
House over 80m^2			-1.09***	-0.104***	0.066***
			(0.014)	(0.015)	(0.011)
Own office			0.086***	0.089***	0.018
			(0.011)	(0.012)	(0.012)
Commute over 20 min				-0.230***	-0.290***
				(0.012)	(0.012)
Age					-0.016***
					(0.001)
Female					-0.144***
					(0.012)
Number of employees	56	56	56	56	56

Notes: The regressions are all probits at individual level of exclusively preferring to work from the office in the future. The effects are marginal effects calculated at the mean. "Household member" is if the agent has usually had another household member working from home simultaneously. The preferences are given from the survey. 27% of the respondents prefer to exclusively work from the office. Robust standard errors are reported. *** denotes 1% significance, ** 5% significance and * 10% significance.

We find that the agents who prefer to work from home at least one day a week are more likely to have children living at home. They are also more likely to usually have had another person in the household who have been working from home simultaneously. Moreover, we find that commuting time is one of the most important factors determining the agents preferred use of home office. Those with commuting time less than 20 minutes are, naturally, more likely to prefer working exclusively from the office. We also find that the agents preferring not to work from home are more likely to be younger. As for gender, those who prefer working from home at least one day a week are more likely to be women.

6.3 Summary of results

Based on an overall assessment of literature, theory and work design, we expected no significant difference in neither productivity nor quality when the agents were working from home (Hypothesis I and II). In regards to productivity, we find that the agents process the inquiries faster at home. As such, productivity based on the number of calls per handle time (talk time + wrap-up time) is higher. On the other hand, they spend more time on being ready waiting and not ready. This may imply that the agents are having more and/or longer breaks, which will be considered in the next section. The net result is that there is no difference in the number of calls per working hour, which complies with Hypothesis I. However, as the agents have been significantly more productive relative to the time spent on actively handling calls, we cannot unambiguously conclude that Hypothesis I is confirmed. In regards to quality, we find negative effects on several measures. Despite the fact that the effects are fairly small, they are still significant, and we thus reject Hypothesis II.

7 Discussion

7.1 Home office performance

7.1.1 What explains the effects on performance?

7.1.1.1 Effects on productivity

We find no significant difference in the number of working hours when the agents are working from home. This is as expected since they have set schedules, regardless of work location. As explained, for home workers we find a significant increase of 2.6% in the number of calls per handle time. The effect is consistent with Bloom et al. (2015) who found an increase of 3.3% in a similar productivity measure for call center representatives working from home. This implies that our results may also apply to other companies with employees performing similar work tasks, as will be discussed in *7.2.3 Transferability*. In the following, we will first explain what lies behind the increase in calls per handle time before discussing why we still do not find a difference in calls per working hour.

Shorter handle time

For agents working from home, the average handle time per call is significantly shorter. The decrease is significant for both the talk time and the wrap-up time. That is, the agents are generally faster at handling inquiries at home. While the percentage effect is largest for the wrap-up time, the total talk time constitutes to twice as much as the wrap-up time on a representative working day. Therefore, the daily, absolute effect of each measure will be fairly similar.

There are indications that the shorter handle time may be explained by the working environment at home. In the survey, 64% of the agents believe they have a quieter working environment when working from home and only 24% report more interruptions (see Figure A3.10 in Appendix). It can be assumed that this has an affect on both the talk time and the wrap-up time. As seen in the correlation matrix in Figure A3.11 in Appendix, we find a strong, positive correlation between a quieter working environment at home and the agents' focus on their work tasks. There is also a significant, negative

correlation between increased focus and the amount of interruptions.

A quieter working environment with fewer interruptions and less background noise is likely to make it easier to hear and talk with a customer as well as streamlining the process of registering a summary of a conversation. This is also consistent with literature. For example, Bloom et al. (2015) found that the employees, when working from home, could more easily hear the customers. As a result, the customers had to repeat themselves less often and the inquiries could therefore be processed more quickly. Furthermore, Banbury and Berry (1998) found that background noise at the office can reduce performance. As for most employees, there is usually less background noise at home, implying that the productivity at home can increase.

Longer ready waiting time and not ready time

While the handle time per call is shorter at home, there is still no significant difference in the main productivity measure, number of calls per working hour. The reason behind this is that there is a significant increase in both the ready waiting time and the not ready time when the agents are working from home. With an increase of almost 11%, the ready waiting time has the largest percentage effect. However, this time constitutes to only about 6% of a representative working day, making the absolute increase relatively small. Since the not ready time makes up almost a third of the working day, the absolute effect of this measure is substantially larger, although the percentage increase is much smaller.

It is natural to assume that the increase in ready waiting time could be caused by higher productivity, in terms of calls per handle time. The reasoning is that, if the productivity increase is sufficiently high, the demand per agent could be reduced to the extent that the agents have to wait longer for the next call. This may explain some of the increase, but presumably only a small part. According to the company, the demand per agent is generally high and there is usually a queue on the line. For that reason, even though the agents work faster, they will usually get a new call immediately after finishing the previous inquiry. As the increase in calls per handle time at home is fairly modest, it is very unlikely that this will have such a significant effect on the workload.

Also, when leaving their seat, for example to get a coffee or go to the toilet, the agents have to set themselves to "not ready" in order to not receive incoming calls. However, according to our survey, when working from home the majority of agents set themselves to "not ready" less often when leaving their seat (i.e. continue to be registered as "ready waiting" when they really are not). This implies that parts of the ready waiting time are, in fact, not ready time, and that the actual ready waiting time is shorter.

Moreover, we believe the increase in not ready time is due to the fact that agents have more and/or longer breaks when working from home. There are few agents who report this in the survey, but our results highly indicate that this is the case. With shorter handling times and the same number of working hours, we should expect the agents to be able to handle more calls per working hour at home, which they do not. If this was due to demand, as discussed, we should only have observed an increase in the ready waiting time, not in the not ready time. As explained above, there is also reason to believe that the actual not ready time is even longer. Since we only have data on daily observations, we do not know if the effect is caused by an increase in the duration or the frequency of breaks, or a combination of both.

Our findings are highly related to principal-agent theory. When the agents are working from home, it is not possible for their team leaders to directly supervise them and to observe their efforts explicitly. However, as the agents' performances are measurable and the link between effort and performance is direct, the team leaders can still get a good indication of their efforts. The theory predicts that the agents may act inconsistently with the wishes of the company, which is also what our results indicate. Due to the lack of direct supervision when working from home, the threshold for acting in one's own interest may be lower, although the agents are aware that this can be observed in the system. There are also ways in which their behavior is challenging to observe. As discussed, the agents are more often set as "ready waiting" when they are leaving their seats at home. By doing this, it becomes difficult for the team leaders to observe their actual amount/duration of breaks, which is reflected in their not ready times.

We also believe it is important to discuss the possibility that the increase in the duration and/or frequency of breaks could be more the result of better time allocation for each

agent, rather than the agents "shirking". It may be that, the reason why the agents have shorter handling times at home, is because they have more and/or longer breaks. And vice versa, with higher productivity when performing their tasks, they may "reward" themselves with breaks. Possibly many agents prefer allocating their time this way, and that this is only observable when they are working from home as they do not have the opportunity to do this at the office. As such, what seems to be "shirking" may be a necessity to perform from home.

7.1.1.2 Effects on quality

When the agents are working from home, we find a small, but yet significant decrease in the average customer score and the company-specific measure, TMK. We also find a large, significant increase in the percentage of missed calls. In regards to the adherence score (i.e. how well the agents follow their schedules), we find no significant difference between home and office workers. We will in the following discuss possible explanations for the effects on these different quality measures.

Reduced customer score

First, we find it natural to consider whether there is a trade-off between productivity and quality when the agents are working from home. There are many examples of productivity increasing at the expense of lower quality, a potential effect that we also should take into account. However, we find no correlations between talk time and average customer score or TMK. The same is true for the wrap-up time. Therefore, the fact that the agents handle the inquires faster at home does not seem to affect how satisfied the customers are with the service.

The decrease in quality is probably caused by other factors that are challenging to measure the effects of. For example, when the agents are working at the office, there are colleagues and managers sitting nearby who can hear them when talking with the customers. Naturally, as the agents are observed directly, they may put greater effort into appearing pleasant and helpful than they do at home. This assumption is also supported by elements from the principal-agent theory. When the agents are working from home, away from direct supervision, they may not act according to how the company wants them to behave in dialogue with the customers.

No difference in adherence

As discussed, the agents appear to be having more and/or longer breaks when working from home. However, this does not affect the adherence score which is the same whether the agents are at home or the office. Put differently, they are just as good at following their schedules, when measured on a daily level. This raises the question of why the increase in the duration and/or frequency of breaks at home does not affect the adherence score.

One possible answer could be that the agents are better at logging in on time when working from home. To investigate this, we performed a regression to see if there is any difference in the log on time between home and office, in the interval from 7.55 AM to 8.30 AM. As long as the agents log on before 8 AM, the adherence score will not be affected, but logging on later, the score will decrease with increasing delay. As seen in Table A1.10 in Appendix, we find that the agents log on about three minutes later when working from the office. This implies that the agents more often log on after 8 AM at the office, which will have a negative effect on their adherence scores. One obvious reason for this could be the likelihood of being delayed, which is naturally higher when the agents have to travel to the office.

Potentially, the same could be the case after the agents' lunch breaks. When working from the office, they may more often log on after the time they are set to work again. For example, when having lunch with colleagues in the canteen, it is natural to assume that it is less likely that the agents will return to their seats on time compared to when working from home. However, this is only an assumption and is not something we can examine with the data. In conclusion, we believe the increase in the duration and/or frequency of breaks is weighed up by the agents being more on time when working from home. The result is that there is no significant difference in the daily adherence score.

Increased percentage of missed calls

In general, only 2-3% of incoming calls are missed by the agents. According to the company, the overall percentage during the period of the observations has been satisfactory. However, we still find that the percentage is significantly higher when working from home, with an increase of about 50%. This finding is consistent with the fact that several agents report

that they less often set themselves to "not ready" when leaving their seat at home. When the agents are "ready" and they receive an incoming call, they have 18 seconds to answer before they are set as "not ready" and the call is being transferred to someone else. As they probably more often leave their seats still set as "ready" when at home, it is likely that there will be more cases where they are not able to answer the call in time.

7.1.1.3 Effects in light of hypotheses

As explained, the results of our study are somewhat different from what we expected based on the literature, theory and work design. While the effect on productivity is relatively consistent with the findings of Bloom et al. (2015), the effect on quality is more in accordance with expectations from principal-agent theory. At the same time, we believe it is important to take into account the work design. As explained, the agents' work tasks are highly individual and directly driven by demand, with a direct link between effort and performance which is also measurable when they work from home. For that reason, we can argue that their performance at home should be similar as the team leaders are still able to get a good indication of the agents' efforts, although this cannot be observed directly. Yet, some of our findings indicate that a principal-agent problem may be present. On the other hand, our findings also show how working from home may improve performance. We will in the following discuss what characterizes the agents who perform better at home.

7.1.2 What characterizes the agents who perform better at home?

In the analysis, we found that the agents who *believe* they perform better at home *actually* are significantly more productive when working from home, with 3.7% more calls per hour compared to those who believe they perform the same or worse. This correlation also holds true the other way. That is, the agents who believe they perform worse when working from home are, in fact, significantly less productive at home. We also observe similar effects in regards to quality. These findings are in contrast to Gajendran and Harrison (2007) who did not find a correlation between actual and self-rated performance at home. Moreover, we find great variations in how the agents perform when working from home relative to the office. As explained in the analysis, the effects on both productivity and quality seem to be homogenous across different characteristics, such as age, gender and

experience. This implies that home office performance is determined by characteristics that are more individual and subjective.

7.1.2.1 Motivating factors

As explained, several studies (Lines, 2011; Manzoor, 2011; Taylor-Bianco & Schermerhorn, 2006) find positive correlations between motivation and performance. This is also what our findings indicate. Analyzing the survey data, we find a strong, positive correlation between perceived performance and motivation when working from home (see Figure A3.11 in Appendix). That is, the agents who believe they perform better at home also report being more motivated at home, and vice versa. By using Herzberg's two-factor theory as a framework, we will further discuss different factors that may increase and inhibit motivation when working from home.

Personal responsibility and recognition

First, we find a positive correlation between motivation and personal responsibility. This is consistent with Herzberg's theory stating that responsibility is a factor that will stimulate motivation and make the employee work harder. There are, however, very divided opinions concerning whether the level of personal responsibility has increased or decreased when working from home, with most (41%) reporting that the level has remained the same (see Figure A3.10 in Appendix). Closely related to responsibility is recognition, which is also one of Herzberg's motivating factors. For this factor, we also find a positive correlation with motivation, although not as strong as the correlation between motivation and responsibility. However, only 7% of the agents report that they are being more recognized for their work when working from home. This implies that the positive correlation is caused mostly by less recognition reducing the agents' motivation. If so, this contradicts to Herzberg's theory saying that this factor will not cause demotivation if not present.

Working conditions

Further, we find a strong, positive correlation between motivation and working conditions. In this case, there are also divided opinions among the agents, with the majority (61%) reporting worse conditions at home. Surprisingly, only 14% believe their working conditions at home are about equally good as in the office. There are great variations among agents regarding for example housing size and living arrangements. This may explain why there

is also great variation in reported working conditions. According to Herzberg, work conditions are considered as hygiene factors that will not increase motivation but cause dissatisfaction if not present. Since the majority of the agents report worse conditions, our findings may indicate the same. As discussed, however, almost two out of three agents believe they have a quieter working environment at home and more than half report fewer interruptions. This implies that there is more to working conditions than only background noise.

Personal development and career opportunities

The survey also shows that 57% of the agents believe working more from home is worse for their personal development, and as much as 66% believe it inhibits their career opportunities relative to working from the office. These are important motivating factors in Herzberg's theory, and we also find a strong positive correlation between each of the two factors and motivation. On the other hand, the correlation seems to be more the result of worse personal development and career opportunities causing less motivation among the agents, which in that case will contradict to the theory. The findings are, however, very consistent with the study of Bloom et al. (2015) which concluded that working from home has a negative impact on promotion as a result of employees being "out of sight" for supervisors. Consequently, this was one of the main reasons why many of the employees decided to return to the office after the experiment.

Coworker and supervisor relations

We also find that the vast majority of agents (68%) believe the relationship with their supervisor has not changed notably when working from home. This is not surprising as, even when most agents have been working from home, team meetings have been held at the same frequency as before, only virtually. As for the relationships between co-workers, however, as many as 41% of the agents believe this has become worse while about as many report that it has been roughly the same. When working remotely it naturally becomes more challenging to interact with colleagues. In fact, we find that almost two thirds of the agents (65%) less often discuss work-related issues with colleagues when working from home. Both co-worker relations and supervisor quality are, according to Herzberg's theory, hygiene factors that may cause dissatisfaction if not present. However, we do not find a notable correlation between any of these factors and motivation. Our findings are, on

the other hand, more consistent with Golden (2006) who found that working from home inhibits co-worker relationships.

7.1.2.2 Remarks

As discussed above, we find positive correlations between factors from Herzberg's two-factor theory and how motivated the agents are when working from home. However, it is challenging to confirm or disprove whether motivating factors only stimulate motivation and that hygiene factors only create dissatisfaction if not present. Although we can indicate in which direction the effects pull, we still cannot make unambiguous conclusions. This is also supported by other studies (Despoteris & Myloni, 2018; Ott, 1965) which concluded that both motivating factors and hygiene factors in regards to Herzberg two-factor theory can cause *both* motivation *and* dissatisfaction (demotivation).

7.1.3 What characterizes the agents who prefer not to work from home?

We find great variations in how many days a week the agents will prefer to work from home after the pandemic. As explained, the average is 1.9 days. This can be related to Golden and Veiga (2015) who found that the number of home working days that maximizes satisfaction is given at 15.1 hours per week. We find, however, no correlation between the agents preferred use of home office and how they perform when working from home, both in terms of productivity and quality. As such, although the agents understand that they perform better or worse at home, this is not essential for what they prefer. This implies that those who prefer to stay more at home want this for reasons that are not directly related to their performances. As discussed, a surprisingly large percentage of agents does not want to work any days from home. We will in the following discuss what lies behind the factors determining whether an agent is more likely to prefer working from home or at the office after the pandemic (ref. Table 6.6 in section *6.2.2*).

Commuting time

One of the most important factors determining the agents preferred workplace is commuting time. Naturally, those with longer commutes are more likely to prefer working from home at least one day a week relative to those with shorter commutes. This is consistent with

Bloom et al. (2015) who found that employees facing longer commutes were more likely to volunteer to work from home. Further, the commuting time does not affect the agents' performances (see Table 6.3 in section *6.1.1*). Therefore, as this is one of the most essential factors for where the agents want to work, this helps explain why we find no correlation between performance at home and the preferred use of home office.

Living arrangements

Besides commuting time, children seem to be an important factor. Agents with children living at home are more likely to prefer minimum one day a week of home office relative to those without. This is also what Bloom et al. (2015) found, explaining that working from home is considered more suitable with the daily duties of having children. Our findings are also consistent with other studies suggesting that working from home may promote work-life balance and contribute to lower work-family conflict (Allen et al., 2015; Gajendran & Harrison, 2007). Moreover, Bloom et al. (2009) did not find a correlation between work-life balance and productivity. This is also what our findings imply as there is no correlation between productivity at home and the preferred use of home office.

Further, the agents who have usually worked without other household members at home simultaneously, are more likely to prefer working exclusively from the office. From the survey, we also find that the majority of respondents (56%) are feeling lonelier when working from home. This indicates that the agents place a high value on social interactions, and that this is an important factor determining whether they want to return to the office or not.

Age

We also find that the agents preferring to work exclusively from the office tend to be younger. As discussed, many agents believe working from home is worse for their personal development and career opportunities. However, there are no correlations between the responses to these statements and age. That is, older agents share the same views as the younger ones in regards to personal development and career opportunities. It is, on the other hand, natural to assume that younger agents will place a higher value and put more emphasis on these factors when determining where they want to work. This is also, as discussed, highly consistent with Bloom et al. (2015) although they did not find that the

preferred workplace was dependent on age.

7.2 Implications for the future of work

7.2.1 What should the company do?

Let the agents decide

One important implication from our study is that the case company should consider allowing the agents to decide for themselves whether they want to work from home or not. As discussed, there is no correlation between performance at home and the preferred use of home office. Therefore, the agents who to a greater extent prefer to work from home are not necessarily going to perform any better at home than they do at the office. As shown in this study, working from home is likely to have a positive effect on productivity, with a downside being a small decrease in quality. Our findings also suggest that the agents are more likely to devote some more time to activities that are not work-related, so-called *deviation costs* in the principal-agent theory. However, by taking appropriate actions, we believe the positive effects of working from home may be greater.

Focus on key performance indicators

Both quality and the time spent on not handling calls are measures that the team leaders can observe in the system. With more focus on monitoring these measures for the agents working from home, it could be feasible to make the agents perform better. In principal-agent theory, this additional monitoring falls under what is referred to as *system costs*. Additionally, the company can consider if they need to specify other goals the agents should work toward. As discussed, it is also important to emphasize that the increased duration and/or frequency of breaks may be a necessity for the increase in calls per handle time. Consequently, getting the agents to devote more time to handle calls may also increase their average handle time, with the net effect being no significant change. Or worse, increased monitoring may lead to a negative net effect on this measure of productivity.

Focus on virtual leadership

Team leaders should take into account that there may be a tradeoff between monitoring and motivating. While it is natural to believe that more focus on monitoring key measures could improve performance, it may also inhibit the motivation of the agents and negatively affect how they perform. In the survey, we find a moderate negative correlation between monitoring and the level of motivation. We also find that only 20% report being more motivated when working from home. As explained, the team leaders are responsible for motivating their team members. Our findings imply that this is more challenging when they are not physically co-located in the office. Thus, we believe the company and its managers should focus more on virtual leadership, and how to motivate the agents when they are working from home. As motivation seems to be one of the most important factors for performance, more focus on leading virtually may be one of the most important measures if the agents are to continue working from home in the future.

Pandemic-specific effects

It is important to emphasize the fact that the majority of observations in our study have been during the period of the Covid-19 pandemic, and whether this have had a significant impact on our conclusions. On one hand, there are some obvious negative effects of the pandemic. For one to two months, from mid-March to mid-April, kindergartens and primary schools were closed. During this period, several agents (26% of survey respondents) thus had to work while at home with their children. As seen in Table A1.11 in Appendix, agents with children younger than 13 years had a significant decrease in the number of calls per hour when working from home during lockdown. There may as well have been substantial psychological challenges of working from home during a pandemic. This is also reflected in the survey as many agents report feeling lonelier when working from home.

Moreover, although the agents have had technical equipment from the company delivered to their homes, the setup has for many of them probably not been ideal. This could be one of the reasons why only 30% of the agents believe their work conditions at home are better. From the survey, we also find that 28% of the agents do not use external PC screens while working from home, which is surprising considering that they use this at the office. Some agents may prefer to only use their laptop. We believe, however, that

the main reason for this may be that many of the agents probably do not have enough space or a suitable place to have a setup similar to the one at the office. Therefore, the sudden impact of the pandemic and the subsequent requirement of having most agents home for a period of time, may have affected the performance of home workers in this period negatively.

On the other hand, it is also important to emphasize potential effects of the pandemic that have been positive for performance. It may be the case that the agents have, due to the extraordinary situation, felt the need to make an extra effort and work collectively to achieve good results. Some agents may also have felt uncertainty related to possible layoffs and a tough job market, making them work harder. However, it is natural to assume that these possible effects have been the same regardless of whether the agents have been working from home or at the office. As the agents, during the period of observations, have had a fairly good distribution of working days at both locations, we consider it unlikely that these effects would affect the validity of our conclusions.

Therefore, although the effects of the pandemic have pulled in both directions, it is unlikely that it has had a net positive impact on the agents when working from home. If the pandemic has had a significant impact, we find it more likely to be negative. This implies that, in a future situation without a pandemic, the performance of home workers could possibly be better than what the results of our study show. We are at least confident that they would not be any worse. This further supports the decision of letting the agents work from home.

Long-term effects

Leaving the decision to themselves may also have several positive long-term effects. Studies found that working from home is positively associated with job satisfaction (Bloom et al., 2015; Gajendran & Harrison, 2007). Among the agents, there are very divided opinions regarding this, with most actually reporting lower job satisfaction at home. However, unlike the abovementioned studies, home office has often been a requirement for the agents. According to Golden and Veiga (2005), the relationship between home working and job satisfaction is curvilinear, meaning that having most of the working days at home may lead to a lower level of satisfaction. Still, we find it natural to assume that the freedom to

choose where to work from will make the agents more satisfied. By giving them greater power to influence their own working day, they can choose what is best for their well-being and their living situation. This will, for example, be of great assistance for agents with younger children as it will become easier to balance work with private life. As discussed above, this is an important explanation for why some agents want to work more from home.

7.2.2 Other benefits of working from home

The main focus of this thesis has been to analyze the effects working from home has on performance. Regardless of these effects, there are also other benefits of having employees at home, some of which we believe are worth discussing.

Attract greater talent

First, allowing employees to work from home may be decisive to attract greater talent. The flexibility to choose one's desired location of work seems to have become increasingly important when choosing an employer. Buzza (2017) found that millenials are significantly more attracted to jobs with high levels of work-life balance, which being able to work from home implies. With the possibility to work from home, employees will also have greater flexibility to choose where they want to live as it becomes less important to have a short commuting time to the office. As discussed, commuting time is one of the most essential factors determining the agents preferred location of work. Therefore, we assume that greater options for where to settle down will positively affect recruitment.

Cost savings

Another important benefit of having employees working from home is the possibility to save office costs. On average, the agents will prefer to work from home 1.9 days a week. As such, there could potentially be up to around 30% fewer agents at the office at any time. This is given that the agents distribute their home working days such that the number of agents working at the office is roughly the same each day. Fewer agents at the office implies cost savings related to, among other things, less required office space, lower energy consumption and less need for cleaning and maintenance.

However, there may also be increased costs by having more employees working from home. For example, all agents have had technical equipment from the company set up at their homes, and it is possible that a potential, future use of home office will further increase the costs related to office supplies. Overall, we still assume that the cost savings of having more employees home will exceed possible cost increases. Accordingly, we would suggest the company to consider investing even more in their employees' home office supplies, also beyond technical equipment. There are obviously some conditions that are difficult to deal with (e.g. living space). The company can, on the other hand, invest in equipment such as proper office chairs and desks to optimize each agent's setup at home. Improving their working conditions may potentially lead to increased performance.

The office is still not dead

We believe the company should be cautious about how they move forward and not make hasty decisions. Although there are many benefits of having employees at home, the office is still not dead. As our study shows, the vast majority of the agents will prefer to work mostly from the office after the pandemic. Therefore, there is still a need for an office to go to. Consequently, closing down the office and requiring the agents to work exclusively from home may have devastating effects. Our findings show that most agents will prefer a combination, with some days at home and others at the office. They seem to place a high value on the flexibility this entails, and the company should thus strive to facilitate this.

7.2.3 Transferability

It is also important to consider the transferability of the results and implications of our study. As explained, the work tasks of the agents are characterized by being highly individual and relatively standardized. There is not much variation in how comprehensive the customer inquiries are and, as such, there is little variation in how the inquiries are being processed. Therefore, the work can mostly be performed individually, although it occasionally requires some collaboration. Also, the agents' workload is directly driven by demand and the link between their effort and performance is direct. This makes it easy to measure their performance, even when they work from home. Combined, these characteristics make the work of call center representatives particularly suitable to perform from home.

We believe our results and implications also apply to other jobs that share the same characteristics. First, we assume that they are transferable to call center representatives at other companies, as the call queueing systems often are universal. Also, we believe our results will apply to other jobs within the company we have analyzed, such as claims processors, sales representatives and IT support. If so, the potential savings on office costs will be much greater. Moreover, the results of this study may also apply to a range of other service jobs across different industries, given that the tasks share most of the same characteristics.

However, the results and implications of this study is probably not applicable to other jobs without the abovementioned characteristics. For example, work that is more team-based is likely to be more challenging to perform exclusively from home. One reason is that it will become difficult for managers to observe each of the team members' effort. Their individual performance will often be challenging, if not impossible to measure. As such, it may be necessary with more direct supervision. Due to generally less interaction between team members, it may also become more challenging to collaborate and work toward the same goal. If so, working from home may have negative effects in the long term and it may be difficult to detect if team members are rowing in different directions.

Our results may also not apply to individual jobs that, to a greater extent, is non-standardized. For such work tasks there is rarely a direct link between effort and performance, and the performance is typically much more challenging to measure. As such, the likelihood of a principal-agent problem occurring may be greater. This may also be the case for work that is not directly driven by demand. While call center representatives have to process inquiries whenever they get incoming calls, there are other jobs without this form of workload in which the threshold to "shirk" may be lower.

8 Conclusion

In 2020, the Covid-19 pandemic required companies across most industries to send their employees home. Having the majority of the workforce working from home for several months, many companies are considering whether they should make this a permanent practice, even after the pandemic. To analyze important impacts of practicing home office, we used actual performance data of 107 call center representatives ("agents") at a Nordic bank and insurance company. By comparing how the agents performed at home relative to the office from the beginning of January to the end of August, we identified significant effects of working from home which have several implications for the future of work.

We find that the agents, when working from home, are a little more productive during the time they spend on actively performing their work. This is probably because most agents have a quieter working environment with fewer interruptions at home. On the other hand, the agents also seem to be having more and/or longer breaks. The result is that there is no difference in productivity based on the number of calls per working hour. We also find that the quality of their work, in terms of customer satisfaction, is slightly lower. When working from home, their team leaders cannot directly supervise the agents and observe their efforts explicitly. In accordance with principal-agent theory, this may lower the agents' threshold to act in their own interests. At the same time, it is important to emphasize that the increase in the duration and/or frequency of breaks may be a consequence of individual time allocation preferences and possibly a necessity for productivity to increase.

Further, we find great variations in how the agents perform when working from home, but the effects do not seem to vary between characteristics such as age, gender and experience. Essential to the differences in performance is rather the agents' level of motivation. By using Herzberg's two-factor theory as a framework, we find that motivation at home seems to depend on particularly the agents' working conditions as well as the level of responsibility, recognition, personal development and career opportunities.

Moreover, we find that the agents understand whether they perform better or worse when working from home. Interestingly, however, this is not decisive for their preferred use of

home office. The agents' preferred location of work seems rather to be determined by factors that are not directly related to their performance. One of the most important factors is commuting time. Other relevant factors are family life and living arrangements. Children and other household members increase the likelihood of preferring to stay at home, which is probably due to the importance of social interactions and the fact that it becomes easier to balance work with family life. We also find that younger agents are more likely to return to the office, possibly because of concerns related to their personal development and career opportunities.

Our findings from this study have several implications. Importantly, we believe the case company can let the agents decide for themselves whether to work from home or not. This may give substantial cost savings which can be used to invest more in the agents' home setups. As such, practicing home office can have great positive long-term effects on the performance and well-being of the agents. These effects may also occur indirectly by attracting greater talent. When having more agents at home, the company can also benefit from focusing more on virtual leadership and putting more emphasis on certain key performance indicators.

Further, we believe our results can apply to other jobs sharing the same characteristics as the work tasks of call center representatives. These are highly individual and relatively standardized, with a direct link between effort and performance which is easy to measure. Combined, these characteristics make the job particularly suitable to perform from home. For other jobs that are less standardized and require more team-work, the effects may differ from our findings. Therefore, we believe the practice of working from home is worth further exploration.

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Appendix

A1 Regression tables

Table A1.1: Table 6.2 with non-transformed variables shows similar effects

Dependent Variable	(1) Calls per hour	(2) Talk time per hour	(3) Wrap-up time per hour	(4) Ready waiting time per hour	(5) Not ready time per hour
Home	-0.048	-34.287***	-30.636***	13.295***	36.439*
	(0.034)	(8.192)	(5.477)	(4.625)	(20.756)
Number of employees	107	107	107	107	107
Observations	7968	7968	7968	7968	7968

Notes: The regressions are run at individual level, with a full set of individual and time fixed effects. "Home" is the independent variable indicating an agent working from home. The regressions are run for the period of January 2 to August 31. All variables are recorded from the call system. Standard errors are clustered at the individual level. *** denotes 1% significance, ** 5% significance and * 10% significance.

Table A1.2: Effect on productivity at home is equal across teams

Dependent Variable:						
log (Calls per hour)	(1)	(2)	(3)	(4)	(5)	(6)
Team:	Team 1	Team 2	Team 3	Team 4	Team 5	Team 6
Home x Team	-0.028	0.004	-0.047	0.026	0.026	0.014
	(0.020)	(0.023)	(0.032)	(0.036)	(0.018)	(0.019)
Home	0.0004	-0.006	-3e-05	-0.008	-0.011	-0.009
	(0.012)	(0.012)	(0.011)	(0.011)	(0.012)	(0.012)
Number of employees	107	107	107	107	107	107
Observations	7969	7969	7969	7969	7969	7969

Notes: The regressions are run at individual level, with a full set of individual and time fixed effects. "Home" is indicating an agent working from home and teams are used in the interaction term. The regressions are run for the period of January 2 to August 31. The dependent variable is log-transformed due to skewness to make the distribution more symmetric. Calls per hour is from the call system. Standard errors are clustered at the individual level. *** denotes 1% significance, ** 5% significance and * 10% significance.

Table A1.3: Effect on quality of working from home is equal across characteristics

Dependent Variable: Customer satisfaction (TMK)	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Characteristic:	Age	Female	Years of experience	Children	Commute > 20min	Own office	Minimum Bachelor
Home x	0.019	2.203	-0.008	0.627	3.078	-1.226	-2.971
Characteristic	(0.073)	(2.096)	(0.129)	(2.823)	(2.570)	(2.391)	(2.620)
Home	-4.737	-5.034**	-3.980**	-5.467***	-7.051***	-4.475**	-6.430***
	(3.368)	(1.968)	(1.896)	(1.888)	(2.520)	(1.923)	(2.011)
Number of employees	101	101	101	56	56	56	56
Observations	7237	7237	7237	4508	4508	4508	4508

Notes: The regressions are run at individual level, with a full set of individual and time fixed effects. "Home" is indicating an agent working from home and "Characteristic" is used in the interaction term. The regressions are run for the period of January 2 to August 31. The dependent variable is a customer satisfaction measure the call system ranging from -100 to 100. Characteristics are from the HR-database and survey. Standard errors are clustered at the individual level. *** denotes 1% significance, ** 5% significance and * 10 % significance.

Table A1.4: Effect on quality of working from home is equal across teams

Dependent Variable: Customer satisfaction (Average score)	(1)	(2)	(3)	(4)	(5)	(6)
Team:	Team 1	Team 2	Team 3	Team 4	Team 5	Team 6
Home x Team	0.017	-0.040	-0.020	-0.034	0.020	0.022
	(0.025)	(0.025)	(0.056)	(0.043)	(0.024)	(0.037)
Home	-0.048**	-0.039*	-0.042**	-0.041**	-0.048**	-0.049**
	(0.022)	(0.020)	(0.018)	(0.019)	(0.022)	(0.020)
Number of employees	107	107	107	107	107	107
Observations	7609	7609	7609	7609	7609	7609

Notes: The regressions are run at individual level, with a full set of individual and time fixed effects. "Home" is indicating an agent working from home and teams are used in the interaction term. The regressions are run for the period of January 2 to August 31. The dependent variable is the average score from customers reaching from 1-5. Standard errors are clustered at the individual level. *** denotes 1% significance, ** 5% significance and * 10% significance.

Table A1.5: Using continuous variables gives similar effects as ordinal

Dependent Variable	(1) Calls per hour log	(2) Customer satisfaction (Average score)	(3) Customer satisfaction (TMK)	(4) Adherence	(5) Missed calls percentage
Home x perceived performance	0.023**	0.020	1.397	0.017**	-0.009**
	(0.011)	(0.016)	(1.231)	(0.007)	(0.004)
Home	0.074*	-0.120**	-9.459**	-0.055**	-0.036***
	(0.038)	(0.058)	(4.462)	(0.024)	(0.013)
Number of employees	56	56	56	56	56
Observations	4707	4508	4508	4707	4707

Notes: The regressions are run at individual level, with a full set of individual and time fixed effects. "Home" is indicating an agent working from home and perceived performance is used in the interaction term. In this regression the Likert-scale variable perceived performance is treated as continuous (scale 1-5). The regressions are run for the period of January 2 to August 31. Standard errors are clustered at the individual level. *** denotes 1% significance, ** 5% significance and * 10% significance.

Table A1.6: Agents understand if they deliver lower quality at home

Dependent Variable: Customer satisfaction (Average score)	(1)	(2)	(3)
Response:	Perceived performance better	Perceived performance worse	Perceived performance the same
Home x Response	0.023	-0.074**	-0.045
	(0.033)	(0.037)	(0.031)
Home	-0.067**	-0.035	-0.074**
	(0.027)	(0.027)	(0.031)
Number of employees	56	56	56
Observations	4508	4508	4508

Notes: The regressions are run at individual level, with a full set of individual and time fixed effects. "Home" is indicating an agent working from home and "Response" is used in the interaction term. The regressions are run for the period of January 2 to August 31. Average customer score is from the call system and the responses are from the survey. Performance better equals 1 if the agent is strongly agree or agree to better perceived performance. Performance worse equals 1 if the agent is strongly disagree or disagree to better perceived performance. Performance the same equals 1 if the agent is neither agree nor disagree to better perceived performance. Standard errors are clustered at the individual level. *** denotes 1% significance, ** 5% significance and * 10% significance.

Table A1.7: Agents understand whether they deliver higher or lower quality at home

Dependent Variable:			
Missed calls percentage	(1)	(2)	(3)
Response:	Perceived performance better	Perceived performance worse	Perceived performance the same
Home x Response	-0.019**	0.019**	-0.003
	(0.008)	(0.010)	(0.008)
Home	-0.015**	-0.002	-0.008
	(0.005)	(0.005)	(0.006)
Number of employees	56	56	56
Observations	4707	4707	4707

Notes: The regressions are run at individual level, with a full set of individual and time fixed effects. "Home" is indicating an agent working from home and "Response" is used in the interaction term. The regressions are run for the period of January 2 to August 31. Missed calls percentage is phones not answered from the call system and the responses are from the survey. Performance better equals 1 if the agent is "strongly agree" or "agree" to better perceived performance. Performance worse equals 1 if the agent is "strongly disagree" or "disagree". Performance the same equals 1 if the agent is "neither agree nor disagree" Standard errors are clustered at the individual level. *** denotes 1% significance, ** 5% significance and * 10% significance.

Table A1.8: Agents understand whether they deliver higher or lower quality at home

Dependent Variable:			
Adherence	(1)	(2)	(3)
Response:	Perceived performance better	Perceived performance worse	Perceived performance the same
Home x Response	0.029**	-0.034**	-0.001
	(0.010)	(0.016)	(0.012)
Home	-0.014	-0.007	-0.005
	(0.010)	(0.009)	(0.011)
Number of employees	56	56	56
Observations	4707	4707	4707

Notes: The regressions are run at individual level, with a full set of individual and time fixed effects. "Home" is indicating an agent working from home and "Response" is used in the interaction term. The regressions are run for the period of January 2 to August 31. Adherence is how well agents follow their schedule in the call system. Responses are from the survey. Performance better equals 1 if the agent is "strongly agree" or "agree" to better perceived performance. Performance worse equals 1 if the agent is "strongly disagree" or "disagree". Performance the same equals 1 if the agent is "neither agree nor disagree" Standard errors are clustered at the individual level. *** denotes 1% significance, ** 5% significance and * 10% significance.

Table A1.9: Preferred use of home office not determined by performance at home

Dependent Variable	(1) Calls per hour	(2) Customer satisfaction (Average score)
	log	
Home x Days preferred working from home	-0.001	0.002
	(0.007)	(0.010)
Home	-0.002	-0.062**
	(0.023)	(0.030)
Number of employees	56	56
Observations	4707	4508

Notes: The regressions are run at individual level, with a full set of individual and time fixed effects. "Home" is indicating an agent working from home, and the variable number of days preferred working from home in the future is used in the interaction term. The regressions are run for the period of January 2 to August 31. Calls per hour is log-transformed due to skewness to make the distribution more symmetric. Customer satisfaction score reaches from 1-5. Calls per hour and customer score is from the call system. The preferred number of days working from home is from the survey. Standard errors are clustered at the individual level. *** denotes 1% significance, ** 5% significance and * 10% significance.

Table A1.10: Home workers login earlier than office workers

Dependent Variable	(1) Login time
Home	-2.931***
	(0.706)
Number of employees	107
Observations	1831

Notes: The regressions are run at individual level, with a full set of individual and time fixed effects. "Home" is indicating an agent working from home. The regressions are run for the period of January 2 to August 31. Only logins between 07:55 AM and 08:30 AM are included. The coefficient is in absolute minutes. Robust standard errors are reported. *** denotes 1% significance, ** 5% significance and * 10% significance.

Table A1.11: Agents with young children performed worse at home during lockdown

Dependent Variable:		
log (Calls per hour)	(1)	(2)
Characteristic:	Children < 13 years	No children living at home
Home x Characteristic	-0.040**	0.018
	(0.019)	(0.035)
Home	-0.003	-0.023
	(0.026)	(0.041)
Number of employees	55	55
Observations	1688	1688

Notes: The regressions are run at individual level, with a full set of individual and time fixed effects. "Home" is indicating an agent working from home and "Characteristic" is used in the interaction term. The regressions are run for the period of February 1 to April 30. The dependent variable is log-transformed due to skewness to make distribution more symmetric. Calls per hour is from the call system. Characteristics are from the survey. Standard errors are clustered at the individual level. *** denotes 1% significance, ** 5% significance and * 10% significance.

A2 Different distributions

Figure A2.1: Talk time per call at home

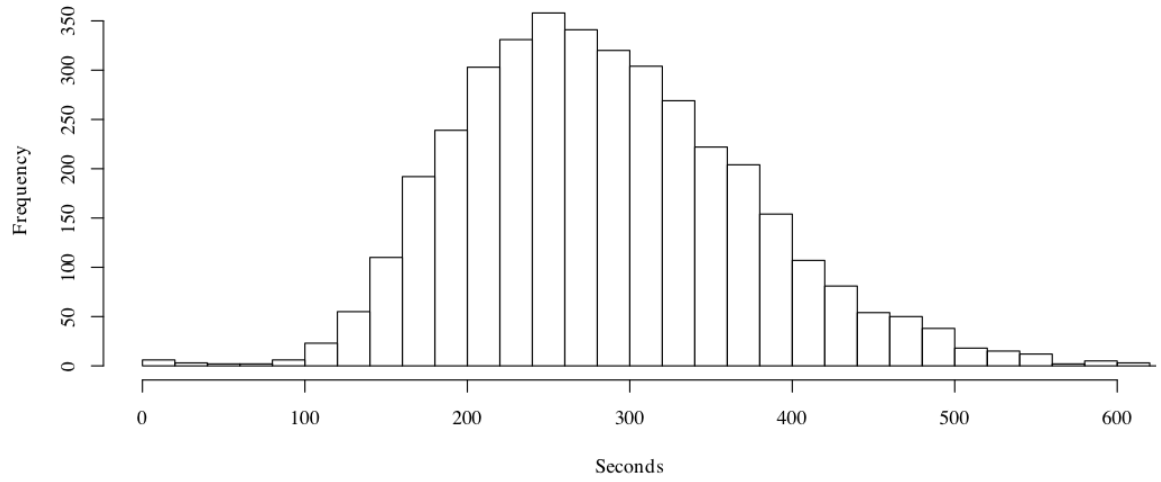


Figure A2.2: Talk time per call at office

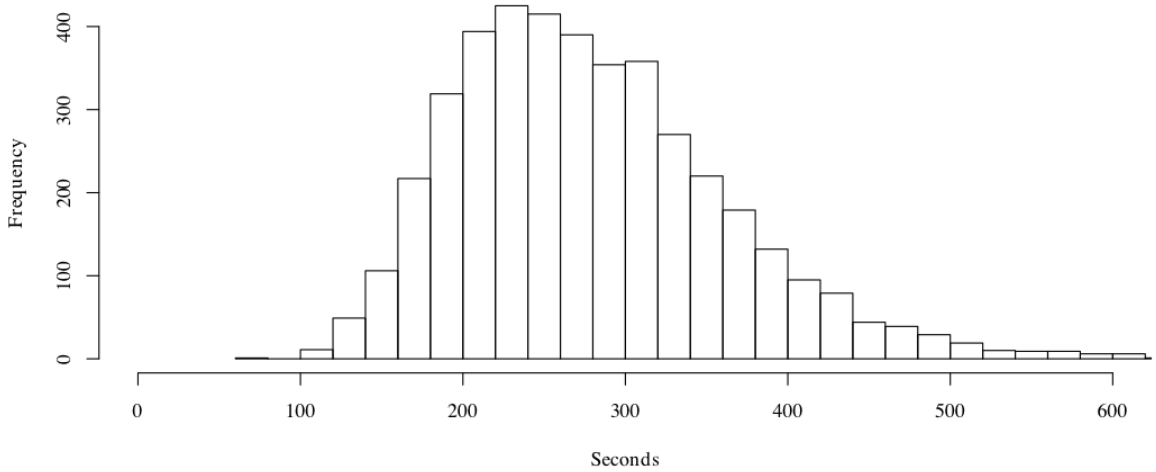
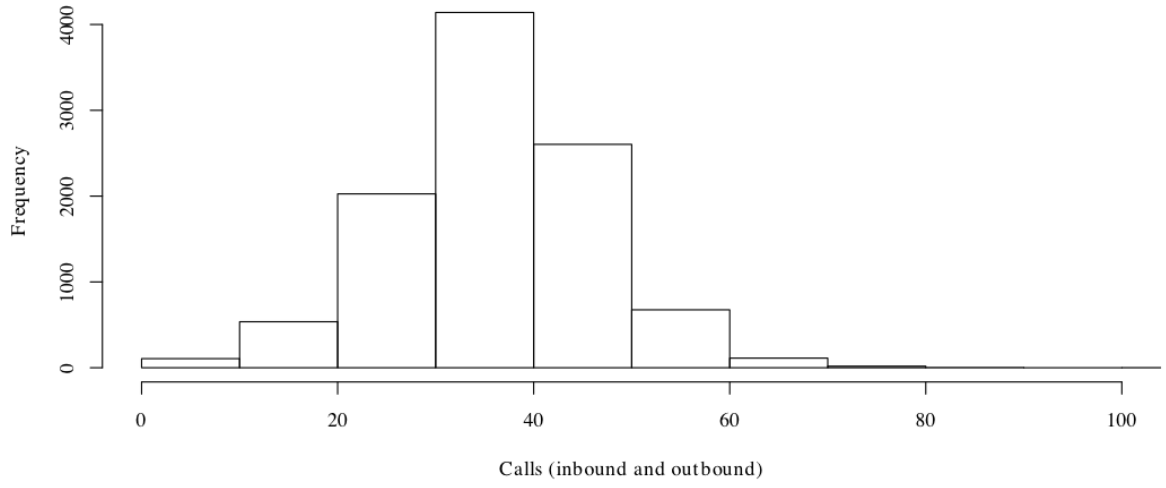


Figure A2.3: Number of calls handled



A3 Survey responses

Figure A3.1: Are you the only person living in your home?

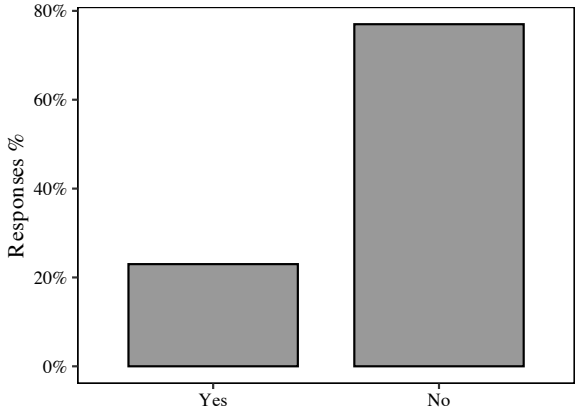


Figure A3.2: Do you have children living at home?

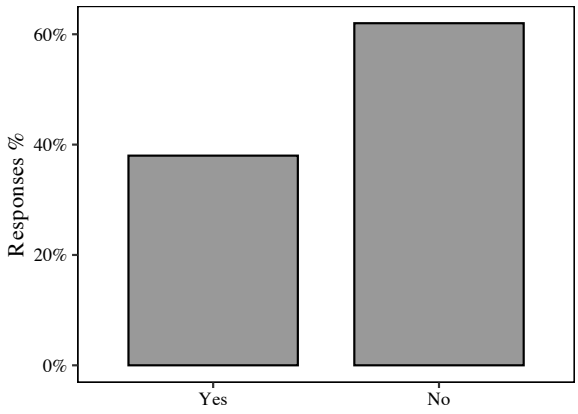


Figure A3.3: How old is your youngest child?

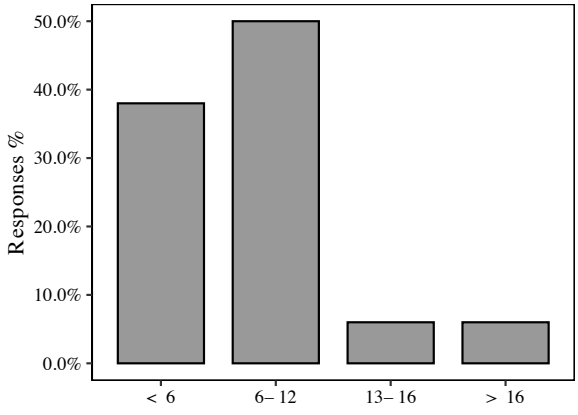


Figure A3.4: Have other household members had home office together with you?

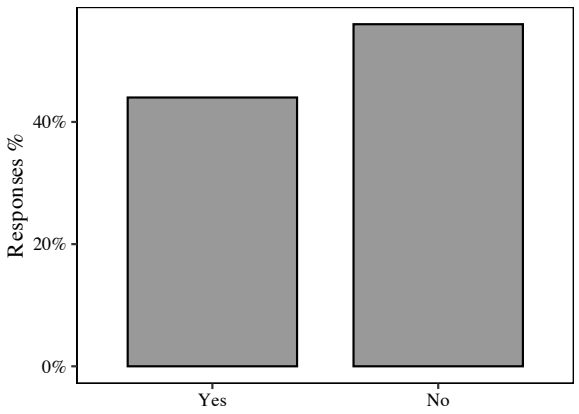


Figure A3.5: What is the size of the house you live in?

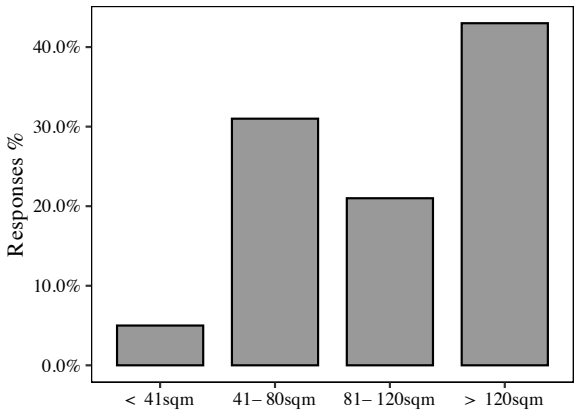


Figure A3.6: Do you have an office (or office bedroom) at home?

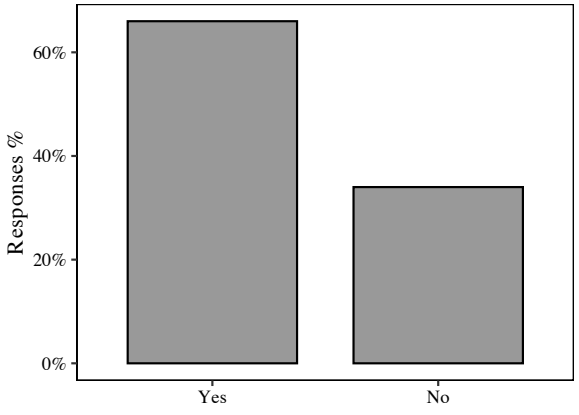


Figure A3.7: Do you usually use external PC-screens when working from home?

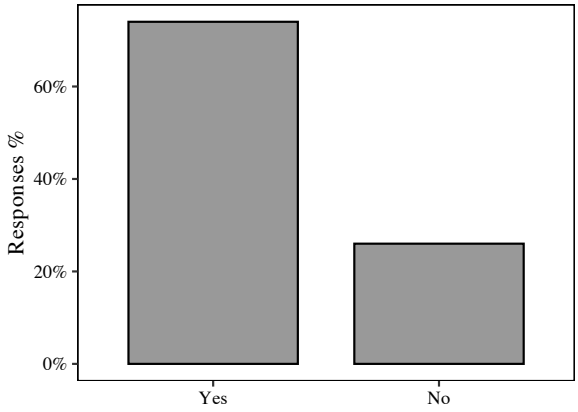


Figure A3.8: How much time do spend travelling to the office (door to door)?

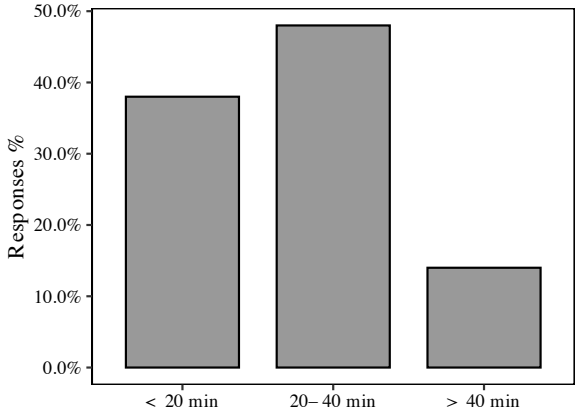


Figure A3.9: Do you have a Bachelors degree or higher?

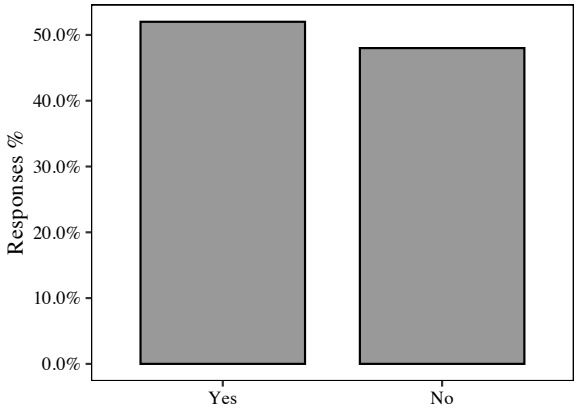


Figure A3.10: Responses to Likert-scale statements

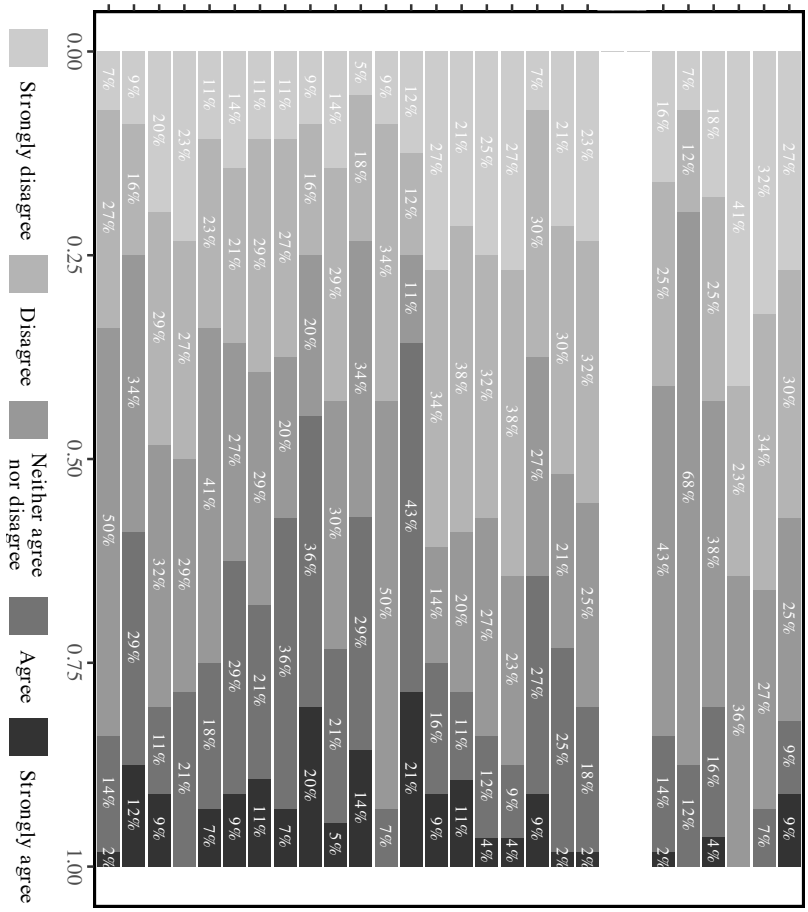
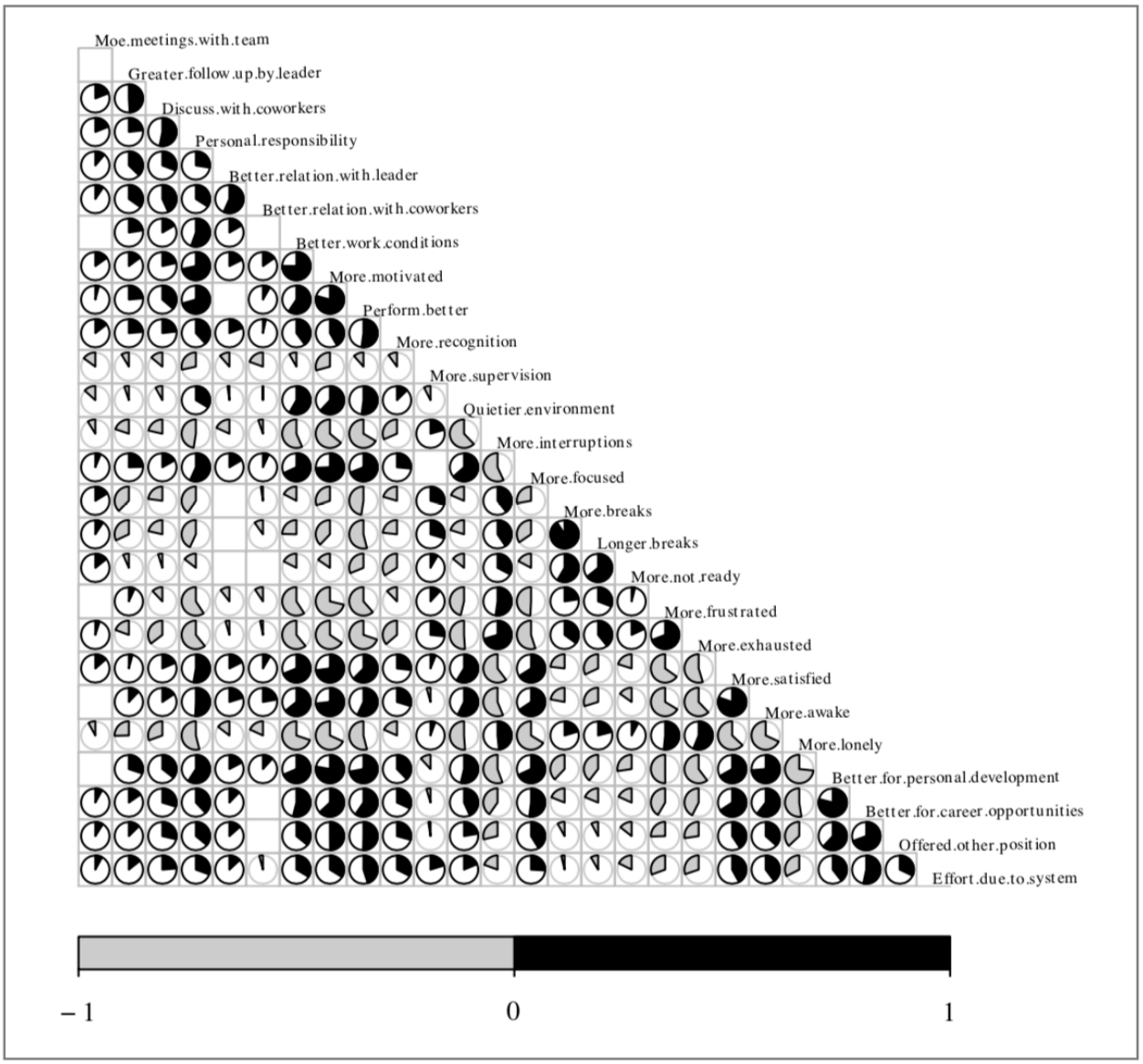


Figure A3.11: Correlation matrix from survey responses



The correlation matrix is based on the responses from the survey. Correlations reach from -1 (perfectly negatively correlated) to 1 (perfectly positively correlated). The "pies" indicate the strength of the correlation, where black represents positive values and grey represents negative. The correlation between two variables/responses can be found by the "pie" in the horizontal/vertical intersection between the respective variables. Blank fields indicate no significant correlation (5% significance level).