The Effect of Telecommuting on Employee Behavior

Alexander Brüggen
a.bruggen@maastrichtuniversity.nl

Christoph Feichter
c.feichter@maastrichtuniversity.nl

Katlijn Haesebrouck
k.haesebrouck@maastrichtuniversity.nl

Maastricht University

August 2017

Very preliminary draft – do not distribute/cite without permission

We appreciate comments from La Trobe University.

The Effect of Telecommuting on Employee Behavior

Abstract

We examine if working outside the conventional workplace (telecommuting) influences employees' performance on tasks where it is more versus less easy to align incentives between employees and the firm. We argue that the impact of telecommuting on employee behavior hinges on two effects, which we refer to as the *selection* and the *incentive alignment* effect. The selection effect indicates that mainly those employees that are highly motivated to perform a task engage in working on it from a remote location. Therefore, employees telecommuting show on average higher effort than employees that perform a task from the workplace. The incentive alignment effect indicates that the impact of the location depends on the task´s ease of alignment of interests between employees and the firm. While location has no effect when interests can be easily aligned via output control, telecommuting leads to more self-interested behavior than office work for tasks where interest alignment cannot be easily achieved. In order to separate the two effects, we run two experiments with an effort and reporting task in which we manipulate the location (home versus class). Results are in line with our predictions. By showing under which circumstances telecommuting has positive or negative effects, this study has important implications for practice.

I. INTRODUCTION

We examine the effect of telecommuting on the task behavior of employees. Specifically, we investigate if working outside the conventional workplace influences employees' performance on tasks where it is more versus less easy to align incentives between employees and the firm.

According to Gallup's annual work survey, around 43 percent of employees regularly telecommute (Gallup 2017). In line with this, popular press and management gurus often tout telecommuting because of its benefits such as cost reductions, higher productivity, elevated job satisfaction and a better atmosphere (e.g., Luciotti 2013, Hess 2016). For example, Cisco estimates that its telecommuting policy leads to annual cost savings of 277 Million dollars (Cisco Website, 2009). At the same time however, disadvantages of telecommuting are also mentioned, including work-life balance issues, negative effects on the work atmosphere and problems with team work (e.g., Luciotti 2013, Myers 2008). Consistent with these arguments, companies that used telecommuting for long times are reconsidering the option by restricting or forbidding remote work (e.g., Yahoo, HP, Best Buy).

Despite the convolute of arguments and anecdotes, accounting research has largely neglected the effects of telecommuting so far, even though it has important implications for the management control systems of companies. Whereas some forms of control can be applied regardless of the location (e.g., output-based controls), other controls are less salient or harder to implement when employees are working remotely (e.g., cultural controls such as mutual monitoring and group pressure). Gaining a better understanding about telecommuting from a control perspective thus provides important insights for academia and practice.

We argue that the impact of telecommuting on employee behavior hinges on two effects, which we refer to as the *selection* and the *incentive alignment* effect. The selection effect

indicates that mainly those employees that are highly motivated to perform a task engage in working on it from a remote location.[1] Therefore, employees telecommuting show on average higher effort than employees that perform a task from the workplace. However, highly motivated employees do not always increase organizational performance since they can also be motivated to act in their own interest. The nature of a task itself – and the associated control options available for the firm – therefore also influences the efficacy of telecommuting. In some tasks the effort of employees directly influences the output of their work. In such tasks the control problem for supervisors is relatively low, as they can write a contract based on the employee's output regardless of the location, assuming that noise plays a minor role. In many other tasks however, controlling employees to work in the best interest of the firm is more challenging. For example, employees often have informational advantages over their supervisors which they can use in their own favor. In such tasks simple, output-based control mechanisms are often not suitable and companies have to rely on other controls (Merchant and Van der Stede 2017, Milgrom and Roberts 1992). That said, while organizations usually have various other, informal options available to control their employees at the workplace (e.g., direct monitoring, group pressure), the options for controlling their employees that telecommute are more challenging. Thus we argue that, abstracting from the selection effect, the incentive alignment effect of the location depends on the task´s ease of alignment of interests between employees and the firm. While location has no effect when interests can be easily aligned via output control, telecommuting leads to more self-interested behavior than office work for tasks where interest alignment cannot be easily achieved.

[1] Note that in the accounting literature, the term "selection effect" is often used to indicate employees' choice between *different* contracts. However, the term can also refer to the choice to engage in *one* contract or not (e.g., Bonner and Sprinkle 2002), which is what we intend with it in this paper.

To test the above predictions, we conduct two separate experiments with students from a large introductory accounting class. In both of the experiments, participants work on two different tasks where they can generate money for themselves and their firm (i.e., the University's charity). The first task is a simple effort task where incentives between the participants and the firm are aligned. Specifically, participants perform a decoding task with a piece rate for both themselves and the University's charity for every decoded unit. The second task is a reporting task in which participants receive private information about the costs of a project and submit a cost report to the firm. Since misreporting (i.e. overstating) the cost increases (decreases) the monetary payoff for participants (the firm), incentives between participants and the firm are not aligned.

In the first experiment participants have to solve both of the tasks at the same location, which is either in class or at home. The results show that the performance on the effort task is significantly higher when the participants performed the tasks at home, while there is no significant difference between home and the classroom on the reporting task. This implies that in those tasks where incentives are aligned, telecommuting has a positive effect on employees' effort. However, results of this experiment could be driven by both the selection effect (only the highly motivated participants perform the task at home) and/ or the incentive alignment effect (informal control differences in the respective environments make participants perform tasks with(out) aligned interests differently at home relative to in class).

To be able to distinguish the two effects, we conduct a second experiment where every participant needs to perform one of the two tasks in class, and the other one at home. Only if they completed both of these tasks they were eligible to receive their compensation. As such, the selection effect plays a similar role across conditions in experiment 2. Hence, differences within experiment 2 must be driven by the incentive alignment effect, whereas differences

between experiment 1 and 2 must be driven by the selection effect. Results indicate that indeed a selection effect led to the higher performance on the effort task at home relative to in class in experiment 1. Furthermore, results of experiment 2 also show that while there is no performance difference across locations for the effort task, individuals misreport significantly less in the reporting task when they perform it in class relative to at home. This implies that in a task where the interests cannot be aligned easily by incorporating output based control mechanisms, working from the company's workplace provides additional, informal control mechanism that prevents opportunistic behavior of employees.

This study contributes to academia and practice in several ways. Based on anecdotal evidence, popular press often highlights the benefits of telecommuting without providing clear explanations for these effects. Moreover, most studies that show positive associations between telecommuting and motivation, job satisfaction, and productivity are based on self-reported surveys without hard evidence of the actual performance of individuals (Bailey and Kruland 2002). By performing experiments, we can not only show the effects of telecommuting on employee behavior, but also provide clear explanations for why and under which circumstances these effects can be expected. That is, we show that telecommuting can translate into increased performance of employees and that this can be primarily attributed to a selection effect. Those employees that are highly motivated engage in work at home. Furthermore, we show for what kind of tasks remote work is suitable. While for those tasks where interests between employees and the companies can easily be aligned the location does not matter, for tasks where interests cannot be aligned so easily the workplace can actually serve as control mechanism that reduces opportunistic behavior of employees. This could also explain why telecommuting is suitable for some firms, but not for others. Our study does not only help to better understand current business practice, but also gives guidance to companies

as for what type of tasks telecommuting is suitable and what type of task are better performed at the workplace.

In section 2 of the paper we discuss the theory and hypotheses we develop. In section 3 we describe the experiments that we conducted to test our theory. Section 4 presents the results of our experiments. Finally, in section 5 we summarize and conclude our study.

II. BACKGROUND, THEORY AND HYPOTHESES

Background

We define telecommuting as employees working outside the conventional workplace during normal working hours, evenings or weekends. Telecommuting is increasingly used in many companies. Results of a survey by Gallup for example show that around 43 percent of employees occasionally telecommute, a number that has been rising consistently over the last decade (Gallup 2017). Several advantages are associated with telecommuting, such as higher motivation, more flexibility, less time spent commuting to work, and even societal advantages, such as less emissions and traffic jams in peak hours (e.g., Bailey and Kurland 2002).

Even though telecommuting has become more common, it is not without critics and drawbacks. Disadvantages related to telecommuting include the potential lack of control on employees, the difficulty to build a well-functioning work environment, challenges in managing a corporate culture, and increasing information asymmetry between supervisors and subordinates (e.g., Siha and Monroe 2006; Ruth 2011). Consistent with these arguments, Yahoo recently banned telecommuting such that employees could communicate and

collaborate better (Guynn, 2013). For similar reasons, Best Buy followed in abandoning telecommuting (Schafer 2013).

Also in academia, a lot of mixed evidence exists regarding the impact of telecommuting. Studies investigating the effect of telecommuting on productivity for example have found positive (e.g., Bailyn, 1988; Baruch and Nicholson, 1997; Bélanger, 1999) and negative relationships (e.g., Phelps 1985; Golden, Veiga and Dino 2008). Since most of the empirical work on telecommuting relies on self-reported behavior of those who telecommute however, results need to be interpreted with caution.

In sum, research evidence on the effects of telecommuting is mixed and also signals from practice are ambiguous. Moreover, a lot of questions remain unanswered, like the role of incentives in a telecommuting environment. Therefore, we contribute by investigating if telecommuting influences employees' behavior on tasks where it is more versus less easy to align incentives between employees and the firm. In the next sections, we argue that the impact of telecommuting on employee behavior hinges on two effects, which we refer to as the selection and the incentive alignment effect.

Theory and Hypotheses

Selection Effect

An important aspect of telecommuting is that companies provide employees the freedom to perform the work from remote locations, where employees themselves decide where and when to engage in it. Consequently, organizations have fewer opportunities to directly monitor the work effort of their employees.. This raises concerns about the degree to which employees engage in a task, and under which circumstances they engage in these tasks at all.

Based on standard economic reasoning, employees will compare the expected benefits of performing a task with the expected costs of performing the actions. Only if this

comparison is beneficial for employees, they will engage in a task. For example, prior studies show that employees chose those employment contracts that maximize their own personal benefits based on the ability level, the risk preferences and personality traits (e.g., Waller and Chow 1985, Falk and Dohmen 2011, Hales et al. 2015). Indeed, Banker et al. (2001) show that the positive effect of introducing a performance based pay scheme on the productivity of the employees was largely driven by a selection effect. Thereby, lower skilled employees dropped out of the company and only high skilled employees who saw the potential to earn a premium above the costs stayed. Similarly, Bonner and Sprinkle (2002) argue that only if the skill level allows a positive assessment of the earning opportunities, individuals engage in a certain task. Otherwise, individuals give up and will not perform a task, something they refer to as the "giving-up phenomena".

Applied to the setting of telecommuting, such selection effects can also have important implications, especially as employees have discretion about whether and to what extent to engage in the remote work. When individuals are provided with an outside (shirk) option, they tend to work less on their main task (e.g., Engel 2010). In their natural environment at home however, the opportunity costs of performing a work related task are often even higher than at the workplace (Dutcher 2012). For example, the distractions and alternatives available at home often provide more benefits than the distractions and alternatives available at the workplace. Similarly, staying at work for an extra appointment often means lower transaction costs for an individual than setting up the technical equipment for a conference call from home. Consequently, in order to exceed the costs, the expected benefits of an individual working from home need to be relatively higher than for an individual who performs the same task at the workplace.

When deciding about whether to engage at a task from home, this cost-benefit tradeoff is more likely positive for individuals who are highly motivated to perform a task and/or are of

high skill. For such employees the costs of effort are relatively lower and the potential payoff higher than for low skill/motivation employees. Thus, high skilled/motivated employees will be less affected by the location of their work but likely engage in a task irrespective of whether it is at the workplace or whether it is telecommuting.

In turn, we argue that for individuals with a low motivation for performing a task and/or low skill on a task the outcome of the cost-benefit tradeoff is affected stronger by the location of the work. As laid out above, the associated costs of engaging in a task at home are relatively higher compared to working from the workplace. At the same time, the costs for performing a task are relatively high and/or the potential benefit is low for low skilled and less motivated employees. Therefore, low skilled/motivated employees are more likely to assess their cost-benefit tradeoff as negatively when they need to engage at a task while telecommuting compared to engaging in a task at the workplace. However, importantly, even though low skilled/motivated employees are more likely to engage in a task at the workplace than from remote locations, their low skill/motivation still leads to a lower output of at the workplace as compared to the higher skilled/motivated employees.

Consequently, while at the workplace both high skilled/motivate and low skilled/motivated employees engage in a task, the number of low skilled/motivated individuals goes down in a telecommuting setting and leaves primarily high skilled/motivated individuals performing the task. As the output for low skilled/motivated employees that decided to engage in a task is still lower compared to the high skilled/motivated employees, overall the average performance of employees engaging in a task is higher in a telecommuting setting than at the workplace, due to a selection effect. Formally we state our hypothesis as:

H1: Telecommuting leads to higher employee effort through a selection effect

Incentive alignment

While in H1 we predict that the selection effect leads on average to higher effort under telecommuting than at the workplace, it is an essential question whether the higher motivation of the employees and their associated effort is spent in a congruent way with the firms' objectives. In fact, even though the selection effect might lead to highly motivated employees engaging in a task, the higher motivation does not necessarily mean that these employees act in the firm's best interest. We argue that whether or not their motivation translates into benefits to the firm depends on the possibility to adequately align incentives via output control when working at home.

Prior literature already argues that the effectiveness of output controls depends on the availably of good quality performance measures (e.g., Moers 2005, Roberts and Milgrom 1992, Solomons 1965). Thus, only if there are good performance measures available for the firm, they can align the interest of the firm with the interest of the employee. One of the main requirements for being a good measure is congruency with the overall organizational objectives (Merchant and Van der Stede 2017). Feltham and Xie (1994, p 434) define congruity as "the degree of congruence between the impact of the agents' action on his performance measure and on the principal's expected gross payoff". In other words, the actions that increase the firm's performance also increase the individual's performance measure, while the actions that decrease the firm's performance also decrease the individual's performance measures.

The extent to which such good quality and congruent performance measures are available often depends on the tasks themselves. For example, for sales staff, programmers or translators the performance can easily be measured and also aligned with the interests of the organization by measuring the contribution margin or productivity of the individuals. On the other hand, there are many instances where such high quality performance measures are not

available, like reporting tasks where local employees have superior knowledge or strategic decisions of managers. In these cases, it is harder to identify adequate performance measures. Therefore, unless firms impose other forms of control, they expose themselves at a risk that employees make use of their information advantage and act opportunistically.

Remote work also decreases the available control options for the firm relative to those available at work. At the workplace there is a large variety of controls available, such as formal output controls, but also more informal, cultural controls like mutual monitoring and group pressure (e.g., Merchant and Van der Stede 2017). For example, research in laboratories and the field shows that the mere presence of a co-worker in the same room can influence individuals' behavior (Falk and Ichino 2006). Furthermore, Brüggen and Moers (2007) show that social incentives in form of social norms can mitigate distorted financial incentives in effort allocation decisions. Thus, prior literature has shown that such informal controls can often complement formal output control and mitigate some of their weaknesses. However, while these informal controls are in place at work, they are harder to implement or less salient in a telecommuting environment.

Based on these discussions we argue that in tasks where the incentives can easily be aligned by output controls, the location has no effect on the behavior of individuals, as they will be motivated to work in the organization's benefit by the financial incentives. However, in tasks where interests between the employee and the organization cannot easily be aligned with output control, working form the workplace can mitigate some negative consequences and decrease the opportunistic behavior compared to telecommuting where such informal controls are not available. Therefore, controlling for any selection effect, we hypothesize:

H2: Employee behavior is not affected by location for tasks where incentives are aligned, whereas telecommuting leads to more self-interested behavior than office work if incentives cannot be aligned easily.

III. METHOD

In order to examine our prediction and separate the different explanations, we perform two distinct web-based experiments with students from an introductory bachelor class of accounting. Both of these experiments were conducted within the same course at the same time. The assignment to experiment 1 or 2 was random. In both experiments participants had to perform two separate tasks, a decoding task and a budget reporting task. With the exception of the manipulation, the tasks and procedures of both experiments were identical. Before we explain the differences in the experiments, we describe the procedure and tasks in detail below.

Procedure and Tasks

The experiment started about 20 minutes before the students' tutorial class normally ended. Tutors randomly provided students with an experimental ID, such that they could participate anonymously in the experiment. Next, tutors asked students to open a web link and read the instructions they could find on the webpage. After ensuring no one experienced difficulties opening the web link, tutors left the room.

In the instructions, we welcomed participants and described they had to work on two independent tasks. The tasks were designed in such a way that they took about four to five minutes each. We gave participants a short description of the tasks (in randomized order) and explained that they could earn LIRA for themselves and the charity of the University by

performing them.[2] For each task, we randomly drew 50 participants where the LIRA amounts were converted into real cash (EUR) that we paid out, with a conversion rate of 10/1. Before they could continue with the experiment, participants had to solve a quiz to ensure they understood these general instructions.

We provided participants with further details on the tasks right before they started working on each of them.

Decoding Task

In the decoding task, participants had to decode letter combinations into numbers based on the decoding table as shown in Figure 1. The first letter of the letter combinations specified the row of the table, and the second letter specified its column. For example, to decode the letter combination "cu", the corresponding number can be found in the third row and the fourth column. The decoded number is thus 26. Participants had four minutes to solve as many letter combinations as possible.

[Insert Figure 1 here]

For every correctly decoded letter combination, they generated a revenue of 2 LIRA, where half of this revenue (1 LIRA) was the participant's personal compensation and the other half was for the University's charity. Thus, in this task the interests between the participant and the University's charity fund are aligned in such a way that a higher output leads to higher payoffs for both of them.

To ensure the participants' understanding of the task and the compensation scheme, participants had to answer a few questions before they could start working on the task. Then

[2] The University's charity aims to improve academic research and education at the University. For example, it provides subsidies to students and funds challenging research projects that increase the recognition and social impact of the University. This description was also given to participants.

they had four minutes to solve the task. Once the time was over, the task stopped automatically and participants were informed about the amount of letter combinations they correctly decoded and the compensation that corresponded to this amount. Next, a short questionnaire asked them about the circumstances under which they performed the task (for example, whether there was a lot of noise and which electronic device (phone, laptop, tablet, etc.) they used).

Reporting Task

In the reporting task, we asked participants to suppose they were the manager of a division responsible for revenues and costs. Revenues were fixed at 100 LIRA. For each participant, the cost of generating these revenues was randomly drawn from a set of possible costs between 0,1,2,…,100 LIRA. Each number was equally likely to be drawn. The manager was the only one who could observe this cost. Managers had to report the cost and got refunded based on the number they reported. However, they could keep the difference between the cost they reported and the actual cost, giving them a monetary incentive to overstate the reported cost. The difference between the revenue and the cost that was reported would go to University's charity. Managers also receive a fixed payment of 50 LIRA.

In summary, payoffs (in LIRA) were calculated as follows:

Managers' payoff = reported cost − actual cost + 50 fixed payment
University's charity payoff = 100 revenue − reported cost

Thus, in this task the incentives between the manager and the University's charity were not aligned. In fact, by reporting a higher cost than the actual cost, the manager could increase the own payoff at the expense of the University's charity fund.

Again, once they completed the task, participants had to answer a few questions about the circumstances under which they performed it.

Experiments

Experiment 1

In the first experiment, we manipulated the location (class versus home). Specifically, in half of the tutorial groups, students had to perform both tasks (decoding and reporting) immediately in class, while in the other half of the tutorial groups, students had to perform both tasks within the next 24 hours at home. Participants were informed about the location right after reading the short description of two tasks. We provided participants in the home condition with a link to continue the experiment later. In both conditions, we randomized the order of the tasks (i.e., half of the participants started with the decoding task and finished with the reporting task, while the other half started with the reporting task and finished with the decoding task).

Experiment 2

In the second experiment, we again manipulated the location (home versus class). However, in this experiment, participants were randomly assigned to perform one of the two tasks immediately in class and the other one within the next 24 hours at home. All participants received a link to continue the experiment at home. Again, they were informed about the location of each task right after reading a short description about them.

By having them solve one task in the classroom and one task at home, they could only finish the entire experiment (and hence be eligible for receiving a compensation) if they performed both tasks. Consequently, if they do not engage in one task at home, also their other task performance in class is not taken into account. This helps to isolate the selection effect that could potentially influence the results of experiment 1, and the incentive alignment effect as we will discuss in the results section.

Post-experimental questionnaire

Both experiments ended with a post-experimental questionnaire, which included manipulation checks and questions about the perceived importance of the University's charity, social value orientation, demographics, etc.

Measures

Our main dependent variables of interest capture the amount of effort participants provide in the decoding task and the amount of slack they induce in the reporting task. *Effort* is measured as the total number of letter combinations that participants decoded correctly. Since the device on which participants performed the decoding task can highly influence their performance (for example, participants who perform the task on a phone score significantly lower than those who work on a laptop, $t = -9.36$, $p < 0.01$), we control for *device* in all our analyses below. *Slack* is measured as the reported cost minus the actual cost. Because the actual cost was randomly determined for every individual participant, and hence differs across subjects, we include the *actual cost* as a control variable in all the analyses concerning slack.

IV. RESULTS

Sample

Experiment 1

Participants comprised 317 undergraduate business students. However, about 31% of them (97 students) did not finish the entire experiment, resulting in a complete sample of 220 participants. As we expected, quite some participants did not resume the experiment at home, and hence the dropout rate is significantly higher in the home condition relative to the class condition (50% versus 8%, respectively, $p < 0.01$). Of the 220 participants who finished the experiment, 25 failed the location manipulation check (for example, they indicated they

performed the task in class although they were in the home condition). Removing these students reduces our sample to 195 participants (38% female, median participant age of 19). Recall that we randomized the order of the tasks within conditions, but we do not find a significant effect of order on our dependent variables within conditions (p's > 0.24).

Experiment 2

Participants comprised 380 undergraduate business students. In experiment 2, about 59% of them (225 students) did not complete the entire experiment, resulting in a useful sample of 155 participants. The dropout rates do not significantly differ across conditions (p = 0.77). Of the 155 participants who finished the experiment, 38 failed the location manipulation check. Therefore, our final sample comprises 117 participants (51% female, median participant age of 19).

Table 1 reports descriptive statistics for our main dependent variables, *Effort* and *Slack*, across experiment 1 and 2. Figure 2 and 3 depict these results graphically. In the next sections, we test our hypotheses.

Hypotheses Tests

Hypothesis 1

In hypothesis one we predict that telecommuting leads to higher employee effort through a selection effect. In order to test this hypothesis, we first briefly analyze the results on the decoding task for experiment 1 and 2 separately, and then compare *Effort* on the decoding task of our participants across the two experiments. In the decoding task the incentives between the company and the individual are aligned and thus, the higher motivation of employees also translates into higher output. Therefore, this task is best suited for testing the selection effect.

As we can see from Table 1 and Figure 2, *Effort* in experiment 1 is higher when the decoding task is performed at home relative to in class (34.08 versus 38.12, respectively). Results of an ANCOVA with Effort as dependent variable, location as independent variable, and device as covariate show that this effect is statistically significant ($p < 0.01$, see Panel A of Table 2). In experiment 2 however, there is hardly any difference in *Effort* when the decoding task was performed at home relative to in class. We perform an ANCOVA test with *Effort* as the dependent variable, *Location* as the independent variable and *Device* as a control variable. Table 3, Panel A reports the ANCOVA results, which confirm the difference in *Effort* across locations is not significant ($p = 0.91$). [3]

Recall that in Experiment 2, one of the two tasks was performed in class, while the other one was performed at home. Only when participants performed both task, they finished the experiment. Hence, the selection effect should play a similar role across conditions in experiment 2. This is confirmed by the almost identical drop-out rate across conditions in experiment 2 (see earlier). Thus, any difference we find across conditions within experiment 2 must be driven by the incentive alignment effect, and differences between experiment 1 and 2 by the selection effect. To test hypothesis 1, we thus test the differences for the locations across experiment 1 and 2.

Panel A of Figure 3 shows that there is a relatively larger difference between the locations for the decoding task in Experiment 1 than in Experiment 2, which is in line with our prediction. To statistically test the hypothesis, we perform an ANCOVA with the performance on the decoding task as dependent variable, location (class versus home) and

[3] Although we find significant differences in surrounding factors across locations in experiment 2, these do not seem to influence participants much. For example, we asked participants in the post-experimental questionnaire to indicate on a 7-point scale with "1" being "strongly disagree" and "7" being "strongly agree" whether there was a lot of noise while they were performing the task. Although they experienced significantly more noise in class relative to at home (3.30 versus 2.36, $t = 2.70$, $p < 0.01$)), scores on other questions like "I was very concentrated" do not differ significantly across locations in experiment 2 (5.27 versus 5.43, $t = -0.68$, $p = 0.50$).

experiment (1 versus 2) as independent variables, and the device as control variable. Panel A of Table 4 shows results of the ANCOVA. While there is a significant main effect of location, there is also a significant interaction effect of location and experiment ($p < 0.03$). Therefore, we perform a simple main effect analysis to analyze the interaction effect further. The results show that location only seems to matter in Experiment 1 ($p < 0.01$), while there is no difference for the location in Experiment 2 ($p = 0.96$) where the selection effect should not play a role. Interestingly, the simple effect analyses also show that there is no difference between the decoding task when it is done at home across Experiments ($p = 0.44$), while there is a statistically significant difference across Experiments when they are performed in class ($p = 0.02$). These results are consistent with our hypothesis 1: a selection effect leads to higher performance when telecommuting. This implies selection mainly drives the lower result for effort in our experiment 1 - class condition relative to the other three conditions. Participants who drop out in the three conditions where the experiment had to be resumed at home are probably the ones who are less motivated to perform well. This supports our first hypothesis.

We test hypothesis 1 with the decoding task because the incentives between the supervisor and the participant are aligned in this setting. As such, it provides a very precise measure of the selection effect. In the reporting task however, the participants face a tension between reporting honestly to the charity versus maximizing own personal payoff. As it is unclear how this tension would affect the selection we do not test hypothesis 1 with the reporting task.

Hypothesis 2

In hypothesis 2 we predict that – controlling for the selection effect - the location of the task matters for tasks where the incentives cannot be aligned while there is no effect of the location if the incentives can be aligned. In order to test this hypothesis we examine the results of experiment 2, where we rule out the selection effect.

Panel A and B of Figure 3 already indicate that there is little difference in the decoding task within experiment 2 (37.07 versus 37.00), while the difference between reporting from home versus reporting in class in experiment 2 seems to be quite large. In fact, the mean slack for those who performed the reporting task in class was around 17.60%, whereas the mean slack for those who performed the task at home was 22.70%.

To statistically test our hypothesis, we compare the simple main effects of location within experiment 2 in the ANCOVAs reported in Table 4. Panel A of Table 4 shows that the location within experiment 2 has no statistically significant effect for the performance on the decoding task (p = 0.96). However, the location has a statistically significant effect on the slack induced within experiment 2, as Panel B of Table 4 shows (p = 0.10). This supports our second hypothesis that, abstracting from the selection effect, the location does not matter for tasks where the incentives can be aligned through performance measures, while the location matters for tasks where incentives cannot be aligned. In these instances, working at the workplace can provide some other form of control that decreases the opportunistic behavior of individuals. This supports our hypothesis 2.

To gain some further insights into what kind of control affects the participants at the workplace, we also asked the participants after they performed the reporting task whether they were influenced by the presence of other people (i.e., some form of social control). The results to that question show that participants were significantly more influenced by the presence of others in class than at home (t = 1.69, p = 0.09).[4] The effect of location on slack also becomes slightly more significant when controlling for this variable in the ANCOVA (p = 0.09). This provides preliminary evidence that some sort of peer pressure helps to work in the best

[4] Note that participants' scores on their level of concentration, how hard they worked and how challenging it was for them to work on the reporting task do not differ across locations in experiment 2. Moreover, these three variables are uncorrelated with the measure "When I was performing the task, there were other people around" (p's > 0.37).

interest of the firm for tasks where incentives between employees and the firm are not aligned.

V. CONCLUSION

The purpose of this study is to examine the effect of telecommuting on performance. In particular, we investigate how a selection effect for those individuals who engage in telecommuting impacts performance and in addition, in how far the availability of appropriate performance measures to align incentives matter for congruent performance in different locations.

We use an effort task and a reporting task in our experiments. For the effort task we have precise performance measures available, whereas for the reporting task individuals need to report private cost information. This reporting task allows for opportunistic behavior and simulates the absence of appropriate performance measures. In our first experiment participants need to work on both tasks either in class or at home (i.e., telecommute). Results show that performance on the effort task is significantly higher when the participants performed the tasks at home, while there is no significant difference between home and the classroom on the reporting task. This finding suggests that telecommuting positively influences employees' effort, confirming prior research and anecdotal evidence. However, the results of the first experiment could be driven by a selection effect (only highly motivated participants perform the task at home) and/ or the incentive alignment effect (control differences in the respective environments make participants perform tasks with(out) incentive alignment differently at home relative to in class). We therefore design a second experiment to investigate this issue further. In our second experiment participants need to perform one of the two tasks in class and the other one at home. Only if they completed both of these tasks they were eligible to receive their compensation. As such, we can exclude any selection effect from the data. The results of this experiment show that while there is no

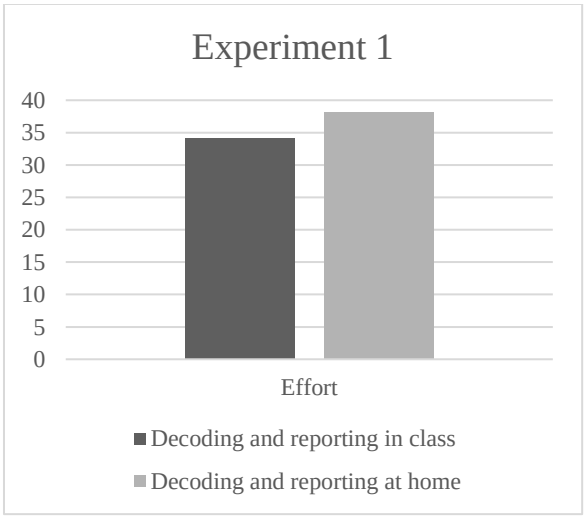
performance difference across locations for the effort task, individuals misreport significantly less when performing the reporting task in class. This indicates that not all tasks are ideal for telecommuting. When performance is difficult to measure, telecommuting can be harmful to the firm.

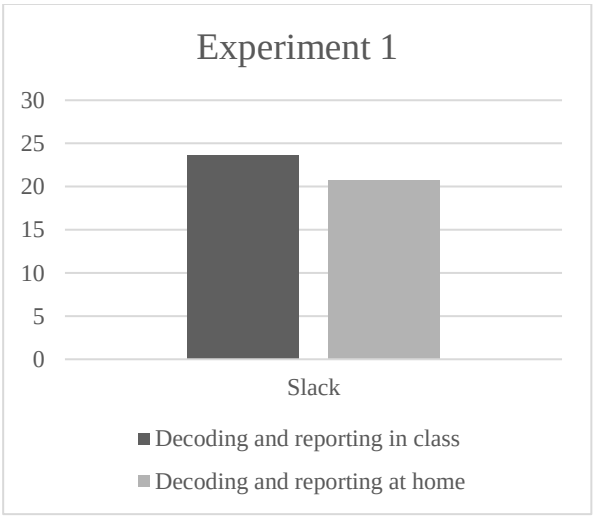
FIGURE 1
Decoding Table

	r	s	t	u	v	w	x	y	z
a	37	46	27	12	99	95	23	44	65
b	86	62	40	72	92	49	51	20	28
c	18	30	93	26	69	87	16	15	84
d	73	94	32	63	54	78	60	22	13
e	45	90	56	67	55	61	98	88	48
f	25	97	75	39	50	42	24	66	19
g	47	89	58	68	91	57	82	29	70
h	38	85	52	71	53	21	80	41	59
i	77	96	11	76	79	31	33	74	81

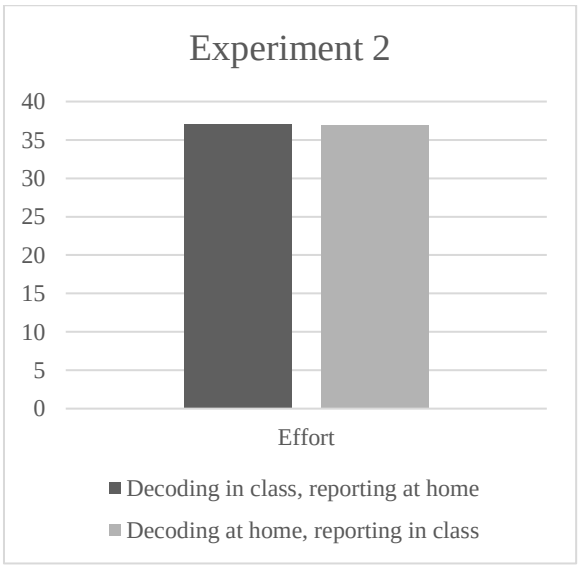
FIGURE 2

Panel A – Experiment 1





Panel B – Experiment 2



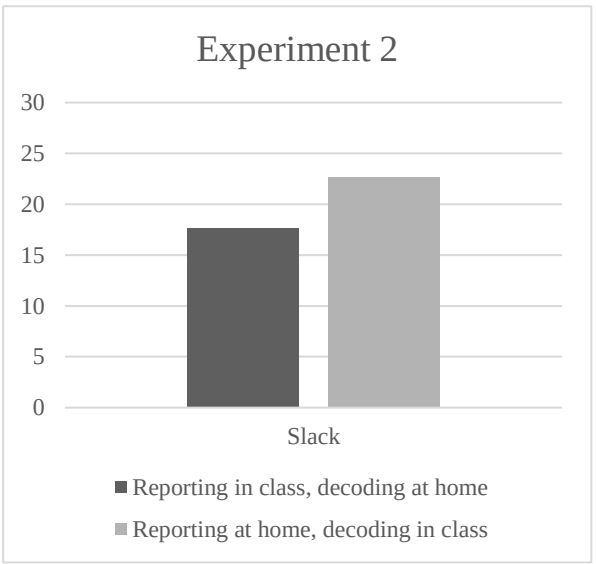
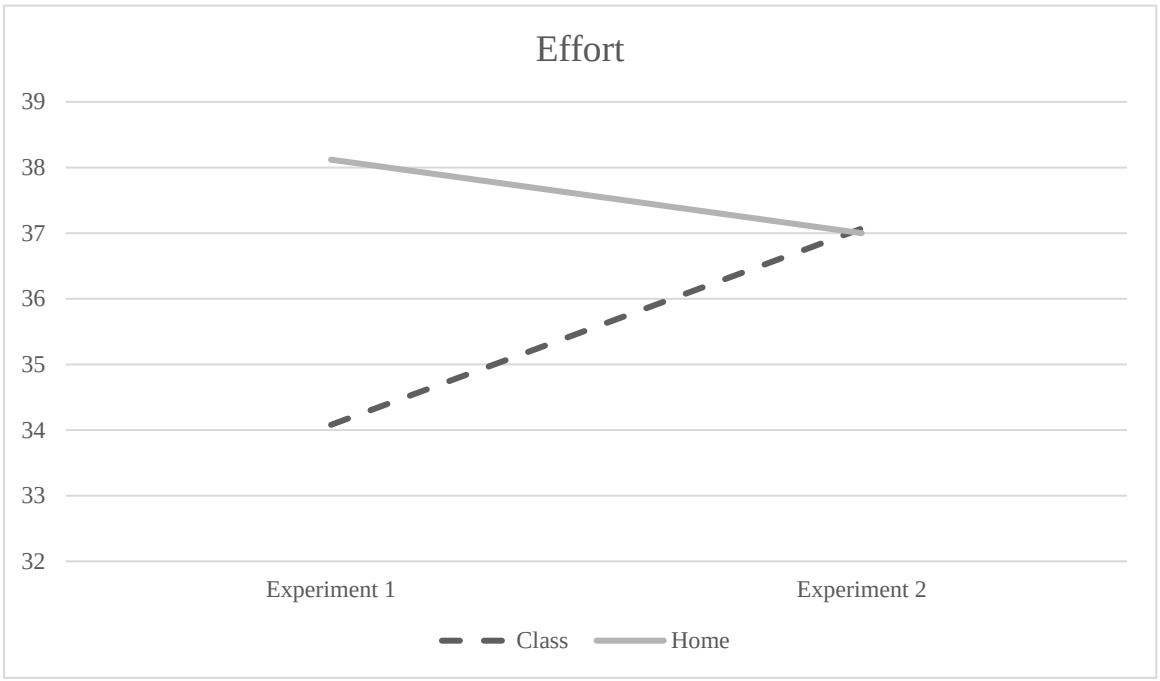


FIGURE 3

Panel A – Effort (Controlling for Device)



Panel B – Slack (Controlling for Actual Cost)

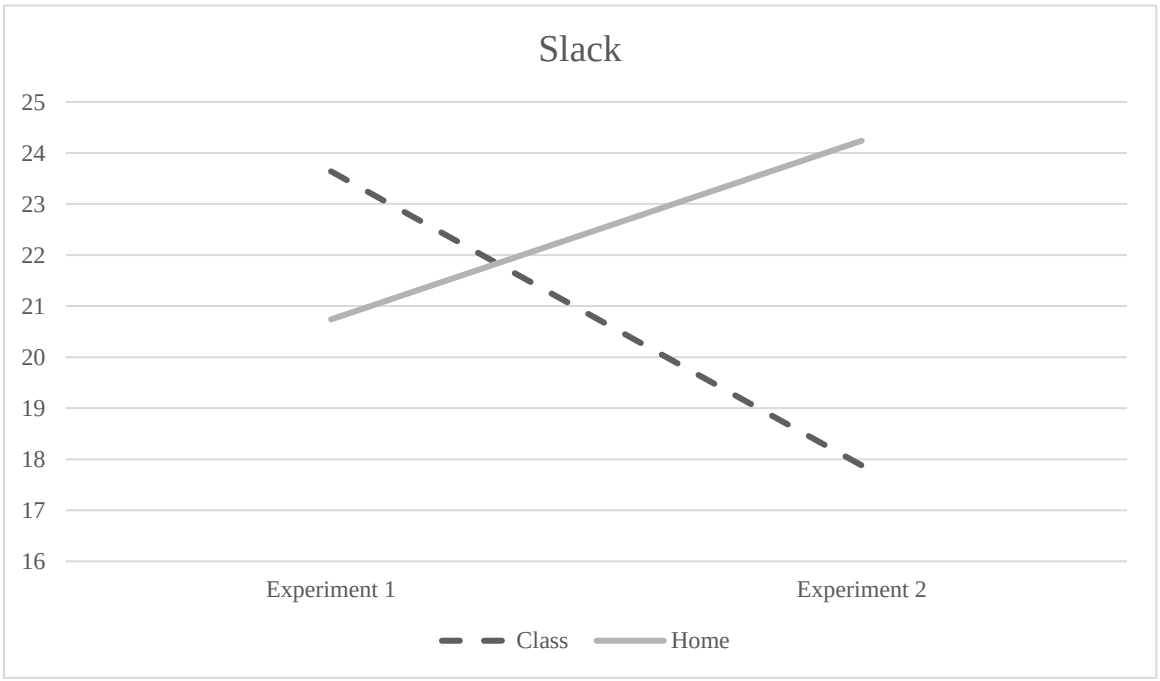
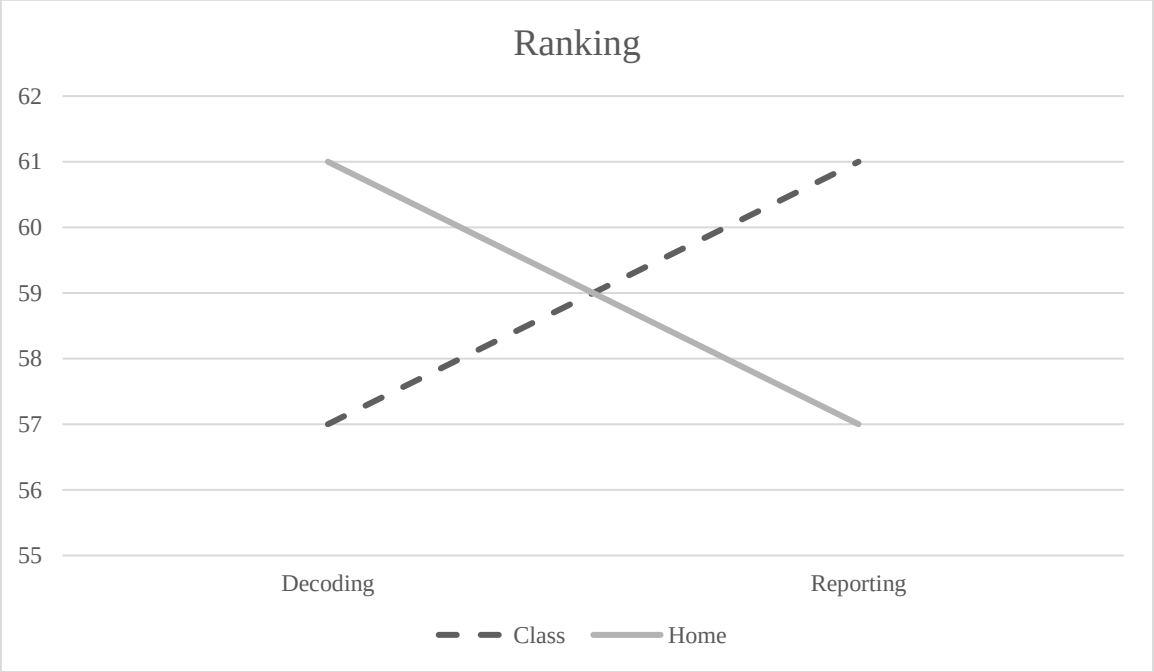


FIGURE 4
Experiment 2: Rankings of Effort and Slack



A higher ranking represents a better outcome from the firm's perspective (i.e., lower slack in the reporting task and higher output in the decoding task).

TABLE 1
Descriptive Statistics

	Experiment 1		Experiment 2	
	Decoding and reporting in class N = 128	Decoding and reporting at home N = 67	Decoding in class, reporting at home N=64	Reporting in class, decoding at home N=53
Dropout rate	8%	50%	59%	60%
Effort	32.30 (8.46)	39.51 (9.32)	38.03 (7.40)	38.38 (7.78)
Effort controlling for device	34.08 (0.74)	38.12 (0.98)	37.07 (0.99)	37.00 (1.09)
Slack	24.75 (28.43)	20.29 (23.87)	22.70 (29.05)	17.60 (20.81)
Slack controlling for actual cost	23.64 (1.84)	20.74 (2.54)	24.24 (2.60)	17.88 (2.86)

TABLE 2
Experiment 1

Panel A – ANCOVA on Effort

Factor	Sum of Squares	df	F	p-value
Device	1816.39	1	26.81	<0.01
Location	666.63	1	9.84	<0.01
Error	13007.01	192		

Panel B – ANCOVA on Slack

Factor	Sum of Squares	df	F	p-value
Actual Cost	56423.63	1	129.18	<0.01
Location	354.06	1	0.81	0.37
Error	83863.44	192		

All p-values are reported on a two-tailed basis

TABLE 3
Experiment 2

Panel A – ANCOVA on Effort

Factor	Sum of Squares	df	F	p-value
Device	1082.14	1	21.74	<0.01
Location	0.68	1	0.01	0.91
Error	5674.26	114		

Panel B – ANCOVA on Slack

Factor	Sum of Squares	df	F	p-value
Actual Cost	27174.99	1	63.84	<0.01
Location	1141.33	1	2.68	0.10
Error	48527.05	114		

All p-values are reported on a two-tailed basis

TABLE 4

Panel A – ANCOVA on Effort

Factor	Sum of Squares	df	F	p-value
Device	2853.89	1	46.79	0.00
Location	256.64	1	4.21	0.04
Experiment	58.38	1	0.96	0.33
Location × Experiment	282.31	1	4.63	0.03
Error	18725.97	307		

Simple Effects

Effect of Location within Experiment 1	623.60	1	10.22	0.01
Effect of Location within Experiment 2	0.13	1	0.01	0.96
Effect of Experiment within Class	342.97	1	5.62	0.02
Effect of Experiment within Home	37.20	1	0.61	0.44

Panel B – ANCOVA on Slack

Factor	Sum of Squares	df	F	p-value
Actual Cost	83391.78	1	193.08	0.00
Location	208.87	1	0.48	0.49
Experiment	89.54	1	0.21	0.65
Location × Experiment	1498.51	1	3.47	0.06
Error	132597.34	307		

Simple Effects

Effect of Location within Experiment 1	369.45	1	0.86	0.36
Effect of Location within Experiment 2	1172.25	1	2.71	0.10
Effect of Experiment within Class	1243.72	1	2.88	0.09
Effect of Experiment within Home	400.30	1	0.93	0.34

All p-values are reported on a two-tailed basis

References

Abernethy, M.A., J. Bouwens and L. van Lent (2004). Determinants of control system design in divisionalized firms. *The Accounting Review* Vol. 79, No. 3 (Jul., 2004), pp. 545-570.

Bailey, D. E. and N. B. Kurland. 2002. A review of telework research: Findings, new directions, and lessons for the study of modern work. *Journal of Organizational Behavior* 23 (4): 383-400.

Bailyn L. 1988. Freeing work from the constraints of location and time. *New Technology, Work, and Employment* 3: 143–165.

Banker, R. D., S. Y. Lee, G. Potter and D. Srinivasan. 2001. An empirical analysis of continuing improvement following the implementation of a performance-based compensation plan. *Journal of Accounting and Economics* 30: 315–350.

Baruch Y, Nicholson N. 1997. Home, sweet work: requirements for effective home working. *Journal of General Management* 23: 15–30.

Bélanger F. 1999. Workers' propensity to telecommute: an empirical study. *Information & Management* 35: 139–153.

Bonner, S. E. and G. B. Sprinkle. 2002. The effects of monetary incentives on effort and task performance: theories, evidence, and a framework for research. *Accounting, Organizations and Society* 27: 303–345

Brüggen, A. and F. Moers. 2007. The Role of Financial Incentives and Social Incentives in Multi-Task Settings. *Journal of Management Accounting Research* 19: 25-50.

Bureau of Labor Statistics, U.S. Department of Labor, The Economics Daily, 24 percent of employed people did some or all of their work at home in 2015 on the Internet at https://www.bls.gov/opub/ted/2016/24-percent-of-employed-people-did-some-or-all-of-their-work-at-home-in-2015.htm (visited June 09, 2017).

Cisco Website. 2009. https://newsroom.cisco.com/press-release-content?articleId=5000107

DuBrin, A. J. 1991. Comparison of the job satisfaction and productivity of telecommuters versus in-house employees: A research note on work in progress. Psychological Reports 68 (supplement): 1223-1234.

Dutcher, E. G. 2012. The effects of telecommuting on productivity: An experimental examination. The role of dull and creative tasks. *Journal of Economic Behavior & Organization* 84: 355– 363.

Engel, R., 2010. Why work when you can shirk? Worker productivity in an experimental setting. *Journal of Applied Business and Economics* 11 (2): 104-119.

Falk A., Ichino A., 2006. Clean evidence on peer effects. Journal of Labor Economics 24 (1): 39–57.

Gallup State of the American Workplace Report. 2017. http://www.gallup.com/reports/199961/state-american-workplace-report-2017.aspx?ays=n

Golden T. D. and Veiga J. F. 2008. The impact of superior–subordinate relationships on the commitment, job satisfaction, and performance of virtual workers. *The Leadership Quarterly*, 19: 77–88.

Golden T. D., Veiga J. F., Dino R. N. 2008. The impact of professional isolation on teleworker job performance and turnover intentions: Does time spent teleworking, interacting face-to-face, or having access to communication-enhancing technology matter? *Journal of Applied Psychology* 93: 1412–1421.

Guynn J. 2013. Yahoo CEO Marissa Mayer causes uproar with telecommuting ban. *Los Angeles Times*, February 26.

Hales J., L.W. Wang, and M. G. Williamson. 2015. Selection Benefits of Stock-Based Compensation for the Rank-and-File. *The Accounting Review* 90 (4): 1497-1516.

Luciotti T. 2013. http://www.milner.com/company/blog/technology/2013/11/26/the-advantages-and-disadvantages-of-teleworking-a-franklin-analysis

Merchant, K. A., and W. A. Van der Stede. 2017. Management Control Systems: Performance Measurement, Evaluation and Incentives. 4th edition. Pearson.

Milgrom, P., and J. Roberts. 1992. Economics, Organization and Management. Upper Saddle River, NJ: Prentice Hall.

Myers, R. C., 2008. The back and forth of working from home. *The Globe and Mail*, March 8. https://www.theglobeandmail.com/report-on-business/the-back-and-forth-of-working-from-home/article17981592/

Phelps N. 1985. Mountain bell: programme for managers. In National Research Council, Office Workstations in the Home (pp. 33–37). National Academy Press: Washington, DC.
Solomons, D. 1965. Divisional Performance, Measurement and Control. Homewood, IL: Irwin.

Ruth, S. 2011. The Dark Side of Telecommuting-Is a Tipping Point Approaching? *Working paper*.

Schafer L. 2013. Pitching in is the new rule at Best Buy. *StarTribune*, February 16
Society for Human Resource Management. 2014. 2014 employee benefits: An overview of employee benefit offerings in the U.S. Alexandria, VA

Siha, S. M. and R. W. Monroe. 2006. Telecommuting's past and future: a literature review and research agenda. *Business Process Management Journal* 12 (4): 455-482.

Waller, W., and C. Chow. 1985. The self-selection and effort effects of standard-based employment contracts: a framework and some empirical evidence. *The Accounting Review* 60: 458–476.