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Does Monitoring Work? A Field Experiment with Multiple Forms of Counterproductive Behaviour*

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Abstract

This paper provides field experimental evidence on the effects of monitoring in a context where workers can engage in various forms of counterproductive behaviour and only one of them is monitored and incentivised. We hire students to do a job for us (identifying euro coins) for which they are paid a flat fee. There are various ways they can behave counterproductively: they can perform sloppily, not complete the task within the requested time or even steal some of the coins. We study how monitoring one productivity dimension (sloppiness) spills over to others (tardiness and theft). We find that introducing lax monitoring does not improve performance, but increases tardiness substantially. Strict monitoring increases tardiness to the same extent, but also leads to substantial improvements in performance. Theft, on the other hand, occurs more rarely and its prevalence is not affected by the monitoring scheme. We conclude that monitoring does have a discipling effect on workers, but at the same time, workers retaliate for being monitored and do so in the least costly manner for themselves (both in monetary and non-monetary terms).

Keywords: counterproductive behaviour, monitoring, experiment

JEL: C93, J24, J30, M42, M52

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1 Introduction

Experts estimate that occupational fraud causes annual losses of more than $3.5 trillion globally, where the average organization loses 5 percent of its revenues due to occupational fraud (Association of Certified Fraud Examiners, 2012). How does one prevent such behaviour? What instruments can employers use to limit opportunistic and fraudulent behaviour? Standard principal agent models suggest that monitoring should discipline workers (Becker, 1968; Grasmik and Bursik, 1990). But does monitoring really work? Psychologists have long been concerned that monitoring may reduce work morale by breaking trust and reducing intrinsic motivation (see Frey, 1993 and Falk and Kosfeld, 2006 for reviews of this literature). Monitoring may entail "hidden costs" that crowd out the disciplinary effect. Therefore and perhaps not surprisingly, the evidence on the effects of monitoring on performance is quite mixed. While some studies find a positive effect of monitoring and incentives (Nagin et al,. 2002; Fisman and Miguel, 2007; Boly, 2011), others find an ambiguous or non monotonic effect depending on the degree of monitoring (Dickinson and Villeval, 2008, Gneezy and Rustichini, 2000; Falk and Kosfeld, 2006).

The evidence so far relates to situations where productivity is operationalized with a single measure, such as for example the number of units produced or sold, performance at a test or monetary transfers in an experimental game. But in many work situations, productivity is multi-dimensional and as a consequence there are usually multiple ways workers can behave counterproductively: From showing up late to do sloppy work, stealing or sabotaging other people's work, counterproductive behaviour has many possible facets. An important question is what happens if the principal monitors and incentivises only a subset of these dimensions? Do the crowding out effects affect these other dimensions as well by depressing work morale? These multiple facets are interesting because they also allow us to understand better the mechanisms driving the possible crowding out effects. Specifically, we can study whether these crowding out effects arise through negative effects on intrinsic motivation (Frey, 1997), information about

the difficulty of the task (Benabou and Tirole, 2003, Sliwka, 2007) or reciprocity effects whereby workers wish to harm the principal for monitoring them (in the spirit of models of inequity aversion such as Rabin (1993) or Dufwenberg and Kirchsteiger (2004)).

The goal of this paper is to provide field experimental evidence on the effects of monitoring in a context where there are multiple ways workers can behave counterproductively and only one of them is subject to monitoring. The question is how monitoring affects the targeted and the untargeted productivity dimensions and ultimately whether monitoring is efficient.

We recruited students to do a job for us. The job consists of identifying the provenance of euro coins collected in different countries of the euro zone.[1] Participants receive 4 boxes of coins (corresponding to different countries of collection), which they can take home. Participants are asked to describe the denomination and the printing country of all coins with the help of a coin catalogue. We ask participants to complete the task and return all the materials at an appointed time.

This experimental design has a number of methodological advantages. First, the job has the advantage of offering a menu of possible counterproductive behaviours that are very common in the workplace, i.e. sloppy work, tardiness and theft. These forms of counterproductive behaviour vary in their nature and perhaps, importantly, in the non monetary (or moral) costs associated with them. Theft is illegal and is associated with a much stronger social norm than tardiness (Robinson and Bennett, 1995). Second, the job is crealy defined, i.e. our workers know exactly what we expect from them. Third, meeting these expectations is only a question of effort, not ability. Everyone can do the job provided they are putting sufficient effort into it. This will allow us to derive clean measures of counterproductive behaviour.

[1] There are currently 17 countries (out of 27 members of the European Union) and three European microstates (Vatican, San Marino and Monaco) that use the euro as their currency. There are 8 euro coin denominations, ranging from one cent to two euros. The coins first came into use in 2002. They have a common reverse, but each country in the eurozone has its own design on the obverse, which means that each coin has a variety of different designs in circulation at once.

We varied the degree of monitoring across 3 treatments. In the baseline treatment participants always received the full payment of €20 independent on the number of mistakes they make. In the two monitoring treatments, we informed participants that we would randomly check one out of the four boxes that they had identified and that their payment would be reduced if the number of mistakes in this box exceeded a threshold value. In the lax monitoring treatment, payment was reduced by €1 whenever we found more than 10 mistakes in the checked box. In the strict monitoring treatment, payment was reduced by €15 whenever we found more than 2 mistakes in the checked box.

We observe that 10 percent of the participants steal coins and that theft is not affected by monitoring. However, both the number of mistakes and tardiness vary with the degree of monitoring. Introducing lax monitoring does not improve performance in the identification task, but substantially increases tardiness. Thus, we can conclude that lax monitoring has an overall negative effect on productivity. For strict monitoring the effect is ambiguous. Compared to the baseline treatment, strict monitoring leads to a reduction in the number of mistakes made in the identification task. However, it also leads to a substantial increase in tardiness. We find no evidence of spill over effects of monitoring on theft.

Our results show the non monotonic relationship between monitoring and productivity, but show that the crowding out effects play out differently in a multi-dimensional setting. They do affect the non monitored dimensions of productivity, but not all of them. Our results are most supportive of a reciprocity interpretation, whereby workers wish to punish the principal (for monitoring them), but do so in the least costly manner for themselves (both in monetary and non-monetary terms).

The rest of the paper is structured as follows. We present the experimental design in Section 2, the results in Section 3 and conclude in Section 4.

2 Experimental design

The job consists of identifying the value and country of origin of euro coins that were collected in various countries in the euro zone.[2] Participants have to fulfill this task before a specific deadline. This job has several methodological advantages. It is a "realistic" job, i.e. it is a job that could realistically be advertised by an economics department and it has multiple dimensions of productivity that arise "naturally". Participants could not do their job well, be late in completing the job or steal some of the coins. It is straightforward for us to design a monitoring scheme targeting only one of these dimensions. Also, as we mentioned earlier, participants who fail to comply in either of these three dimensions can be categorised as behaving counterproductively, since it is possible to do a perfect job just by putting sufficient effort into it.

2.1 Procedure

Each participant received a set of 4 boxes of euro coins collected in 4 different countries of the euro zone. The lid of each box indicates the country the coins were collected in. Within one set, the composition of boxes, with respect to the value and the number of coins varied. Across sets, however, the composition of boxes was very similar. Each participant received a total of 780 coins with a value of €114.70.

We recruited student workers via a notice posted at various points on campus. Students contacted us by e-mail and were invited to collect the materials (each of them came separately) and received standardised verbal instructions on how to do the job. Participants received a catalogue illustrating the popular euro coins and four identification tables.[3] Using the catalogue, participants were told to identify each coin by indicating the value and the country it was printed in on the identification table.

[2] Each country of the euro zone has its own set of coins. All coins have the same reverse indicating the value of the coin. However, the obverse varies with the country of origin. For a detailed description of this task see Belot and Schröder (2013).

[3] The catalogue and the tables did not include special coins and coins from the microstates Monaco, San Marino and the Vatican. If any box contained such a coin, students were told to identify the coin as "not in the catalogue".

We told participants to identify all coins in each box and asked participants to work on one box at a time and to put all coins back into the box once identified. Participants were told to use a separate identification table for each box and to indicate the country of collection (as indicated in the lid of the box) on the identification table. In the monitoring treatments, we informed the participants about the number of boxes that will be checked, about the tolerated number of mistakes and the fine applied if the number of mistakes exceeded the tolerated number. We informed participants about the amount of money they would receive when returning the material and the amount they would receive after we had checked their work. If participants had no further questions, we asked them to indicate the exact time at which they would return the coins the next day. We gave participants enough time to check their calender for the best suitable time in the time horizon between 3:30 p.m. and 6 p.m.. Once a participant had decided on the exact return time, we wrote the time on a sheet of paper handed out to the participant. Participants were informed that the process of returning the coins and collecting payment would only take 1 minute.

Participants were allowed to work from home. When a participant returned the coins, we noted the exact time the material was returned. We also asked for an estimate of the time they had worked on the task, for their field of study and we noted their gender.

We checked all returned material with respect to coin composition and mistakes in the identification task. Whenever we observed deviations in the composition of coins, we replaced coins by identical coins or coins with similar collector's value before handing the material to the next participant. In the monitoring treatments, participants were informed whether they had met the performance requirement and could collect the remaining amount of money.

2.2 Treatments

Table 1 summarizes the three treatments of the experiment. In the *no monitoring* treatment, there were no fines. When returning the work material, participants in the no monitoring treatment immediately received the full pay-

ment of €20 in cash. In the *lax monitoring* treatment and the *strict monitoring* treatment, participants knew that 1 out of the 4 boxes would be checked after returning the coins. In the lax monitoring treatment the tolerated number of mistakes was 10. If we found more than 10 mistakes in the box randomly chosen for checking, the participant would only receive €19 instead of €20. In the strict monitoring treatment, the tolerated number of mistakes was only 2. If we detected more than 2 mistakes in the checked box, the participants' payment was reduced by €15. In both monitoring treatments, participants received the reduced payoff when returning the work material, i.e. only €19 in the lax monitoring and €5 in the strict monitoring treatment. After we had checked the boxes for mistakes, those participants who were not imposed a fine could collect the remaining amount of money.

Table 1 Treatments of the experiment

	no. of boxes checked	tolerated no. of mistakes	fine
no monitoring	0	-	-
lax monitoring	1	10	€1
strict monitoring	1	2	€15

2.3 Sample

Overall, 91 students participated in this study, 30 in the no monitoring and lax monitoring treatments and 31 in the strict monitoring treatment. We recruited participants via a notice posted at various points on campus. The notice informed students that we needed support for a research project in economics, that all students could participate, that the task would last for 2 to 3 hours and could be fulfilled from home, and that the average payment was €20. Interested students were asked to contact the research team via mail. Those students who had not participated in any previous related studies, received a response mail shortly explaining the task. Further, we suggested two collection dates with the corresponding return dates and asked students to choose one date and to indicate at what time they would collect the working material.[4]

[4] Collection was always in the morning between 10 a.m. and 12:30 p.m. and return was the next day between 3:30 p.m. and 6 p.m..

3 Predictions

Introducing monitoring and fines effectively increases the marginal benefit of providing effort in the monitored productivity dimension (*disciplinary effect*). Therefore, standard economic theory predicts that monitoring improves performance in the monitored dimension (Becker 1968). Thus, we should see that the number of mistakes made in the identification task is highest in the no monitoring treatment and lowest in the strict monitoring treatment. Tardiness and theft are not directly affected by the introduction of monitoring and should therefore be stable across treatments.

In a context with multiple productivity dimensions, monitoring only one dimension effectively changes the relative marginal benefit of providing effort in that dimension relatively to other dimensions. Monitoring should therefore lead to a shift of effort away from non monitored dimensions and towards the monitored dimension (Holmstorm and Milgrom, 1991; Baker, 1992). But this only applies if efforts associated with different productivity dimensions are substitutes. In the context of our job, it is plausible that doing the task well and showing up on time are substitutes. Doing the identification task well presumably requires more time and may therefore make it harder for workers to complete the task on time. On the other hand, sloppy work and stealing are unlikely to be substitutes. Thus, we would expect monitoring to reduce sloppy work, possibly increase tardiness and have no effect on theft.

But monitoring may also have a *crowding out* effect on productivity and different mechanisms could drive these crowding out effects. A first possible mechanism is through *intrinsic motivation* (Frey, 1993, Akerlof and Kranton, 2008). Workers feel demotivated by the introduction of monitoring and fines and, consequently put less effort in the job. These crowding out effects could spread across all dimensions of productivity. In our context this means that monitoring could increase sloppy work, tardiness and theft.

A second mechanism is *reciprocity*. It could be that workers perceive monitoring as unkind and put less effort into the job as a form of retaliation. Mon-

itoring effectively reduces the expected payoff. In our context, the worker gets €20 for sure in the treatment with no monitoring, while she gets €20 with a probability (less or equal to 1) in the two monitoring treatments. Theories of reciprocity (Rabin, 1993; Duwenberg and Kirchsteiger, 2004) would predict that workers would want to retaliate and reduce the principal's payoff. But then workers should pick the least costly manner of harming the principal. If they put less effort in the monitored task, they also get paid less in expectation. If they retaliate through the other dimensions, they incur no monetary costs (and in the case of theft they even incur a monetary gain) but they incur non monetary (or moral) costs. We conjecture that these non monetary costs are higher for theft than for tardiness and we would therefore expect that reciprocity is at work, tardiness may be more affected than performance at the identification task or theft.

A third mechanism that has been proposed is through *information*. Monitoring (and incentives) could be perceived as a signal of task difficulty (Bénabou and Tirole, 2003)[5] or of peers' work behavior (Sliwka, 2007)[6]. In both cases, if workers put less effort in the monitored dimension because of information, then their performance in the targeted productivity dimension may decrease with monitoring and incentives and, on top of that, they save on effort they can spend elsewhere (the marginal cost of spending effort in other dimensions is lower). So, we would expect them to show up more on time. We do not expect effects on theft because again, stealing and sloppy work are unlikely to be substitutes in terms of effort.

[5] In this approach monitoring reveals information about the difficulty of the task to the agents. Workers who are monitored infer that the task is difficult and as a consequence put less effort into it.

[6] The principal's monitoring choice signals his expectations of a large fraction of counterproductive workers in the monitored productivity dimension. Workers who aim at behaving conform to their peers will react to this signal in choosing to behave counterproductively in the monitored but not in other productivity dimensions.

4 Results

4.1 Summary statistics

Table 2 shows summary statistics for the behaviours of interest across the three treatments. First, performance is on average better in the strict monitoring treatment than in the no monitoring and lax monitoring treatments. In fact, performance without monitoring or with lax monitoring is very similar: workers make 10 mistakes on average, while they make on average 7 mistakes in the strict monitoring treatment. The proportion of workers making more than 10 mistakes is largest in the lax monitoring treatment (30%), followed by the no monitoring treatment (23%) and is lowest in the strict monitoring treatment (16%). These results indicate that monitoring only works when the incentives are high enough.

Second, tardiness varies substantially on average across treatments. Workers are more likely to be late and less likely to come back early (i.e. before the actual deadline) in the no monitoring treatment. Tardiness is worst in the strict monitoring treatment.

Finally, theft occurs relatively rarely (9 people out of 91 stole money, which is 10% of the cases). Overall, it seems that stealing is motivated by the collectors' value of coins, rather than the nominal value of circulating coins. Subjects especially steal coins that are only rarely found in Germany, such as coins from the Vatican, Slovenia, or Slovakia. These are coins that have a higher collectors' value than their actual nominal value. For example, in three cases a 50 Cent coin from the Vatican is stolen. On the German ebay platform this coin is sold for €3 (plus shipping). In two cases subjects replaced coins with a higher collectors value by other coins with the same nominal value. We categorize these acts as theft as they did not inform us that they replaced the coins. In addition to the two coins that were replaced, 12 coins were stolen, resulting in a nominal loss of €1.53. We observe no variation in the prevalence of theft across treatments.

Table 2 Summary of the results

	no monitoring	lax monitoring	strict monitoring
Performance			
avg. no. of mistakes	10.23 (16.23)	9.97 (13.45)	6.90 (10.93)
no. of subjects with 0-2 mistakes	37%	40%	35%
no. of subjects with 3 mistakes or more	63%	60%	65%
no. of subjects with 10 mistakes or more	23%	30%	16%
. **Tardiness**			
avg. delay in minutes (if late)	0.77 (2.84)	4.63 (11.32)	9.84 (27.90)
avg. advance in minutes (if early)	152.60 (425.31)	7.50 (14.37)	26.29 (83.42)
Theft			
no. of subjects who stole coins	3	3	3
Work time			
avg. work time in minutes	111.83 (42.58)	112.50 (45.04)	124.45 (47.69)

Mean values with standard deviation in parenthesis.

4.2 Regression analysis

We now turn to a regression analysis of the number of mistakes and tardiness (we do not analyse theft since there is no variation across treatments), which allows us to control for some observable characteristics of the workers. Starting with the number of mistakes, col. (1) shows the results of a Poisson regression.[7] We find that there are 40% less mistakes under the strict monitoring treatment than under no monitoring. On the other hand, we find no significant differences between lax and no monitoring. We find that the time difference (i.e. difference between the actual and the appointed return time) is significantly larger in both monitoring treatments compared to the treatment withouth monitoring(col. (2)).

One important question here is whether the difference is driven by a substitution effect, i.e. workers show up late because they put more effort into the task. We asked participants how much time they spent on the task and the average reported working time was 112 minutes for the no monitoring treatment, 113 minutes for the lax monitoring treatment and 124 minutes for the strict monitoring treatment, with none of these differences being statistically signifi-

[7] The distribution of the number of mistakes is not normal. There is a substantial fraction of zeros and small positive values. In those cases, count data models are more appropriate. This is why we use a Poisson regression.

cant (U-test, p>0.20, two-tailed). We find that differences between treatments with respect to punctuality exist even when controlling for the total number of mistakes and the reported work time (Col (3)). There is some evidence that part of the delay in the strict monitoring treatment could be due to the extra care in the task (the difference in delay falls from 143 minutes to 132 minutes, which corresponds exactly to the additional amount of time spent on the task. But neither the total number of mistakes, nor the reported working time appear to be correlated with the delay at all.

Col (4-7) look at the probability of completing the task early or late. We only find significant differences in the probability of being late. Participants are 36% and 39% more likely to be late under the lax and strict monitoring schemes respectively. The effects of monitoring remain identical if we control for the total number of mistakes and the reported work time (Col 5 and 6), which shows that there is no relationship between effort in the identification task and tardiness. Thus our results are most supportive of a reciprocity interpretation. Workers perceive monitoring as unkind and retaliate by putting less effort in the dimension that is the least costly for themselves (both in monetary and non monetary terms).

One important question is whether it pays overall to monitor. Clearly this is not the case when we compare lax monitoring to no monitoring. There are no significant differences in the performance in the task and tardiness increases with monitoring. Strict monitoring, on the other hand, improves performance, but increases tardiness as well. In that case, depending on the opportunity cost of time, it could be that monitoring pays off.

Table 3 Regression analysis

	Number of mistakes (Poisson)	Time difference (OLS)		Early (Probit)		Late (Probit)	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
lax monitoring	.003	145.754	145.154	-.137	-.136	.348	.356
	(.082)	(65.137)***	(64.896)**	(.119)	(.119)	(.132)**	(.132)*
strict monitoring	-.407	143.140	131.754	-.105	.066	.363	.389
	(.089)***	(64.791)***	(65.157)**	(.120)	(.106)	(.129)***	(.131)*
female	-.298	37.005	36.556	.070	.066	.000	.015
	(.074)***	(54.098)	(53.897)	(.105)	(.106)	(.103)	(.104
total mistakes	-	-	1.341	-	-.001		.005
			(1.997)		(.004)		(.004
reported work time	-	-	.772	-	.000		.000
			(.602)		(.001)		(.001
constant	2.435	-185.343	-266.523	-		-	
	(.062)***	(55.355)***	(83.951)***				
(Pseudo) R^2	.027	.082	.047	.014	.016	.081	.098

*significance at p<0.10, **significance at p<0.05, ***significance at p<0.001
Marginal effects are reported for probit estimates in col (4)-(7)

5 Discussion and conclusions

This paper provides field evidence on the effects of monitoring in a context where productivity is multi-dimensional and only one of the dimensions (performance) is monitored. We find that introducing a lax monitoring technology (allowing for a fair amount of mistakes) and small fines are inefficient. There is no significant improvement in performance, and tardiness increases significantly.

Strict monitoring (allowing for very few mistakes) and big fines are more effective. The number of mistakes falls by 40%, but at the same time the adverse effects on the other dimensions are as large as in the lax monitoring treatment.

Overall, these results are in line with a model of reciprocal behaviour. Workers choose to punish the principal for monitoring them, but choose do this through dimensions that are costless for them. Theft is presumably much more costly (in moral terms) than tardiness, and putting less effort in the monitored task also involves direct costs. Tardiness on the other hand does not involve high moral costs and has no financial consequences.

Based on these results, we conclude that introducing a monitoring technology only pays off if (1) the incentives associated with passing the checks are high and (2) if the dimensions that cannot be monitored either entail high moral costs or if the relative gains in productivity in the monitored dimension more than compensate for the losses in the other dimensions.

These findings relate more broadly to the literature on adverse effects of incentives (see Gneezy et al. (2011) for a recent review) and the adverse effects of control (Falk and Kosfeld, 2006) and monitoring (Frey, 2003). In line with this literature, we find that weak monitoring and weak incentives are less effective than no monitoring and no incentives.

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