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Michèle Belot/Marina Schröder

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Verantwortlich für diese Ausgabe:
Marina Schröder
Otto-von-Guericke-Universität Magdeburg
Fakultät für Wirtschaftswissenschaft
Postfach 4120
39016 Magdeburg
Germany

http://www.fww.ovgu.de/femm

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Sloppy Work, Lies and Theft: A Novel Experimental Design to Study Counterproductive Behaviour*

Michèle Belot† and Marina Schröder‡

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Abstract

We propose a novel experimental design to study counterproductive behaviour in a principal agent setting. The design allows us to study and derive clean measures of different forms of counterproductive behaviour in a controlled but non obtrusive manner. We ask participants to complete a specific task (identify euro coins) and report their output. Participants can engage in various forms of counterproductive behaviour, none of them being offered to them explicitly. They can make mistakes in the identification task, lie in their report or even steal coins. We present an application of the design to study the effects of different pay schemes (competition, fixed pay and piece rate) on counterproductive behaviour. On average counterproductive behaviour amounts to 10 percent of the average productivity, almost all arising through mistakes and overreporting of output. We find essentially no evidence of theft. Moreover, we find that both productive and counterproductive behaviour are significantly higher under competition than under the two other pay schemes.

1 Introduction

Counterproductive or deviant work behaviour, refers to voluntary acts that are detrimental to an organisation (Sackett 2002, Robinson and Bennett 1995). It can take various forms such as employee theft, lies, slow and sloppy performance, sabotage, tardiness and absenteeism, to name a few. Some experts estimate that globally the average organisation loses 5 percent of its revenues due to

*The authors thank the Institute for Fraud Prevention for financial support.

†University of Edinburgh, School of Management, michele.belot@ed.ac.uk, 30 Buccleuch Place, Edinburgh, EH8 9JT, UK

‡University of Magdeburg, Faculty of Economics and Management, marina.schroeder@ovgu.de, Postbox 4120, 39108 Magdeburg, Germany

occupational fraud and that the median financial losses per case are 160,000 dollars.[1]

Despite their direct relevance for economic productivity, there are surprisingly few studies in economics on counterproductive behaviour, most plausibly because of the difficulty of collecting reliable information. We propose an experimental design to study counterproductive behaviour in a controlled but non obtrusive manner. The experiment is designed within a principal agent framework. We (the principal) ask the participants (the agents) to complete a specific task. The task is framed within a realistic work context - the euro currency, to bring the situation close to real employer-employee relations. The task consists of identifying the provenance of euro coins collected in different countries of the eurozone.[2] Participants are asked to describe coins with the help of a coin catalogue and then report how many of them they have identified. Counterproductive behaviour is defined as non-compliance with the instructions. Compliance here (i.e. the ability to complete the task) does not depend on skills, it only depends on effort. Anyone can correctly complete the task provided they put sufficient effort into it.

The main contribution of this paper is to propose a novel design for the study of counterproductive behaviour and overcome a number of limitations of alternative designs (which we discuss in the next section). The design has three main advantages. First, it allows us to derive clean individual measures of various forms of counterproductive behaviour. We can study how many errors participants make, to what extent they inflate their report and whether they steal coins. These behaviours are associated with different social norms and so allow for a richer study of counterproductive behaviour. Second, the task could plausibly take place in a real principal agent setting. The task relates to eco-

[1] Source: Association of Certified Fraud Examiners, 2010.

[2] 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 euro. 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.

nomics (which fits to the participants' expectations) and the nature of the task itself explains why we cannot condition payment on productivity. It is impossible to observe productivity immediately and check whether the participants did their job properly. This is why we need to rely on participants' reports at the time of payment. Finally, the option to deviate or to be counterproductive is not offered explicitly. There is a range of obvious counterproductive behaviours participants can engage in, but none of them is mentioned explicitly. Participants are told what to do, there is no ambiguity about whether counterproductive behaviour is acceptable or not, but it is not an obvious option. Again, this feature corresponds more to many real life situations where "cheaters" have to come up with a plan themselves if they want to cheat.

We use our design to present original experimental evidence on the relationship between pay schemes and counterproductive behaviour in a real effort experiment. We consider three pay schemes: competition, piece rate and fixed pay. Competition rewards the participant among a group of four participants who reports the highest number of coins identified. The winner earns a prize of 50 euro. The piece rate scheme rewards participants according to the number of coins they report having identified. They earn 10 euro cent per coin. In the fixed pay treatment, participants earn 12.50 euro for the 10 minutes work. We do not implement any monitoring. As a result, participants cannot be sanctioned for counterproductive behaviour.

There is a fair amount of experimental evidence on the effect of pay schemes on effort and performance in principal agent settings, both in the laboratory and in the field (see for example van Dijk, Sonnemans and van Winden 2001 or Lazear 2000). But these existing studies are not directly informative for the study of counterproductive behaviour because counterproductive behaviour is not clearly defined and measurable. Importantly, it is often impossible to distinguish between incompetence and counterproductive behaviour.

We find evidence of counterproductive behaviour under all three schemes. Overall, counterproductive behaviour amounts to 10 percent of productivity on average. We find essentially no evidence of theft. The results are supportive

of a model of social norms, more than a model of other regarding preferences. Theft or inflating the report are equivalent in a gift exchange model and there is no reason why we should observe one type of behaviour more frequently than the other. In contrast social norms presumably differ across types of behaviour: not doing a perfect job is not as bad as stealing money directly (Robinson and Bennett 1995).

Comparing across pay schemes, we find that productivity is significantly higher under competition. On average participants identify 138 coins correctly in the competition treatment, in comparison to 122 in the piece rate and 106 in the fixed pay treatment. We find no significant differences in the number of errors made in the identification task across pay schemes. But we do find significant differences in reporting. The report error is significantly greater under competition than under the other pay schemes. Thus, competitive pay triggers higher productivity and higher inflation in comparison to the other schemes.

In the remaining of the paper, we first discuss the related literature, then present the experimental design, the results and then conclude.

2 Literature review

There is a large literature on counterproductive behaviour in psychology, organisation and, more recently, economics. We will mainly discuss the experimental literature as it is most related to this study, but we briefly introduce the different approaches in social sciences for the sake of completeness.

Non-experimental research mainly uses self-reports and psychological tests to study the determinants of counterproductive behaviour. Psychologists have mainly focused on personality traits of individuals who are likely to engage in counterproductive behaviour, i.e. Salgado (2002). Data is usually obtained from personality tests in combination with direct questions about own engagement in counterproductive behaviour, see for example Furnham and Thompson (1991), or Mount, Ilies and Johnsons (2006).

There is also a large body of research in Organisation, focusing on how organisational aspects affect counterproductive behaviour. For example Fine et al. (2010) show that employees who have a positive general attitude towards their employer are less likely to engage in counterproductive behaviour. Again, findings rely on interviews and thus, on self reports concerning counterproductive behaviour.

There is a growing body of experimental research on counterproductive behaviour in economics. The advantage of economic experiments is that knowledge is generated from actual payoff relevant choices and not from self reporting. In most economic experiments counterproductive behaviour is individually beneficial for an agent. One major question is why participants do not choose the highest possible level of counterproductive behaviour as would be predicted by theories of pure self interest (Becker 1968).

A first popular design to study dishonesty is the die roll proposed by Fischbacher and Heusi (2008). In their design, participants privately roll a die and are asked to report the outcome to the experimenter. The reported die roll determines a participant's payoff. Thus, participants face a simple decision between reporting the truth or lying in order to increase the personal payoff. The great advantage of the design is that one can compare ex post the distribution of reports to the theoretical uniform distribution to make inferences about the prevalence of lies without detecting lies on an individual basis. In the original experiment of Fischbacher and Heusi (2008) only 22 percent of the participants chose to fully deceit, while about 39 percent were honest. A large group chose an intermediate level of deception. Fischbacher and Heusi (2008) find that stakes, consequences for others, and the level of anonymity do not have a significant effect on deception. It seems that the main reason not to choose full deception is a desire to maintain a positive self-concept and thus, to conform with social norms.

A second popular design is the sender-receiver game proposed by Gneezy (2005). An agent is given payoff relevant information and has to forward this information to an uninformed principal. The agent in the experiment faces

the binary choice of lying to the principal in order to increase her own payoff and hurt the principal or telling the truth, which would be beneficial to the principal. Gneezy (2005) shows that deception increases in personal benefits but also decreases in the disadvantages caused for others. The design is simple and can be easily adapted to study various types of lies by varying the payoff structure.

Other designs apply real effort tasks to study counterproductive behaviour in settings where conformity with the rules requires the provision of effort. Generally, in this type of experiments participants have to fulfill different brainteasers such as math tasks (Mazar, Amir and Ariely 2008), maze games (Schwieren and Weichselbaumer 2010), or word creation tasks (Schweitzer, Ordóñez and Douma 2004). While these experiments give consideration to the fact that counterproductive behaviour may be very different if conformity requires effort provision, they do not represent sensitive tasks, i.e. the participants know that providing effort does not create extra value to anyone.

Some of these designs have been applied by previous research on the effect of pay schemes on counterproductive behavior. For example Schwieren and Weichselbaumer (2004) apply a maze game where various form of counterproductive behavior are possible. They compare a competitive pay scheme to a piece rate scheme and find that overall there is no significant difference in counterproductive behavior but that women seem to cheat more under competition than under piece rate. Schweitzer, Ordóñez and Douma (2004) and Cadsby, Song and Tapon (2010) apply a word creation task and test for the effect of target-based incentives on counterproductive behavior. Schweitzer, Ordóñez and Douma (2004) compare monetarily incentivised targets to unincentivised targets and find that counterproductive work behavior occurs under both conditions but that more counterproductive behavior is observed when reaching the target is incentivised. Cadsby et al. 2010 compare target-based incentives to both a linear piece-rate and tournament incentives. While they do not find any differences between piece-rate and tournament incentives, they find that counterproductive behavior is significantly higher under target-based incentives. Conrads et al. (2011)

adapt the die experiment to study the effect of team incentives on counterproductive behavior. They compare behaviour under a piece rate scheme to team pay and find significantly more counterproductive behavior under team pay.

We see three main limitations with the existing experimental designs. One is that the possibility to cheat / lie / behave counterproductively is often salient to the participants. It is often easy for participants to understand that the experiment relates to cheating, lying or other forms of counterproductive behaviour. This is potentially problematic not only because of possible experimenter-demand effects, but also because in many situations cheating is not an obvious option and requires some cognitive input. Second, the effort tasks are typically not providing benefits to anyone else, which shuts down an important channel through which counterproductive behaviour may be restrained in many real settings. Third, the lack of perfect monitoring is most often a choice of the experimenter and does not arise through the nature of the task. In most cases it would be feasible and straightforward for the experimenter to perfectly monitor participant behaviour. This design feature tends again to make the research question relatively obvious to the participants. Of course, these three limitations do not necessarily compromise the study of treatment effects, but they could certainly lead to biased estimates of the prevalence of counterproductive behaviour. Our design is an attempt to overcome some of these limitations.

3 Experimental design

3.1 Procedure

The experiment was conducted at the Magdeburg experimental laboratory. Overall, 108 participants took part in the experiment (36 per treatment). For each treatment we ran 3 session each consisting of 12 participants. Participants were recruited through the online recruiting system ORSEE (Greiner, 2004), and we took precaution that nobody took part more than once.

Participants know that the laboratory conducts experiments in economics. We framed the experiment around the euro. The first part of the experiment was

a test of familiarity with euro coins, the second part was an identification task, where participants were asked to describe coins placed in a box according to their country of origin and denomination. Finally, the third part was a questionnaire asking for some background characteristics and perceptions of fraud. The first and third parts were identical for all treatments. The variation in pay scheme applied to the second part only. We added the first and third parts to provide a broader context to the identification task.

Before the experiment started, participants were randomly assigned a desk number and were asked to quietly read the instructions which we provided on the desks. Instructions were given for the entire experiment and the payment for all three parts was explained. After all participants read the instructions, they were asked to collect all working materials required for the experiment from a work station at the entrance of the laboratory and take it with them to their desk. Participants were not individually assigned to working material, so that during the entire experiment the experimenter did not know which set of working material a participant was working with.[3] The experimenter read the instructions relevant to each part out loud at the beginning of each part.

The first part consists of a familiarity test lasting 10 minutes. Participants receive a sheet with pictures of euro coins from different countries and different denominations. They are asked to indicate the country of origin corresponding to the coins presented. For each correct answer participants receive 10 euro cent and for each wrong answer 0 euro cent. At the end of the 10 minutes, we collected the forms and took them to a separate room where we marked them during the second part of the experiment.

The second part is an identification task. Participants are asked to identify real euro coins with respect to the country they were printed in and the denomination. To do so, they are told to use a catalogue illustrating all common euro coins in alphabetical order of the country of origin. Participants are given 5 minutes before the task started to familiarise themselves with the catalogue

[3] After the experiment was over, we were able to bring together subjects' records for all three tasks. We did so using a subtle code related to the page numbers of the sheets provided in the packages of working material.

(which they can keep for the entire duration of the task). Coins are provided in boxes containing 195 coins each. These boxes were among the materials collected at the entrance of the laboratory. Each box corresponds to a country of collection (Belgium, France, Germany, Italy and Luxembourg), which was indicated in the lid of each box.[4] In each session, there were four boxes of coins collected in the same country. We used the same set of boxes across all treatments.

Participants are told to keep accurate records of identified coins on a preprinted identification sheet and are given precise instructions on how to do so. On the identification sheet participants have to mark for each coin, the value of the coin and the country it was printed in. At the end of the 10 minutes, participants are told to put all coins back into the box. They are instructed to put coins that had been identified into a plastic bag and the other coins loosely into the box. Then, participants are asked to indicate on a separate report sheet the total number of coins identified, the country of collection of the coins as indicated in the lid of the box and their desk number. After filling in the report sheet, participants are told to also put the identification sheet into the box, so that at the end the box contains a plastic bag with identified coins, the remaining unidentified coins and the identification sheet. They are told at the beginning that we will collect the receipt, prepare the payment and that they should place the materials back at the entrance as they leave the room to get their payment.

The third task is not incentivised. Participants are asked to fill in a questionnaire while the experimenter prepares payment. In the questionnaire participants are asked about their opinion on the euro, about the current euro-crisis, about their attitude towards fraud, and about some demographic aspects. After filling in the questionnaires, participants are individually called outside of the

[4] Coins were collected from local banks in each country of collection. For Germany, we had 8 boxes of coins, 4 coming from a bank and 4 coming directly from the money circulating in Germany. The fraction of coins which were not printed in the country of collection was highest in Belgium, where 65 percent of the collected coins were printed in countries different than Belgium. The fraction was lowest in Germany. For both sets of German coins only 12 percent of the collected coins were not printed in Germany. Overall, 31 percent of the coins were printed in a country different to the country of collection.

laboratory for payment. On the way out, participants leave boxes containing coins and identification sheets at the work station, where they first collected them. Thus, it was clear that boxes are not checked before payment.

We were able to match the receipts to the identification sheets and materials by using a subtle matching code whereby the position of the page number on the final questionnaire corresponded to the position of a university stamp on the identification sheet. The participants were not told about this subtle matching procedure (but were of course also not told that we would not be able to match receipts and identification sheets). But the participants knew for sure that they would be paid before we could possibly match or check their actual performance.

Of course a key aspect of the experiment is to check carefully the work of all participants after the experiment is finished. We had a team including ourselves and a number of research assistants and we double checked all work done. The research assistants were carefully instructed before the experiment started and the whole team worked in the same room at the same time and under our careful supervision.

3.2 Treatments

We consider three treatments: a competition treatment, a piece rate treatment and a fixed pay treatment. In the competition treatment participants are assigned to groups of four (defined by the country where coins were collected) and compete for one prize. The participant who reports the largest number of identified coins receives 50 euro, while the other three participants receive 0 euro for the second part. In the piece rate treatment, participants are paid 10 euro cent per coin reported. In the fixed pay treatment, participants earn 12.50 euro for 10 minutes of work.[5] Participants are informed about the procedure at the beginning of the experiment (see the Appendix for the instructions).

[5] To assure that expected payoffs in the three treatments were as similar as possible, we first ran the piece rate treatments and then defined the fixed wage and the prize in the competition treatment according to participants' earnings in the piece rate treatment.

3.3 Measures of counterproductive behaviour

A participant i (the agent) receives a payment e_i. Under competitive and piece rate schemes e_i is a function of the number of coins i reports to have identified (r_i). In the fixed pay treatment, e_i is independent of r_i. We measure the *productivity* (y_i) as the number of coins identified correctly. In addition to measuring productivity, the design allows us to derive a clean measures of various forms of counterproductive behaviour.

The first measure of counterproductive behaviour we derive is the number of *errors in the identification task*. Coins could be confused, or there could be too many or too few coins described in comparison to those found in the plastic bag. Since participants had a catalogue with illustrations of all coins, compliance with the instructions is only a question of effort provision. These errors could be honest mistakes, but whether honest or not, they are counterproductive and a failure to comply with the instructions. Of course, participants could differ in their abilities and therefore could have different costs of complying with the instructions, but they could make sure they are doing a perfect job by putting enough effort into it. Consequently, all errors can be interpreted as counterproductive behaviour rather than incompetence. We classify an error as a *confusion* if we find that the subject reported a coin from a given country which is not contained in the plastic bag and instead we find a coin of similar size that is not reported on the sheet.[6] Another possible confusion occurs if participants indicate the right denomination, but confuse printing countries. We classify these errors as one mistake (rather than two). The two other types of errors are coins that are found in the bag but have not been described on the sheet, i.e. *missing bars* or coins that are described on the sheet but are not in the bag, i.e. *excess bars*.[7]

[6] The euro coins of similar size are the one and the two cent ont the one hand and the 10 and 20 cent on the other.

[7] There were 3 subjects who put all coins into the bag even though they have not identified all coins on the form. To estimated the number of errors, we calculated the difference of the coins reported on the identification sheet to the coins that were in the box for each type of coin. If this difference is positive, we were able to detect errors in the sense that the participant reported a coin which was actually not in the box.

The second form of counterproductive behaviour is an incorrect report $r_i \neq y_i$. We call the discrepancy between the report and the actual productivity the *total reporting error*. Of course the reporting error could be due to mistakes in the identification task, i.e. participants just count the number of bars on the identification sheet, do not correct for mistakes and report their apparent output (z_i). Note that not all mistakes increase the apparent output. Missing bars in particular decrease the apparent output. If all mistakes are missing bars, then the apparent output will correspond exactly to the actual output. On top of that participants could also directly inflate the report, i.e. report a higher number than their apparent output. Thus, the total reporting error ($r_i - y_i$) can be decomposed into two components: (1) the difference between the report and the apparent output ($r_i - z_i$), which we will refer to as *direct inflation* and (2) the difference between the apparent output and the actual productivity ($z_i - y_i$) - which we will refer to as *indirect inflation* .

Finally, a third way of behaving counterproductively is *theft*. Since the coins are in circulation, participants have a direct monetary benefit from stealing them. We identify theft by comparing the value of coins in the box before and after the experiment.

To summarise, our design allows for various forms of counterproductive behaviour, which we can measure in a clean manner. Our three measures of counterproductive behaviour are:

1. The number of mistakes in the identification task, which is equal to the sum of confusions, missing and excess bars.

2. The reporting error ($r_i - y_i$), which we decompose into two coponents: direct inflation ($r_i - z_i$) and indirect inflation ($z_i - y_i$).

3. Theft: identified by the difference between 195 and the total number of coins found in the box at the end of the experiment.

3.4 Predictions

As there is no monitoring and no punishment, a payoff maximising individual should choose the highest possible level of counterproductive behaviour (Becker 1968), that is, not provide any effort and, whenever this leads to an increase of own payoff, report the highest possible output. Previous experiments have shown that people do not behave purely opportunistically and counterproductively. The literature proposes different models to account for such behaviour: models incorporating other regarding preferences and models of social norms.

Theories of other regarding preferences argue that individuals care not only about their own monetary payoffs but also about the payoffs of others, i.e. Rabin (1993), Fehr and Schmidt (1999), Falk and Fischbacher (2006). This means that participants may refrain from choosing the highest possible level of counterproductive behaviour because of the negative effects such behaviour has on others.

Errors and theft only affect the principal and the negative external effect of these two types of counterproductive behaviour is constant for all three pay schemes. Reporting errors on the other hand do not affect the principal in the competition or fixed wage treatment. It only affects the principal in the piece rate. In the competition, the other participants in the group are negatively affected by report inflations since only one participant of a group wins the prize. Whether or not participants consider other regarding costs as higher in the piece rate or in the competition treatment depends on whether participants care more about the principal or about their peers. Concerning the two types of inflation, indirect and direct, the other regarding costs are equal. Thus, other regarding participants should choose both types of inflation with equal probability.[8]

An alternative theory that could explain counterproductive behaviour are social norms. Theories of social norms propose that violating a social norm involves a non-monetary (moral) cost. The assumption is that offenses against social norms create a disutility for individuals, for example a feeling of guilt

[8] If participants belief that the identification task itself is of value for the experimenter, than participants should choose direct inflation more often than indirect inflation.

(Battigalli and Dufwenberg 2007) or a disadvantageous change in self-perception (Bénabou and Tirole 2011). In our context, we would expect that there are different social norms attached to different forms of deviant behaviour. For example, in the categorisation of Robinson and Bennett (1995), theft and lying (i.e. direct inflation) are considered as serious offenses while erroneous work is considered as a minor offence. Our hypothesis is that the social norm is strongest for theft (which is, in fact, illegal). When considering social norms, we would expect to see less stealing than other forms of counterproductive behaviour. We would also anticipate to see more indirect inflation of the report (inflation through erroneous work) than direct inflation (inflation through lying), because the latter may appear more deliberate and dishonest than the former. Errors in the identification task may more easily pass as "honest mistakes" and may be perceived as more acceptable than other forms of counterproductive behaviour (Robinson and Bennett 1995).

4 Results

General overview

On average participants identified 121.8 coins correctly. The smallest number of correctly identified coins was 10 and the maximum was 193. Different to other real effort tasks, such as adding tasks or solving mazes, we observe no significant differences in performance depending on gender. On average female participants identified 120.4 coins correctly and male participants identified 123.1 coins correctly. The difference in the productivity of female and male participants is not statistically significant (Wilcoxon, z=-0.15, p=0.88, two-tailed). In line with previous studies on performance under different incentive schemes (van Dijk, Sonnemans and van Winden 2001 and Lazear 2000), we find that productivity is highest in the competition treatment (on average 138.2 coins identified correctly) and lowest in the fixed pay treatment (on average 105.6 coins identified correctly). These differences are statistically significant with z=2.87, $p<0.01$ and z=-2.73, $p<0.01$, correspondingly (U-test, two-tailed).

There are 12 participants out of 108 who do a perfect job: (1) no errors in the identification task, (2) truthful report and (3) no theft. But a large majority does behave counterproductively. There are 6.2 errors per participant on average and the average report is 6.2 coins above the average productivity. We do not find systematic evidence for theft. Only one out of 108 participants stole money. Table 1 presents summary statistics on the performance and on the three forms of counterproductive behaviour. In the following we will separately discuss the three types of counterproductive behaviour in more detail.

Table 1: Productive and counterproductive behaviour (average)

	competition	piece rate	fixed wage	total
Number of coins identified correctly	138.2 (37.6)	121.6 (33.2)	105.6 (44.6)	121.8 (40.7)
Number of errors in identification task	3.1 (2.3)	8.6 (22.3)	7.0 (16.4)	6.2 (16.0)
Total inflation of the report	7.9 (22.8)	5.0 (22.2)	5.8 (17.3)	6.2 (20.7)
Value of coins stolen (in euro)	0	0.31 (1.8)	0	0.1 (1.0)

Mean values with standard deviation in parenthesis.

Errors in the identification task

On average participants make 6.2 mistakes, which corresponds to 5 percent of the average productivity. The error rate (proportion of errors relative to the apparent output) ranges from 0 to 0.9 with a mean value of 0.05. In line with predictions of other regarding preferences and of social norms, there are no significant treatment differences in the number of errors made (U-test, $p>0.20$, two-tailed) or in the error rate (U-test, $p>0.20$, two-tailed).

Out of 108 participants, 21 fulfilled the identification task without any errors, which shows that error-free work is possible. It is worth noting that 80 percent of the observed errors are caused by 26 participants (24 percent of participants). On average, this smaller group of participants makes 20.8 mistakes (80 percent of all errors observed) while the remaining 76 percent of the participants make only 1.6 errors on average.

Reporting errors

On average the report is 6.2 coins above the actual productivity. This difference is significantly different from 0 (Wilcoxon, $z=6.42$, $p<0.01$, two-tailed). As we mentioned earlier, there are two ways a subject can inflate the report:

they can hide behind mistakes in the identification task or they can report a number even higher than their apparent productivity. A priori it looks like the reporting error could be entirely driven by mistakes in the identification task. Participants make 6.2 mistakes on average, and the report is also 6.2 coins above the actual productivity. But remember that the number of mistakes adds up confusions, missing and excess bars, but these different mistakes do not all inflate the apparent output. To see to what extent participants indirectly inflate the report through mistakes in the identification task, we should calculate the difference between the apparent output (number of bars on the identification sheet) and the actual output (number of coins identified correctly). This difference is equal to 4.98 coins on average, that is, most of the reporting error comes from the mistakes but not all of it. On top of that, participants also inflate the report directly. The average direct inflation (difference between the apparent output and the actual productivity) is 1.26 coins. The total reporting error is highest under competition (U-test, z=1.98, p=0.05, two-tailed) and lowest in the piece rate treatment compared to the other treatments (U-test, z=-1.74, p=0.08, two-tailed).

Overall, we observe a significantly higher degree of indirect inflation compared to direct inflation (Wilcoxon, z=5.78; p<0.01, two-tailed). This is true for each separate treatment (Wilcoxon, p<0.05, two-tailed). The observed difference in type of inflation is in line with the predictions of social norms, but contradictory to the predictions of other regarding preferences.

As already for erroneous work, there are no significant differences in indirect inflation across pay schemes (U-test, p>0.20). But we do observe significant treatment differences in direct inflation. Direct inflation is significantly higher under competition (U-test, z=2.57, p=0.01). Additionally, direct inflation seems to be lower under piece rate compared to the other schemes. This finding is not significant though (U-test, z=-1.29, p=0.20).

Overall there are 21 participants (19 percent) who inflate the report by 5 coins or more (which we call *strong inflators*). This fraction of strong inflators is very similar to the fraction of participants who chose to lie by the maximum

possible amount in the die experiment (Fischbacher and Heusi 2008). The average inflation of these strong inflators is 30.14 coins, which is 27 percent of productivity and accounts for 94 percent of the observed inflation. The average inflation among the remaining 87 participants (81 percent) is only 0.5 coins, which corresponds to less than 1 percent of own productivity. It is worth mentioning that the productivity of strong inflators is not different to that of the other participants (U-test, z=-0.97, p=0.33, two-tailed).

Theft

We observe only one case of theft. One individual in the piece rate treatment stole 8 out of the 195 coins in the box. This subject stole 3 two euro coins and 5 (all) one euro coins. Thus, overall 11 euro out of 29.2 euro were stolen from the box. The fact that we rarely observe theft is in line with a model of social norms. Theft is illegal and is therefore presumably associated with the strongest social norm (Robinson and Bennett 1995). A participant who cares about social norms will rather choose a different type counterproductive behaviour, such as inflation of the report.

Other regarding preferences cannot explain the absence of theft. The negative externalities of theft are similar to those of inflating the report in the piece rate treatment. Participants in the piece rate treatment regularly inflate the report while they do not steal any coins.

5 Discussion and conclusions

This paper presents a novel experimental design to study counterproductive behaviour. The experimental task takes place within a principal-agent context. Participants are asked to do a simple well-defined task: identifying euro coins with the help of a catalogue and reporting how many coins they have identified. They are paid according to their report. The set-up leaves room for various forms of counterproductive behaviour such as erroneous work, inflating of the report or even stealing coins. We find essentially no evidence of theft, but find that participants make mistakes and inflate the report. The type of counter-

productive behaviour chosen gives information on why participants may refrain from choosing the personally beneficial level of counterproductive behaviour. Our findings are more consistent with a model of social norms rather than a model of other regarding preferences.

We apply the experimental design to three different pay schemes, i.e. competition, fixed pay and piece rate. We find evidence of counterproductive behaviour under all three schemes. On average the total amount of counterproductive behaviour amounts to 10 percent of productivity and is driven by errors in the job as well as report inflation. There is essentially no theft taking place. Overall, productivity is highest under competition and lowest under fixed pay.

We also find that counterproductive behaviour is concentrated among a minority of people. Only 24 percent of the participants are responsible for 80 percent of the errors in the identification task. Similarly, 19 percent of the participants are responsible for 94 percent of the report inflation.

To conclude, the goal of this study was to introduce a novel experimental design to study counterproductive behaviour in a precise but non obtrusive manner. We illustrated the design by looking at how counterproductive behaviour varies across different pay schemes. The design is well suited to study determinants of counterproductive behaviour and can easily be adjusted to allow for partial monitoring and fines. It could also be used to compare counterproductive behaviour across different social environments.

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6 Appendix

6.1 Appendix 1 - Instructions

Thank you for participating in this economic experiment. All information from this experiment will of course remain confidential and anonymous.
The experiment consists of three tasks related to the "euro". All material needed for this experiment is provided in a plastic box and a large envelope at the entrance of the laboratory. Please randomly choose one box and one large envelope and take them to your seat.

First Task: Familiarity (10 minutes):

When asked to, please take the envelope labeled **"Familiarity"** from the large envelope and open it. The envelope contains a sheet of paper displaying pictures of euro coins. Please indicate in which country the corresponding coins were printed. The sheet displays in total 45 coins of which you are to identify as many as you can. When 10 minutes are over, we will collect the sheets. **For each correct answer you earn 10 cent (there are no negative payoffs for wrong answers)**. While you are working on the second task, we will mark your answers.

Second Task: Coins Circulation (10 minutes):

When asked to, please take the envelope labeled **"Catalogue"** and open it. In the included Catalogue, the standard euro coins are displayed sorted by country of origin. At the beginning of this task, you will have 5 minutes to familiarise with the Catalogue.
The boxes you have chosen at the entrance contain coins which we have collected in different countries in Europe. Four of you will work with boxes containing coins collected in the same country. Your task consists in precisely identifying coins, but this time with the help of the Catalogue.

For each coin please indicate according to the Catalogue

- which country the coin was printed in
- and the denomination of the coin (there are 8 types: 1 Cent, 2 Cent, 5 Cent...)

In the large envelope you will find an envelope labelled "**Description Table**". When asked to, please open this envelope and take out the Description Table. Use this sheet to report each coin identified (please mark with a bar as illustrated below). If you cannot find a coin in the Catalogue, please report it in the last row of the table as "Not in the Catalogue". Please note, that the Catalogue displays coins from one specific printing year. Coins may slightly differ with printing years; nevertheless such coins are to be identified as coming from the same country.

a) Competition Scheme:

In the group of 4 participants identifying coins collected in the same country that participant receives 50 euro who categorized the highest number of coins. All other participants receive **0 euro** for the second task. If more than one participant identify the same (highest) number of coins, we will randomly choose one of those participants to receive the 50 euro.

b) Fixed Pay:

For working on the second task you receive a fixed payment of 12.50 euro.

c) Piece Rate:

For each identified coin you receive 10 euro cent.

Country where printed	1cent	2cent	5cent	10cent	20cent	50cent	1euro	2euro
Austria	I				III			
Belgium		I		II	I			
...			III					
Spain						I		
Not in the Catalogue		I						

At the end of the 10 minutes

- Please put all the **identified coins** in the plastic bag provided in the box.
- **Put all coins back in the box.** (Those coins which have not been identified should be loose and those which have been identified should be in the plastic bag.)
- Take the envelopes labeled **"Receipt"** and **"Questionnaire"** out of the large envelope.
- Open the envelope labeled **"Receipt"** and fill in your **desk number** and the **number of coins you have identified**. After filling in the Receipt please put it back into the corresponding envelope. We will collect receipts and prepare your payment while you are working on the third task.
- **Put the description sheet in the box and close the box**

.

Third task: general information (5 minutes):

Please open the envelope labeled **"Questionnaire"** and answer all questions. All information from the Questionnaire remains anonymous. The Questionnaire has no implications for your earnings but is valuable for our study. We would be grateful if you can fill it in carefully.

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End of the experiment:

At the end of the experiment, we will call you by desk number. When called, please put the box back into the large box at the entrance of the laboratory as you leave the room (we do not need to see your box) and leave all other material from the experiment on your desk. We will pay you according to your marked answers from the first task and your Receipt from the second task. After payment, the experiment is completed.

Otto von Guericke University Magdeburg
Faculty of Economics and Management
P.O. Box 4120 | 39016 Magdeburg | Germany

Tel.: +49 (0) 3 91 / 67-1 85 84
Fax: +49 (0) 3 91 / 67-1 21 20

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