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# JENA ECONOMIC RESEARCH PAPERS



# 2010 – 007

## **Hidden Costs of Control: Three Repetitions and an Extension**

by

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# Hidden Costs of Control: Three Repetitions and an Extension\*

Matteo Ploner<sup>†</sup>, Katrin Schmelz<sup>‡</sup> and Anthony Ziegelmeyer<sup>§</sup>

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## Abstract

We report three repetitions of Falk and Kosfeld's (2006) C5 and C10 treatments whose results largely conflict with those of the original study. We mainly observe hidden costs of control of *low* magnitude which lead to low-trust principal-agent relationships. We also report an extension where performance-based rewards are absent i.e. both principals and agents are paid according to a flat participation fee. Our extension largely reproduces the striking findings of the original study. In particular, we observe that hidden costs outweigh benefits of control.

KEYWORDS: Control, Experimental Economics, Incentives, Intrinsic Motivation, Trust.

JEL CLASSIFICATION: C81, C91, M52.

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# 1 Introduction

A core principle of economics is that individuals respond to incentives. Following the standard economic view, employers implement monitoring and incentive pay policies since the imposition of extrinsic incentives invariably leads to profitable increases in employees' effort. Some empirical studies on the effects of incentive pay on performance confirm that employees respond to extrinsic incentives just as economic theory predicts (Lazear, 2000; Bandiera, Barankay, and Rasul, 2007). However, since the work by Deci (1971), psychologists and sociologists have argued that providing extrinsic incentives for employees can be counterproductive, because it may reduce the employees' intrinsic motivation. Not only do many economists consider that the idea of motivation crowding-out effects holds some intuitive appeal, but several economic explanations have been suggested for the phenomenon and economists have demonstrated that these effects are empirically well-founded (Frey and Jegen, 2001). A broader view of human motivation therefore suggests that, in many employment relationships, the imposition of extrinsic incentives is likely to have two opposite effects on the employees' performance: a disciplining effect and a crowding-out effect. Whether imposing extrinsic incentives is beneficial to the employer depends on the relative size of the two countervailing effects. A worthwhile goal for economic research is to identify the conditions under which crowding-out effects arise, and under which they are predicted to dominate disciplining effects.

In a recent contribution to this research agenda, Falk and Kosfeld (2006, henceforth F&K) have conducted a laboratory study to assess the relative importance of implicit incentives, explicit incentives and their interaction effects. F&K's experimental work consists of three main treatments, three robustness treatments and a questionnaire study (details are provided in sections 2 and 6). In their main treatments, F&K implement a principal-agent game where the principal either restricts the agent's choices by setting  $x_{\min} = \underline{x}$  or leaves the agent's choices unrestricted by setting  $x_{\min} = 0$  and the agent then chooses a transfer  $x \in \{x_{\min}, x_{\min} + 1, \dots, 119, 120\}$  resulting in a payoff of  $2x$  for the principal and  $120 - x$  for the agent. The minimum transfer requirement  $\underline{x} \in \{5, 10, 20\}$  is a treatment variable which measures the principal's degree of control. Experimental results show that control entails *hidden costs* caused by the existence of pro-social agents who choose a lower transfer if controlled than otherwise. Hidden costs of control do not constitute a new phenomenon. Indeed, the negative reaction to control observed in F&K's study is a mere motivation crowding-out effect of ruling out the most opportunistic choices (extrinsic incentives do not only affect *narrowly defined* intrinsic motivation but also *norms* internalized by individuals; see Frey, 1997). Considerable research has already shown that minimizing control is important for maintaining intrinsic motivation (Deci, Koestner, and Ryan, 1999) and that a substantial fraction of employees do not exploit reductions in monitoring to their own advantage (Nagin, Rebitzer, Sanders, and Taylor, 2002). The economic relevance of F&K's study comes from the striking result that *most* agents react negatively to the implementation of control, which in turn implies that imposing explicit incentives is detrimental to the principal (except for the highest level of control). In fact, F&K's study provides the first conclusive empirical evidence that, under certain conditions, negative effects of control dominate disciplining effects in a principal-agent framework. If robust, this experimental result would imply that monitoring strategies need not only to regulate the margin of employees who are opportunistic but that they should also sustain the motivation of the large fraction of employees disinclined to shirk.<sup>1</sup>

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<sup>1</sup>F&K do not conclude that hidden costs *always* prevail over benefits of control (whenever strong economic incentives are easy to provide one expects the benefits to outweigh the costs of control). However, they argue that the benefits of control should be weighted in light of hidden costs and that their experimental results suggest important implications for the design of organizations. This argument seems relevant to us if sufficiently many conditions are identified under which it is better for principals to trust than to control.

Given the abstract nature of the decision task and the anonymity of subjects' one-shot interactions, F&K's laboratory finding of the overall negative effect of control on effort is surprising (most of the evidence shows that monitoring by a principal reduces an agent's work effort only in personalized relationships; see Frey, 1993, Barkema, 1995, and the recent laboratory experiments by Dickinson and Villeval, 2008). Clearly, the striking nature of F&K's experimental findings calls for a check since scientific findings rest upon replication and only corroborated findings provide a sound foundation for the development of economic theory. In this paper, we first report three *repetitions* of F&K's C5 and C10 treatments whose results largely conflict with those of the original study. Our three repetitions reproduce as faithfully as possible the conditions of the original study with different subject pools (like F&K, each of our experiments employs a standard subject pool of students). By using three different pools of subjects, we check the robustness of F&K's experimental results to minor variations in implementation details and we offer some preliminary insights on the individual determinants of control aversion. In the first repetition, subjects are students from the University of Jena (federal state of Thuringia, Germany) and the sample composition according to educational background is (almost) equally distributed among the primary fields of academic study. In the second repetition, subjects are students from the University of Trento (capital of the Trentino-South Tyrol region of Italy) with economics majors being over-represented (about 60 %). In the third repetition, subjects are students from the University of Jena and the sample composition according to educational background is identical to the one of the second repetition. Overall, the findings of our first three experiments question the robustness of F&K's findings in their principal-agent game. Contrary to F&K, we mainly observe hidden costs of control of *low* magnitude which lead to low-trust principal-agent relationships. In our three first laboratory implementations of F&K's principal-agent game, the disciplining effect almost always dominates the crowding-out effect in line with the evidence on distant principal-agent relationships mentioned above. Our findings also suggest that nationality and educational background have an effect on the degree of control aversion, Italian students from the Trentino being less control-averse than German students from Thuringia and economics majors being more control-averse than non-economics majors.

Once game play data had been collected, subjects were asked to complete a questionnaire in which they had to state their work motivation in hypothetical scenarios. Our questionnaires were identical to the ones F&K administrated in their questionnaire study. In contrast to the incentivized data of the principal-agent game, our questionnaire data are qualitatively very similar to F&K's questionnaire data. Given the concomitance of dissimilar game play data and similar questionnaire data with respect to F&K, we decided to investigate the influence of hypothetical incentives in the play of the principal-agent game. In the second part of the paper, we report an extension of F&K's C5 and C10 treatments where performance-based rewards are absent i.e. both principals and agents are paid according to a flat participation fee. We observe that hidden costs outweigh benefits of control in C5 and C10. Experiment 4's findings suggest that most of the explanation for the observed discrepancy in subjects' behavior between our first three experiments and F&K's C5 and C10 treatments is the salience of monetary incentives: F&K might not have provided sufficiently large performance-contingent earnings to their subjects.

The remainder of this paper is organized as follows. Section 2 summarizes F&K's experimental findings in their main treatments. Sections 3 to 5 discuss our three repetitions. Section 6 analyzes our questionnaire data and Section 7 presents our extension. We provide a general discussion in Section 8.

## 2 Falk and Kosfeld's main treatments

In their main treatments F&K implement a principal-agent game to study the potential interaction between control and generosity in a parsimonious way. An agent has an endowment of 120 experimental currency units (ECUs) and chooses a transfer of  $x$  ECUs to the principal. For every ECU that the agent gives up, the principal receives two ECUs. Before the agent decides how much to transfer voluntarily, the principal decides whether or not to impose a compulsory transfer of  $\underline{x}$  ECUs. F&K consider a low ( $\underline{x} = 5$ ), a medium ( $\underline{x} = 10$ ), and a high ( $\underline{x} = 20$ ) control treatment (referred to as C5, C10 and C20 respectively) where principals and agents interact only once and they make use of the strategy method to elicit agents' transfers. Concretely, each agent is asked to choose a pair of transfers  $(x^C, x^{NC})$  where  $x^C \in \{\underline{x}, \underline{x} + 1, \dots, 120\}$  is payoff-relevant in case the principal imposes a compulsory transfer and  $x^{NC} \in \{0, 1, \dots, 120\}$  is payoff-relevant in case the principal does not impose a compulsory transfer. A total of 140, 144, and 134 subjects participated in the control treatments C5, C10, and C20 respectively.

For a given agent's pair of transfers  $(x^C, x^{NC})$ , the decision to impose a compulsory transfer has a total effect on the principal's payoff which is given by  $2(x^C - x^{NC})$ . This total effect can be expressed as the sum of the direct and indirect effects of control which are given by  $2 \max\{\underline{x} - x^{NC}, 0\}$  and  $2(x^C - \max\{\underline{x}, x^{NC}\})$  respectively (see Schnedler and Vadovic, 2007). Hence, there is an indirect effect of control (or psychological reaction to control) if (i)  $x^C \neq x^{NC}$  and (ii)  $x^{NC} \leq \underline{x}$  implies  $x^C > \underline{x}$ . Moreover, the indirect effect of control is positive if either  $x^C > \underline{x} > x^{NC}$  or  $x^C > x^{NC} \geq \underline{x}$ , in which case there are hidden benefits of control. Alternatively, there are hidden costs of control, i.e. the indirect effect is negative, if  $x^{NC} > x^C$ . For a given distribution of pairs of transfers, statistically significant hidden costs of control are observed whenever negative psychological reactions to control "dominate" positive psychological reactions to control.

F&K's key findings can be summarized as follows: (i) Statistically significant hidden costs of control are observed in all control treatments (C5, C10 and C20); (ii) A clear majority of agents choose a pair of transfers such that  $x^C - x^{NC} < 0$  in C5 and C10. Almost identical proportions of agents exhibit positive and negative psychological reactions to control in C20; (iii) The average transfer by agents is higher when agents are not controlled than when they are ( $\bar{x}^C - \bar{x}^{NC} < 0$ ). These differences are statistically significant in C5 and C10 but not in C20. In other words, in C5 and C10, principals earn less when they control their agents than when they do not control them, which implies that the hidden costs of control outweigh the benefits; and (iv) A clear majority of principals anticipate the adverse effect of control and choose to leave transfers unrestricted in C5 and C10. About half of the principals choose to leave transfers unrestricted in C20.<sup>2</sup>

## 3 Experiment 1: Repeating F&K's C5 and C10 treatments

F&K observe hidden costs of control in all their main treatments. However, hidden costs outweigh benefits of control only in C5 and C10. In the C20 treatment, where principals have the possibility

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<sup>2</sup>F&K ran three robustness treatments for which treatment C10 served as a basis of comparison. First, F&K checked whether their results were an artifact of the strategy method by applying the specific response method in treatment SR10 (agents decided only after knowing the principal's decision). Their results do not indicate any effect of using the strategy method versus the specific response method in the considered principal-agent relationship. Second, they established that control only hurts the agent's motivation when the principal has a choice whether to impose control or not. Indeed, in treatment EX10 which is similar to treatment C10 except that control is exogenously imposed meaning that the agent always has to choose a transfer of  $x$  ECUs in the set  $\{10, 11, \dots, 120\}$ , the negative effect of control vanishes. Third, they explored the validity of their results in a more general economic setting by implementing a gift-exchange treatment (GE10) where the principal not only determines the agent's minimum level of  $x$ , but also pays the agent a wage. They found that the reciprocal relationship between wages and effort is weaker in the presence of control in treatment GE10.

to impose stronger extrinsic incentives, the motivation crowding-out effect and the disciplining effect break even.<sup>3</sup>

If corroborated, the finding that hidden costs of control are substantial enough to undermine the effectiveness of weak extrinsic incentives has important implications for the design of employment contracts. Contrary to what standard economic theory predicts, the elimination of agents' most opportunistic choices may actually decrease the principal's payoff. Our first experiment repeats F&K's C5 and C10 treatments to assess the robustness of the overall negative effect of control on generosity. From now on, we refer to the two principal' choices as the control and no-control conditions.

### 3.1 Experimental design and practical procedures

The four sessions of the computerized experiment were conducted at the Experimental Laboratory of the Max Planck Institute of Economics in Jena. The experiment was programmed and conducted with the software z-Tree (Fischbacher, 2007) and we used a slightly modified version of the code employed by F&K (we enlarged the fonts in order to facilitate subjects' reading of the computer screens and we added a questionnaire). Subjects were invited using the ORSEE recruitment system (Greiner, 2004). All 118 subjects were students from the University of Jena, in each session the gender composition was approximately balanced, and no subject participated in more than one session. The top panel of Table 1 shows the sample composition according to educational background which is partitioned into four categories: business administration & economics, other behavioral & social sciences (education sciences, law, political science, psychology, and sociology), humanities, and engineering, life & natural sciences. Each category is well represented in both treatments. Some subjects had participated in earlier economics experiments, but all were inexperienced in the sense that they had never taken part in an earlier session of this type. Subjects interacted only once, each session lasted on average 40 minutes and the average earnings per subject were about 9.25 euros including a 2.50 euros show-up fee.

ECUs were converted to euros in the calculation of subjects' final earnings at a conversion rate of 10 ECUs to 1 euro. F&K used roughly the same conversion rate but paid their subjects a 6 euros show-up fee. In almost all sessions conducted at the Experimental Laboratory of the Max Planck Institute of Economics, subjects are paid a 2.50 euros show-up fee in addition to their earnings in the experiment. We decided to follow the usual practice and therefore put more emphasis on the performance-contingent earnings compared to F&K.

At the beginning of each session subjects randomly drew a cubicle number. Half of the subjects were assigned the role of a principal and the other half the role of an agent, depending on their cubicle number. Once all subjects sat down in their cubicles, instructions were distributed. Principals and agents were given different sets of instructions. We used the exact same instructions as F&K but modified them slightly to account for the change of currency and show-up fee (see Appendices A and B of the supplementary material).<sup>4</sup> Cubicles were visually isolated from each other and communication between the subjects was strictly prohibited.

Subjects first read the instructions silently and then listened as the monitor read them aloud (the monitor was a native German speaker who read a "role-neutral" version of the instructions). Questions were answered privately. Understanding of the payoff functions was assured by a control

<sup>3</sup>F&K argue that hidden costs outweigh benefits of control whenever principals' monetary earnings are lower when they control their agents than when they do not control them (see Falk and Kosfeld, 2006, Result 2 page 1619). We additionally require that the difference is statistically significant which leads us to conclude that hidden costs of control do not outweigh the benefits in F&K's C20 treatment.

<sup>4</sup>Additionally, we modified the first sentence in F&K's instructions which reads as follows "You are now participating in an economic experiment which has been funded by various research support foundations."

	C5	C10	Pooled
<b><i>Experiment 1</i></b>			
Business Administration & Economics	26.56	31.25	28.91
Other Behavioral & Social Sciences	21.88	20.31	21.09
Humanities	20.31	25.00	22.66
Engineering, Life & Natural Sciences	31.25	18.75	25.00
Unknown	0.00	4.69	2.34
<b><i>Experiment 2</i></b>			
Business Administration & Economics	50.00	63.33	56.90
Law	28.57	16.67	22.41
Other Behavioral & Social Sciences	5.36	5.00	5.17
Humanities	7.14	8.33	7.76
Engineering, Life & Natural Sciences	8.93	6.67	7.76
<b><i>Experiment 3</i></b>			
Business Administration & Economics	59.37	63.63	61.54
Law	21.88	12.12	16.92
Other Behavioral & Social Sciences	9.37	9.09	9.23
Humanities	6.25	7.58	6.92
Engineering, Life & Natural Sciences	3.13	7.58	5.39
<b><i>Experiment 4</i></b>			
Business Administration & Economics	20.17	24.56	22.37
Other Behavioral & Social Sciences	26.32	32.46	29.38
Humanities	31.58	20.17	25.88
Engineering, Life & Natural Sciences	21.93	22.81	22.37

Table 1: Subjects' educational background (percentages).

*Note:* In Experiment 1, subjects' educational background has not been elicited. The percentages indicated in the table have been computed with the help of the lists of registered subjects generated by the online recruitment system. In treatment C10, the educational background of three of the registered subjects is missing and the category "Unknown" is added.

questionnaire. Subjects had to calculate both the principal and the agent's payoffs in three exercises with hypothetical decisions. After all subjects had answered correctly the control questionnaire, subjects played the principal-agent game once. At the end of the one-shot interaction, subjects' payoffs were displayed on their screens.

Before leaving the laboratory, subjects were asked to complete a questionnaire in which they had to state their work motivation in five hypothetical scenarios (subjects did not know at the beginning of the session that they would have to answer a questionnaire). Different subjects answered different versions of the questionnaire, the two versions being identical to the ones F&K administrated in their questionnaire study. Indeed, for each scenario, there is a condition in which the principal trusts the agent and a condition in which the principal controls the agent and each subject went through only one of the two conditions for a given scenario (see Appendices C and D of the supplementary material). Answering the questionnaire was mandatory but not incentivized and subjects were told that their answers to the questionnaire would not affect their previous earnings. After completion of the questionnaire, subjects privately retrieved their final earnings (including the show-up fee).

The top panel of Table 2 shows some of the features of our first experiment.



	C5	C10	Pooled
<b>Experiment 1</b>			
Location	Jena		
Number of sessions	2	2	4
Number of subjects	60	58	118
Gender (% female)	50.00	53.12	51.56
Agents' average earnings	10.50 (1.31)	10.52 (1.07)	10.51 (1.19)
Principals' average earnings	3.00 (2.63)	2.97 (2.13)	2.98 (2.38)
<b>Experiment 2</b>			
Location	Trento		
Number of sessions	3	3	6
Number of subjects	56	60	116
Gender (% female)	51.79	50.00	50.86
Agents' average earnings	10.83 (1.33)	10.91 (0.70)	10.87 (1.04)
Principals' average earnings	2.34 (2.67)	2.19 (1.40)	2.26 (2.09)
<b>Experiment 3</b>			
Location	Jena		
Number of sessions	4	4	8
Number of subjects	64	66	130
Gender (% female)	51.56	50.00	50.77
Agents' average earnings	10.08 (1.97)	10.53 (1.12)	10.31 (1.60)
Principals' average earnings	3.83 (3.95)	2.94 (2.25)	3.38 (3.20)
<b>Experiment 4</b>			
Location	Jena		
Number of sessions	5	5	10
Number of subjects	114	114	228
Gender (% female)	48.25	50.88	49.56
Agents' average earnings	10.00 (0.00)	10.00 (0.00)	10.00 (0.00)
Principals' average earnings	10.00 (0.00)	10.00 (0.00)	10.00 (0.00)

Table 2: Experimental conditions.

*Notes:* Earnings are stated in euros net of the show-up fee with standard deviations in parentheses. There was no show-up fee in Experiment 4.

### 3.2 Results

In this section, we present our main findings concerning the behavior of the agents and the principals in the one-shot interaction. Subjects' answers to the questionnaire are discussed in Section 6. We report the results of two-sided tests throughout the paper and acceptance or rejection of the null hypothesis is always based on a 5 percent level of significance.

Our first result concerns the hidden costs of control and is qualitatively in line with F&K's first result.

**Result 1.1:** *We observe hidden costs of control.*

*Support:* Figure 1 shows the cumulative distribution of agents' transfers given the decision of the principal in both control treatments. For each value of  $x \geq \underline{x}$ ,  $\underline{x} \in \{5, 10\}$ , there are always strictly more agents who transfer at least  $x$  if the principal leaves transfers unrestricted than if the principal forces the agent to transfer at least  $\underline{x}$  ECUs. In order to test whether the difference between the two distributions is statistically significant, we follow F&K's procedure and modify the distribution of

transfers in the no-control condition such that any transfer strictly lower than  $\underline{x}$  is set equal to  $\underline{x}$ . We reject the null hypothesis that the modified distribution in the no-control condition is the same as the distribution in the control condition (exact Wilcoxon signed rank tests for paired observations,  $p - value < 0.01$  in C5 and  $p - value = 0.016$  in C10).  $\square$

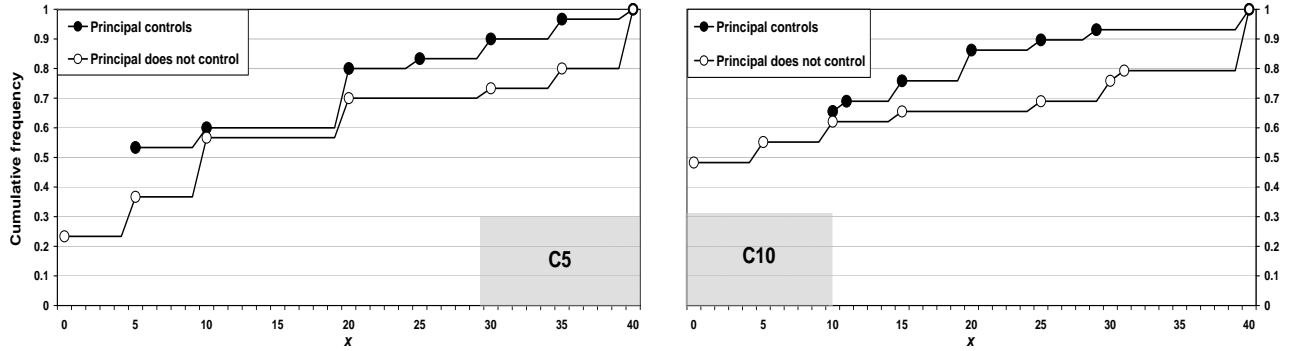


Figure 1: Cumulative distributions of agents' transfers in Experiment 1.

Hidden costs of control should be taken seriously only if they are substantial enough to undermine the effectiveness of economic incentives.<sup>5</sup> Our second result establishes that in none of the control treatments do the hidden costs outweigh the benefits of control. This result contradicts F&K's second result.

**Result 1.2:** *Hidden costs do not outweigh benefits of control. In C5, the average number of ECUs transferred by the agent to the principal is not statistically significantly higher in the no-control condition than in the control condition. In C10, the average number of ECUs transferred by the agent to the principal is not statistically significantly higher in the control condition than in the no-control condition.*

*Support:* Table 3 shows agents' transfers as a function of the principal's decision in treatments C5 and C10. In each of the five panels, the first row reports average transfers for each condition followed by the impact of control,  $(\bar{x}^C - \bar{x}^{NC})/\bar{x}^{NC}$ , measured in percentage terms. The second row reports standard deviation followed by 1st quartile followed by median followed by 3rd quartile for each condition. Agents' transfers in our first experiment are summarized in the top panel. In C5, both the average and the median number of ECUs transferred by the agents to the principals are higher in the no-control condition than in the control condition but not statistically significantly so (exact Wilcoxon signed rank test for paired observations,  $p - value = 0.106$ ).<sup>6</sup> In C10, both the average and the median number of ECUs transferred by the agents to the principals are higher in the control condition than in the no-control condition but not statistically significantly so (exact Wilcoxon signed rank test for paired observations,  $p - value = 0.307$ ). Interestingly, in both control treatments, the variance of transfers is higher in the no-control condition than in the control condition and this

<sup>5</sup>As already mentioned, for a given agent's pair of transfers  $(x^C, x^{NC})$ , the principal's decision to control entails hidden costs if  $d = x^C - \max\{\underline{x}, x^{NC}\} < 0$  i.e. the agent's indirect choice shift due to control is negative. According to F&K's procedure, for a given sample of agents' choices, we observe hidden costs of control if the sum of the ranks of the negative  $d$ 's is sufficiently larger than the sum of the ranks of the positive  $d$ 's. Hidden costs of control can therefore be observed in samples which comprise mostly selfish agents since the choices of such agents are not taken into account by the procedure.

<sup>6</sup>Unlike the procedure employed to obtain Result 1, no transformation is applied to the distribution of transfers in the no-control condition when comparing the agents' transfers in the two conditions.

difference is large in C10. Finally, agents' transfers in our sample are statistically significantly lower than agents' transfers in F&K's sample in the no-control condition (exact Wilcoxon signed rank tests,  $p - value = 0.028$  in C5 and  $p - value = 0.015$  in C10). In the control condition, agents' transfers do not statistically differ among the two samples (exact Wilcoxon signed rank tests,  $p - value = 0.695$  in C5 and  $p - value = 0.278$  in C10).  $\square$

	<b>C5</b>			<b>C10</b>		
	Control condition	No-control condition	Impact of control (%)	Control condition	No-control condition	Impact of control (%)
Experiment 1	<b>13.83</b> (11.35;5;5;20)	<b>16.67</b> (15.44;5;10;34)	-17.04	<b>14.66</b> (8.68;10;10;15)	<b>13.83</b> (16.81;0;5;30)	6.00
Experiment 2	<b>12.07</b> (12.56;5;5;13)	<b>11.21</b> (14.39;0;5;20)	7.67	<b>12.50</b> (5.26;10;10;12)	<b>9.53</b> (11.96;0;4;18)	31.16
Experiment 3	<b>15.53</b> (17.99;5;10;20)	<b>20.50</b> (20.49;5;20;34)	-24.24	<b>13.82</b> (7.87;10;10;15)	<b>15.97</b> (14.47;0;20;25)	-13.46
Experiment 4	<b>16.81</b> (23.00;5;5;20)	<b>21.42</b> (24.64;0;20;40)	-21.52	<b>20.58</b> (12.92;10;15;40)	<b>27.79</b> (20.15;20;30;40)	-25.94
Falk & Kosfeld	<b>12.19</b> (10.98;5;5;15)	<b>25.11</b> (19.34;10;20;40)	-51.45	<b>17.53</b> (13.57;10;10;20)	<b>22.99</b> (17.97;10;20;40)	-23.75

Table 3: Agents' transfers as a function of the principal's decision.

An interesting aspect of F&K's experimental design is that agents' heterogeneity in the behavioral reaction to control can be analyzed. Indeed, the use of the strategy method permits to quantify the number of agents who react positively, neutrally, or negatively to the principal's implementation of control. Result 1.3 summarizes our findings about the heterogeneity of agents' behavioral reaction to control. Negative reactions to the implementation of control are less prevalent than in F&K's C5 and C10 treatments.

**Result 1.3:** *There is a strong heterogeneity among the agents with regard to their behavioral reaction to control. In C5, less than a quarter of the agents reacts positively to the implementation of control with the rest dividing almost equally between negative and neutral reactions, the average negative response to control equals -10.00 ECUS and the average positive response to control equals 5.00 ECUS. In C10, a clear majority of agents reacts positively to the implementation of control, the average negative response to control equals -16.50 ECUS and the average positive response to control equals 9.17 ECUS.*

*Support:* The top and bottom panels of Table 4 summarize the agents' behavioral reaction to control in our first experiment and in F&K's C5 and C10 treatments respectively. The relative share of agents who are averse to being controlled is much lower in our first experiment (40.00 % and 27.59 % in C5 and C10 respectively) than in F&K's C5 and C10 treatments where control-averse agents are the clear majority (64.29 % and 56.94 % in C5 and C10 respectively). In C10, the difference in the magnitude of hidden costs of control observed by F&K and the one we observe is entirely driven by the difference in the fraction of control-averse agents (negative and positive reactions to control are of similar strength). However, in C5, the difference in the fraction of control-averse agents observed by F&K and the one we observe is only partly responsible for the difference in the magnitude of hidden costs of control. Indeed, the control-averse agents in F&K's C5 treatment exhibit a much

stronger negative response to control than our control-averse agents. □

	C5			C10		
	Positive	Neutral	Negative	Positive	Neutral	Negative
<i>Experiment 1</i>						
Relative share (%)	<b>23.33</b>	<b>36.67</b>	<b>40.00</b>	<b>58.62</b>	<b>13.79</b>	<b>27.59</b>
Mean control transfer	5.00	16.82	16.25	10.35	28.75	16.75
Mean no-control transfer	0.00	16.82	26.25	1.18	28.75	33.25
<i>Experiment 2</i>						
Relative share (%)	<b>50.00</b>	<b>21.43</b>	<b>28.57</b>	<b>60.00</b>	<b>16.67</b>	<b>23.33</b>
Mean control transfer	8.00	19.17	13.88	10.33	14.80	16.43
Mean no-control transfer	0.64	19.17	23.75	1.39	14.80	26.71
<i>Experiment 3</i>						
Relative share (%)	<b>25.00</b>	<b>34.38</b>	<b>40.62</b>	<b>39.40</b>	<b>15.15</b>	<b>45.45</b>
Mean control transfer	5.62	23.64	14.77	10.00	22.40	14.27
Mean no-control transfer	0.62	23.64	30.08	0.77	22.40	27.00
<i>Experiment 4</i>						
Relative share (%)	<b>33.33</b>	<b>22.81</b>	<b>43.86</b>	<b>21.06</b>	<b>33.33</b>	<b>45.61</b>
Mean control transfer	5.84	42.69	11.68	11.25	36.32	13.38
Mean no-control transfer	0.84	42.69	26.00	0.42	36.32	34.19
<i>Falk and Kosfeld</i>						
Relative share (%)	<b>20.00</b>	<b>15.71</b>	<b>64.29</b>	<b>25.00</b>	<b>18.06</b>	<b>56.94</b>
Mean control transfer	10.21	22.27	10.33	11.11	22.69	18.71
Mean no-control transfer	4.79	22.27	32.13	1.94	22.69	32.32

Table 4: Agents' behavioral reaction to control.

In C5, both the average number of ECUs transferred and the variance of transfers in the no-control condition are larger than those in the control condition. Assuming that they correctly anticipate the ambiguous effects of controlling their agents, the optimal decision for principals will typically vary with their degree of risk-aversion. In C10, on the contrary, it is clearly optimal for principals to control their agent (controlling the agent is at least as rewarding in monetary terms and safer than leaving the transfer unrestricted). Our fourth result is in line with the hypothesis that most principals took an optimal decision anticipating well the distributions of conditional transfers. The same hypothesis is supported by F&K's findings but the consequences are different in the two samples. The relative absence of control in Experiment 1 contradicts F&K's fourth result.

**Result 1.4:** *In C5, half the principals chooses to control. In C10, the large majority of principals chooses to control.*

*Support:* 50% and 83% of our principals force the agent to transfer at least  $\underline{x}$  ECUs in C5 and C10 respectively. Judging by a binomial test, the proportion of principals who leave transfers unrestricted is statistically significantly lower than the proportion of principals who control in C10 ( $p$ -value < 0.01). In F&K's C5 and C10 treatments, respectively 74% and 71% of the principals leave transfers unrestricted which is the most rewarding decision since average transfers are respectively 106% and 31% higher in the no-control condition. □

After having made their decision, principals were asked to state their expectation about the number of ECUs transferred by the agent (expectations were not incentivized). We find that principals

who control have lower expectations about the agent's transfer than principals who leave transfers unrestricted (8.07 vs. 18.93 and 17.21 vs. 28.00 in C5 and C10 respectively). The two distributions statistically differ in C5 (exact Wilcoxon signed rank test,  $p - value = 0.020$ ) but they do not in C10 (exact Wilcoxon signed rank test,  $p - value = 0.153$ ) with the caveat they are only 5 expectations in C10's control condition. In F&K's C5 and C10 treatments, the two distributions of expectations statistically differ with principals who control being more pessimistic. Note that since expectations were elicited after decisions in both experiments, stated expectations could be mere rationalizations for behavior after the fact, i.e., the expectation might be induced *by* the decision rather than reflecting the reasons *for* the decision.

### 3.3 Discussion

In assessing the reproducibility of F&K's experimental findings, we have confirmed the existence of hidden costs of control but we have also shown that these costs are not substantial enough to undermine the effectiveness of economic incentives. In the low control treatment, the difference in the magnitude of hidden costs of control observed by F&K and the one we observe is driven both by the difference in the fraction of control-averse agents and the strength of their negative response to control. In the medium control treatment, the difference in the magnitude of hidden costs of control is entirely driven by the difference in the fraction of control-averse agents. Our sample of agents is less inclined to perceive negatively the implementation of control than F&K's sample of agents. In both experiments most principals seem to have well anticipated the distributions of conditional transfers. Consequently, our principals predominantly control their agent while in F&K's C5 and C10 treatments agents are trusted to be generous.

## 4 Experiment 2: Repeating Experiment 1 in Trento

Intrigued by the discrepancy between F&K's results and the results of our first experiment, anonymous referees suggested that this discrepancy might be due to cross-country differences. In particular, it has been argued that students of the former communist area around Jena might be less bothered by the imposition of control than Zürich students because East Germany scores lower on self-expression than Switzerland and a low score implies, in turn, a relatively favorable attitude towards authority (the argument built on Inglehart, 2000).

Our second experiment repeats Experiment 1 in Trento partly to address the potential issue of cross-country differences. Italy's score on self-expression in 2006 is more than twice the score of East Germany and about one-third of Switzerland's score.<sup>7</sup> If, as argued by anonymous referees, the score on survival/self-expression values positively correlates with control aversion then the magnitude of hidden costs of control should be larger in Experiment 2 than in Experiment 1. This being said, the main purpose of Experiment 2 is not to investigate whether the score on survival/self-expression values is a good predictor of control aversion since this general explanatory factor score is based on many values, some of which are unlikely to relate to control aversion.<sup>8</sup> Rather, Experiment 2 allows us to further assess the representativeness of F&K's experimental results by rerunning Experiment 1 on a new pool of subjects.

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<sup>7</sup>Evidence has been collected from the World Values Survey, a large investigation of attitudes, values and beliefs around the world. See <http://www.worldvaluessurvey.org/>.

<sup>8</sup>In our general discussion, we offer an alternative investigation of the country-based explanation for the discrepancy in experimental results.

## Experimental design and practical procedures

The six sessions of the computerized experiment were conducted at the Computable and Experimental Economics Laboratory of the University of Trento. All 116 subjects were students from the University of Trento, in each session the gender composition was approximately balanced, and no subject participated in more than one session. The second panel of Table 1 shows the sample composition according to educational background where law is shown separately from the category “other behavioral & social sciences”. Contrary to Experiment 1, two categories are excessively represented: business administration & economics and law which gather about 80% of the subjects. Experimental procedures were identical to those of Experiment 1 except that once all subjects had played the principal-agent game and had answered the questionnaire they were asked to report their year of birth, their gender, and their academic major.

The second panel of Table 2 shows some of the features of Experiment 2.

## Results

Similarly to Experiment 1, we present here our main findings concerning the principal-agent game data and subjects’ answers to the questionnaire are discussed in Section 6.

Result 2.1 summarizes our findings concerning the behavior of agents in Experiment 2 which are even less in line with F&K’s findings than the ones from Experiment 1.

**Result 2.1:** *We do not observe hidden costs of control. In C5, the average number of ECUs transferred by the agent to the principal is not statistically significantly higher in the control condition than in the no-control condition. In C10, the average number of ECUs transferred by the agent to the principal is statistically significantly higher in the control condition than in the no-control condition. The majority of agents reacts positively to the implementation of control.*

*Support:* Agents’ transfers in Experiment 2 are summarized in the second panel of Table 3. We never reject the null hypothesis that the modified distribution in the no-control condition is the same as the distribution in the control condition (exact Wilcoxon signed rank tests for paired observations,  $p - value = 0.177$  in C5 and  $p - value = 0.068$  in C10). The impact of control on transfers is always positive (it equals 7.67 % in C5 and 31.16 % in C10) but it is statistically significantly so only in C10 (exact Wilcoxon signed rank tests for paired observations,  $p - value = 0.720$  in C5 and  $p - value = 0.046$  in C10). Like in Experiment 1, agents’ transfers in our sample are statistically significantly lower than agents’ transfers in F&K’s sample in the no-control condition (exact Wilcoxon signed rank tests,  $p - value < 0.01$  in C5 and  $p - value < 0.01$  in C10), and, in the control condition, agents’ transfers do not statistically differ among the two samples (exact Wilcoxon signed rank tests,  $p - value = 0.345$  in C5 and  $p - value = 0.226$  in C10). Finally, as shown in the second panel of Table 4, the majority of agents react positively to the principal’s implementation of control (50.00 % and 60.00 % in C5 and C10 respectively), and the control-averse agents in F&K’s C5 and C10 treatments exhibit a stronger negative response to control than the control-averse agents in Experiment 2.  $\square$

Like in Experiment 1, the variance of transfers is always higher in the no-control condition than in the control condition and this difference is large in C10. Consequently, the optimal choice for principals who anticipate well-enough the distributions of conditional transfers is to control their agent both in C5 and in C10. Most principals seem to have correctly anticipated the effects of controlling their agents which leads to the prevalence of control. The predominance of control in Experiment 2 is in strong contradiction with its relative absence in F&K’s C5 and C10 treatments.

**Result 2.2:** *The majority of principals chooses to control the agent.*

*Support:* 64% and 77% of our principals force the agent to transfer at least  $\underline{x}$  ECUs in C5 and C10 respectively. Judging by binomial tests, the proportion of principals who leave transfers unrestricted is statistically significantly lower than the proportion of principals who control in C10 ( $p$ -value  $< 0.01$ ) but the difference is statistically insignificant in C5 ( $p$ -value  $= 0.185$ ). Additionally, we find that principals who control have lower expectations about the agent's transfer than principals who leave transfers unrestricted in C10 (12.61 vs. 25.14) whereas in C5 expectations are very similar in both conditions (15.89 vs. 14.20). The two distributions never differ statistically (exact Wilcoxon signed rank tests,  $p$ -value  $= 0.841$  in C5 and  $p$ -value  $= 0.411$  in C10).  $\square$

## Discussion

The results of Experiment 2 do not confirm the presence of statistically significant hidden costs of control and show that principals are better off controlling their agent even in the case of extremely weak extrinsic incentives. This second set of results raises additional doubts about the representativeness of F&K's experimental results. Moreover, we find that Trento students are less bothered by the imposition of control than Jena students with the caveat that the two subjects pools differ according to educational background. This finding does not seem to be in line with the observation that Italy's score on self-expression in 2006 is more than twice the score of East Germany.

## 5 Experiment 3: Repeating Experiment 1 with (mostly) economists

The results of our first two experiments largely conflict with F&K's results as they support the basic premise of economics that extrinsic incentives work. Additionally, Experiment 1 has confirmed the existence of hidden costs of control but such hidden costs are absent in Experiment 2. The difference in results between our two experiments cannot be attributed solely to cross-country differences in subjects' attitudes since the subjects pools in our first two experiments also differ according to educational background. The majority of subjects in Experiment 2 are students in business administration & economics while such students represent less than 30% of Experiment 1's sample. This difference in educational background between the two samples confounds with cross-country differences but the severity of this confound is difficult to appreciate given the existing evidence. Indeed, though a few empirical studies have argued that economists behave in a more self-interested way than other people, the results are inconclusive and vary with the context (see Faravelli, 2007 and the references therein). Moreover, Fehr, Naef, and Schmidt (2006) have shown that economics majors value efficiency much more than non-economics majors in simple dictator game experiments. Finally, and most important, economists' reaction to the implementation of control has not been documented to the best of our knowledge.<sup>9</sup> In summary, the current evidence does not clearly suggest whether economics majors will behave differently than non-economics majors in F&K's principal-agent game, and, if so, whether they will decrease or increase the magnitude of hidden costs of control. To assess the severity of the confound and offer some preliminary insights on the individual determinants of control aversion, our third experiment repeats Experiment 1 with a sample of Jena students whose composition according to educational background closely resembles the one of Experiment 2.

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<sup>9</sup>Unfortunately, we were not able to investigate the relationship between the educational background and the reaction to control in F&K's data since the two authors did not agree to provide us with their subjects' characteristics.

## Experimental design and practical procedures

The eight sessions of the computerized experiment were conducted at the Experimental Laboratory of the Max Planck Institute of Economics in Jena. All 130 subjects were students from the University of Jena, in each session the gender composition was approximately balanced, and no subject participated in more than one session. The third panel of Table 1 shows the sample composition according to educational background which closely resembles the one of Experiment 2 with business administration & economics and law gathering about 80% of the subjects. Experimental procedures were identical to those of Experiment 2.

The third panel of Table 2 shows some of the features of Experiment 3.

## Results

Similarly to Experiments 1 and 2, we present here our main findings concerning the principal-agent game data and subjects' answers to the questionnaire are discussed in Section 6. The behavior of principals is again in line with the hypothesis that most of them have well anticipated the distributions of conditional transfers. Details are omitted for brevity.<sup>10</sup>

Result 3 summarizes our findings concerning the behavior of agents in Experiment 3.

**Result 3:** *We observe hidden costs of control. In C5, hidden costs outweigh benefits of control since the average number of ECUs transferred by the agent to the principal is statistically significantly higher in the no-control condition than in the control condition. In C10, hidden costs do not outweigh benefits of control since the average number of ECUs transferred by the agent to the principal is not statistically significantly higher in the no-control condition than in the control condition. The largest group of agents shows a negative reaction to the implementation of control.*

*Support:* Agents' transfers in Experiment 3 are summarized in the third panel of Table 3. We always reject the null hypothesis that the modified distribution in the no-control condition is the same as the distribution in the control condition (exact Wilcoxon signed rank tests for paired observations,  $p$ -value  $< 0.01$  in both treatments). The impact of control on transfers is always negative (it equals -24.24 % in C5 and -13.46 % in C10) but it is statistically significantly so only in C5 (exact Wilcoxon signed rank tests for paired observations,  $p$ -value  $< 0.01$  in C5 and  $p$ -value = 0.3026 in C10). Finally, as shown in the third panel of Table 4, the largest group of agents reacts negatively to the principal's implementation of control (40.62 % and 45.45 % in C5 and C10 respectively).  $\square$

Experiment 3's findings concerning the behavior of agents are more in line with F&K's findings than the ones from Experiment 1 and, in turn, they are less in line with Experiment 2's findings than the ones from Experiment 1. Two immediate implications are that (i) Trento subjects are much less bothered by the imposition of control than Jena students after controlling for the educational background. This cross-country effect is statistically significant in C5 where agents' transfers in the no-control condition are statistically significantly lower in Experiment 2 than in Experiment 3 (exact Wilcoxon signed rank test,  $p$ -value = 0.041) whereas in C10 agents' transfers in the no-control condition do not statistically differ between the two experiments (exact Wilcoxon signed rank test,  $p$ -value = 0.101). Not surprisingly, agents' transfers in the control condition never statistically differ (exact Wilcoxon signed rank tests,  $p$ -value = 0.101 in C5 and  $p$ -value = 0.899

<sup>10</sup>In Experiment 3, 53% and 64% of our principals force the agent to transfer at least  $\underline{x}$  ECUs in C5 and C10 respectively. Judging by binomial tests, the proportion of principals who leave transfers unrestricted is never statistically significantly lower than the proportion of principals who control ( $p$ -value = 0.860 in C5 and  $p$ -value = 0.163 in C10).



in C10) ; and (ii) Economics majors seem to be more control-averse than non-economics majors in F&K’s principal-agent game. However, the educational effect is statistically insignificant since agents’ transfers never statistically differ between Experiment 1 and Experiment 3 (exact Wilcoxon signed rank tests,  $p$ -values for the no-control condition are 0.602 and 0.519 in C5 and C10 respectively, and for the control condition they are 0.688 and 0.932 in C5 and C10 respectively). Both implications are further investigated in our general discussion.

## Discussion

In C10, Experiment 3’s findings are in line with those of Experiment 1 which implies that they largely conflict with those of the original study. On the contrary, in C5, Experiment 3’s findings confirm F&K’s striking observation that the implementation of control is detrimental to the principal. Still, agents’ data in Experiment 3 are quantitatively quite different from those in F&K’s experiment. Indeed, only 40.62 % of our agents react negatively to the implementation of control and their negative response ( $\bar{x}^C - \bar{x}^{NC}$ ) is lower than the one observed by F&K (-15.31 vs. -21.80). Overall, the impact of control in Experiment 3’s C5 treatment is less than half the impact of control in F&K’s C5 treatment (-21.52 % vs. -51.45 %).

Overall, the findings of our first three experiments question the robustness of F&K’s findings in their principal-agent game. Contrary to F&K, we mainly observe hidden costs of control of *low* magnitude which lead to low-trust principal-agent relationships. Our findings also suggest that nationality and educational background have an effect on the degree of control aversion, Italian students from the Trentino being less control-averse than German students from Thuringia and economics majors being more control-averse than non-economics majors.

We now discuss our subjects’ answers to the questionnaires that F&K administrated in their questionnaire study.

## 6 Questionnaire results

With the help of a questionnaire in which they presented 403 subjects with vignettes, F&K studied how control and explicit incentives affect motivation in typical work environments. They considered five different workplace scenarios, and, for each scenario, they presented a condition where the principal trusts the employee and a condition where the principal controls or uses explicit incentive devices. Each subject went through all five scenarios but faced only one of the two conditions for a given scenario. Based on a sample of 2,015 responses, F&K observe that, in all scenarios, control reduces stated work motivation statistically significantly.

Like in F&K’s questionnaire study, our subjects had to indicate their work motivation on a five-level scale ranging from “very low” to “very high” for each of the five hypothetical scenarios. Our sample of 1820 subjects’ answers is very similar to F&K’s sample: For all scenarios, the cumulative frequencies of subjects indicating that they have at most a medium motivation are always higher in the control than in the trust condition (for details see Appendix E of the supplementary material). Like F&K, we observe that, in all scenarios, control reduces stated work motivation statistically significantly (exact Wilcoxon signed rank tests,  $p - value < 0.01$  in each scenario). Even when restricting the sample to Trento subjects who are hardly bothered by the imposition of control in the experimental game, we observe that, in all scenarios except the fifth one, control reduces stated work motivation statistically significantly (exact Wilcoxon signed rank tests,  $p - value = 0.278$  in scenario 5 and  $p - value < 0.01$  for all remaining scenarios).

In summary, our questionnaire data are qualitatively very similar to F&K's questionnaire data even though subjects' behavior in our first three experiments differs significantly from subjects' behavior in F&K's C5 and C10 treatments. Two possible implications are that hypothetical incentives are key for the pervasiveness of substantive hidden costs of control in the considered setting or that F&K's principal-agent game misses important elements of employment relationships for control to be perceived negatively in most samples of subjects (or both).

Given the concomitance of dissimilar game play data and similar questionnaire data with respect to F&K, we decided to investigate the influence of hypothetical incentives in the play of the principal-agent game. Below, we present the results of an extension of F&K's C5 and C10 treatments where performance-based monetary rewards are absent i.e. both principals and agents are paid according to a flat participation fee. An empirical assessment of hidden costs of control in rich decision environments seems an important direction for future research.<sup>11</sup>

## 7 Experiment 4: Hypothetical choices in Experiment 1

Experiment 4 aims at resolving the puzzling discrepancy in subjects' behavior between our first three experiments and F&K's C5 and C10 treatments. Given the similarity of the questionnaire data in both studies and the fact that more emphasis was put on the performance-contingent earnings in our first three experiments compared to F&K, we conjectured that Jena students are more likely to express a negative reaction to the implementation of control in the principal-agent game under hypothetical incentives. Experiment 4 extends our first experiment by asking agents and principals to make hypothetical choices for a flat fee, and the samples of Jena students used in the two experiments have similar observed characteristics. The findings of Experiment 4 confirm our conjecture: We observe that hidden costs outweigh benefits of control in C5 and C10.

### Experimental design and practical procedures

The ten sessions of the computerized experiment were conducted at the Experimental Laboratory of the Max Planck Institute of Economics in Jena. All 228 subjects were students from the University of Jena, in each session the gender composition was approximately balanced, and no subject participated in more than one session.<sup>12</sup> The fourth panel of Table 1 shows the sample composition according to educational background which closely resembles the one of Experiment 1. Experimental procedures were identical to those of Experiment 1 except that (i) Once all subjects had played the principal-agent game and had answered the questionnaire they were asked to report their year of birth, their gender, and their academic major; and (ii) Subjects were paid a flat participation fee of 10 euros for completing the experiment.<sup>13</sup>

The fourth panel of Table 2 shows some of the features of Experiment 4.

### Results

Result 4 summarizes our findings concerning subjects' behavior in Experiment 4 which are qualitatively in line with F&K's results 1 to 4.

<sup>11</sup>A rich decision environment has been studied by Bartling, Fehr, and Schmidt (2010) who, like in most of our cases, confirm the existence of *low magnitude* hidden costs of control.

<sup>12</sup>Since not using salient incentives usually increases the "noise" in subjects decisions, we collected twice the amount of data in Experiment 4 compared to Experiment 1.

<sup>13</sup>Sessions in which subjects make hypothetical choices for a flat fee are the exception at the Experimental Laboratory of the Max Planck Institute of Economics. In such cases, no distinction is made between the show-up fee and the flat participation fee i.e. the usual 2.50 euros show-up fee is included in the participation fee.

**Result 4:** *We observe hidden costs that outweigh the benefits of control. The largest group of agents reacts negatively to the implementation of control. The majority of principals chooses not to control the agent.*

*Support:* Agents' transfers in Experiment 4 are summarized in the fourth panel of Table 3. We always reject the null hypothesis that the modified distribution in the no-control condition is the same as the distribution in the control condition (exact Wilcoxon signed rank tests for paired observations,  $p$ -value  $< 0.01$  in both treatments). The impact of control on transfers is negative (it equals -21.52 % in C5 and -25.94 % in C10) and statistically significantly so (exact Wilcoxon signed rank tests for paired observations,  $p$ -value  $\leq 0.01$  in both treatments). As shown in the fourth panel of Table 4, the largest group of agents reacts negatively to the principal's implementation of control (43.86 % and 45.61 % in C5 and C10 respectively). Only 42% and 44% of our principals force the agent to transfer at least  $\underline{x}$  ECUs in C5 and C10 respectively. Judging by binomial tests, the proportion of principals who leave transfers unrestricted is not statistically significantly higher than the proportion of principals who control ( $p$ -value = 0.289 in C5 and  $p$ -value = 0.427 in C10).  $\square$

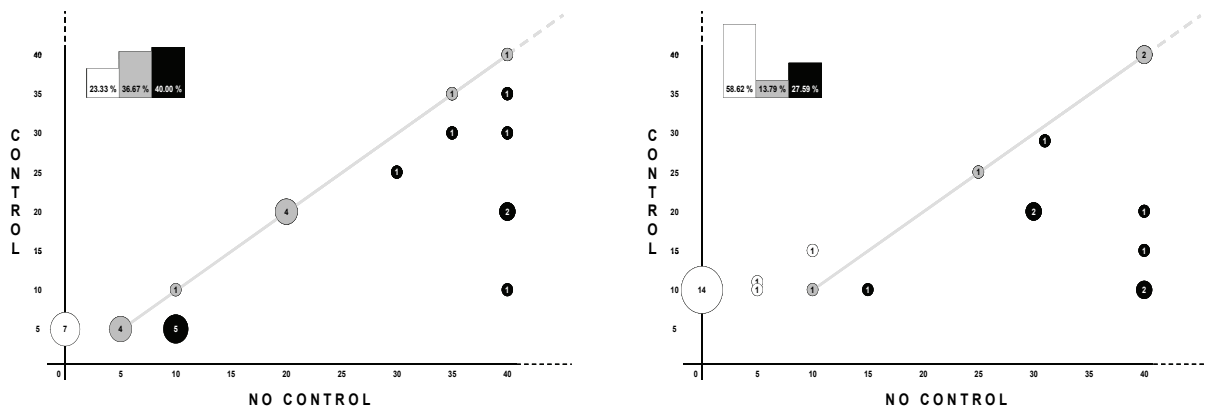
Though Experiment 4's findings confirm F&K's striking observation that the implementation of control is detrimental to the principal, the puzzling discrepancy in subjects' behavior between our first three experiments and F&K's C5 and C10 treatments is only partially resolved. We now document in detail that much stronger negative responses to control are observed in F&K's C5 treatment compared to Experiment 4's C5 treatment (in C10, agents' responses to control are similar in both experiments). Figure 2 shows the distributions of transfer pairs from agents to principals in Experiment 1, Experiment 4 and in F&K's low and medium control treatments (see Appendix F of the supplementary material for the distributions in Experiments 2 and 3). Bubble plots on the left (respectively right) represent distributions of transfer pairs in C5 (respectively C10). On the horizontal axis we denote the amount transferred in the no-control condition and on the vertical axis we denote the amount transferred in the control condition. The size of bubbles is proportional to the number of transfer pairs. Black, grey and white bubbles correspond to negative, neutral and positive reactions to control respectively and histograms with the relative frequencies of behavioral reactions to control are added in the left upper corner of each bubble plot. The few transfer pairs that include a transfer of more than 40 ECUS are clustered on the right side of the plot.

Compared to Experiment 1, the absence of performance-based monetary rewards in Experiment 4 has induced a clear downward-right shift in the distribution of transfer pairs. In particular, agents whose negative response to control is strictly lower than  $(-\underline{x})$  are twice as many in Experiment 4 compared to Experiment 1 (13% vs. 26% and 14% vs. 30% in C5 and C10 respectively). Moreover, the shift in the distribution of transfer pairs in C10 has been sufficiently strong so that behavioral reactions to control observed by F&K are comparable to the ones observed in Experiment 4. In particular, the proportion of agents whose negative response to control is strictly lower than  $(-10)$  equals 24% in F&K's C10 treatment. In C5, on the contrary, the shift is insufficient to have similar reactions to control in both experiments with 53% of the agents exhibiting a negative response to control strictly lower than  $(-5)$  in F&K's sample. This notable difference mainly explains that the impact of control in Experiment 4's C5 treatment is less than half the impact of control in F&K's C5 treatment.

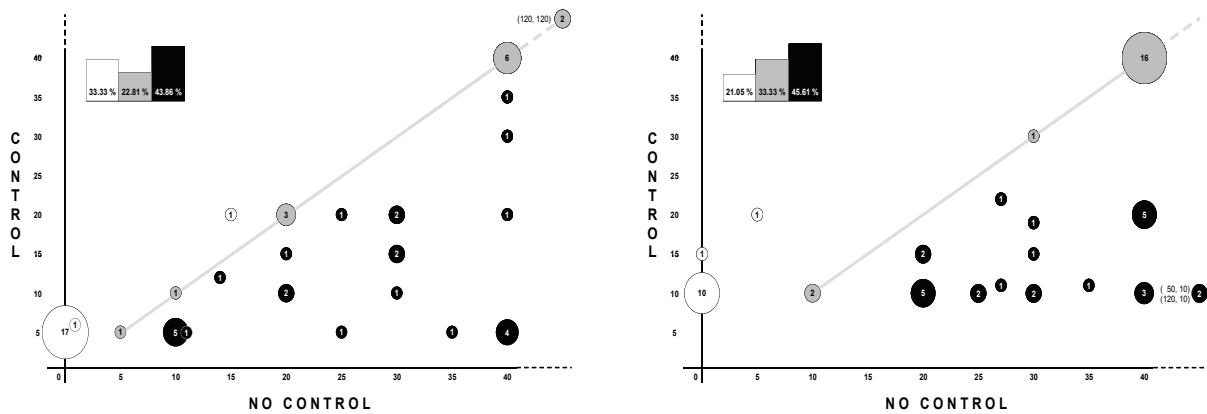
## Discussion

Experiment 4's findings suggest that most of the explanation for the observed discrepancy in subjects' behavior between our first three experiments and F&K's C5 and C10 treatments is the salience

## Experiment 1



## Experiment 4



## F&K's C5 and C10 treatments

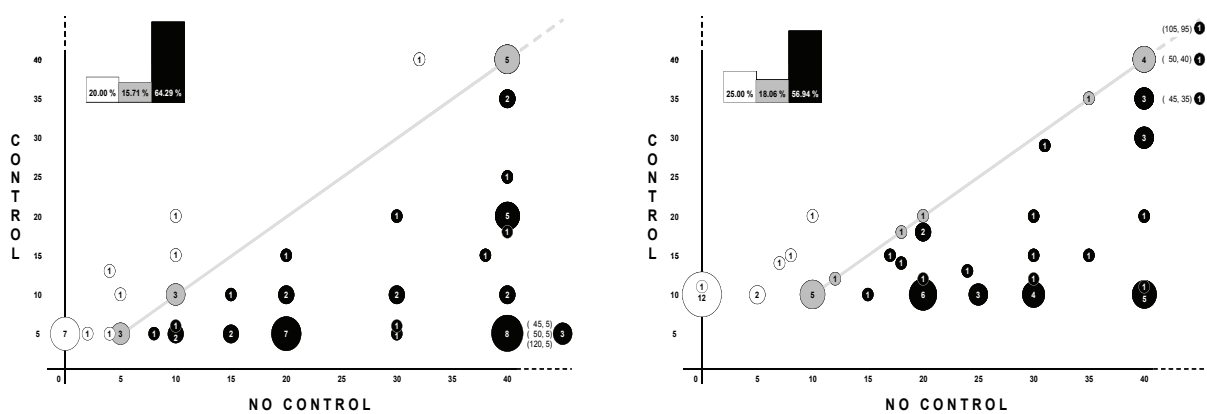


Figure 2: Distributions of transfer pairs from agents to principals.

of monetary incentives: F&K might not have provided sufficiently large performance-contingent earnings to their subjects. The remaining discrepancy in the results of the two experiments in

treatment C5 seems to confirm that nationality has an effect on the degree of control aversion.

## 8 General discussion

Several of our findings suggest that nationality has an effect on the degree of control aversion. We also established that our evidence is not in line with the observation that Italy's score on self-expression in 2006 is more than twice the score of East Germany. We now investigate whether a country-based explanation holds for the discrepancies in experimental results by relying on specific variables identified by F&K as related to control aversion. Taking for granted that societal-level variables exist which correlate with experimentally observable control aversion, we believe that this alternative investigation is more likely to shed light on country-based explanations.

In F&K's study, most agents who react negatively to the implementation of control perceive the principal's controlling decision as a signal of *distrust* or a limitation of their *choice autonomy* (pages 1623-1625). As proxies for distrust and choice autonomy at the society-level, we select two variables *trustworthiness* and *freedom of choice* based on data taken from the World Values Survey, henceforth WVS (Appendix G of the supplementary material documents in detail the followed procedure and the used material). The variable trustworthiness is derived from answers to the question "Do you think most people would try to take advantage of you if they got a chance, or would they try to be fair?" (answers are on a 10-point scale where 1 is take advantage and 10 is fair). The variable freedom of choice is derived from answers to the question "Some people feel they have completely free choice and control over their lives, while other people feel that what they do has no real effect on what happens to them. Please use this scale where 1 means 'no choice at all' and 10 means 'a great deal of choice' to indicate how much freedom of choice and control you feel you have over the way your life turns out." We hypothesize that hidden costs of control of larger magnitude prevail in regions where the average citizen expects more trustworthiness and/or his perceived freedom of choice is higher. Our hypotheses are only weakly confirmed by the WVS's evidence. On the one hand, we observe that the region around Zürich scores much higher than the region around Jena and the region around Trento on both variables. Cross-societal data show that freedom of choice and trustworthiness are extraordinarily prevalent in the region around Zürich (only Norway and Sweden reach slightly higher scores on both variables) which provides a potential explanation for the lack of representativeness of F&K's findings in their principal-agent game. On the other hand, the comparison of the field evidence for the regions around Jena and Trento shows that scores on freedom of choice and trustworthiness are negatively correlated with the experimentally observed degree of control aversion.

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