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Risk attitudes, randomization to treatment, and self-selection into experiments

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ABSTRACT

Randomization to treatment is fundamental to statistical control in the design of experiments. However randomization implies some uncertainty about treatment condition, and individuals differ in their preferences towards taking on risk. Since human subjects often volunteer for experiments or are allowed to drop out of the experiment at any time if they want to, it is possible that the sample observed in an experiment might be biased because of the risk of randomization. On the other hand, the widespread use of a guaranteed show-up fee that is non-stochastic may generate sample selection biases of the opposite direction, encouraging more risk averse samples into experiments. We directly test these hypotheses that risk attitudes play a role in sample selection. Our results suggest that randomization bias does affect the overall level of risk aversion in the sample we observe, but that it does not affect the demographic mix of risk attitudes in the sample. We show that the common use of non-stochastic show-up fees can generate samples that are more risk averse than would otherwise have been observed.

Randomization to treatment is fundamental to statistical control in the design of experiments. However randomization implies some uncertainty about treatment condition, and individuals differ in their preferences towards taking on risk. Since human subjects often volunteer for experiments or are allowed to drop out of the experiment at any time if they want to, it is possible that the sample observed in an experiment might be biased because of the risk inherent in randomization. In the extreme case, subjects in experiments might be those who are *least* averse to being exposed to risk. For many experiments of biological response, this might not be expected to have any influence on measurement of treatment efficacy, although many laboratory, field and social experiments measure treatment efficacy in ways that could be directly affected by randomization bias.[1]

In economics experiments there are two monetary aspects that might affect sample selection. Experimenters often determine final payoffs using randomization, such as selecting one decision out of many at random to reward subjects. Thus randomization of outcomes, which is what matters to subjects evaluating participation, can arise even if there is no randomization to treatment employed. On the other hand, it is common in experimental economics to offer subjects a fixed

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[1] Heckman and Smith (1995, pp. 99–101) provide many examples from social experiments and coin the expression "randomization bias" for this possible effect. Harrison and List (2004) review the differences between laboratory, field, social and natural experiments in economics, noting that all could be potentially affected by randomization bias. Palfrey and Pevnitskaya (2008) use thought experiments and laboratory experiments to illustrate how risk attitudes can theoretically affect the mix of bidders in sealed-bid auctions with endogenous entry and thereby change behavior in the sample of bidders observed in the auction.

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participation fee to encourage attendance. These non-stochastic participation fees could offset the effects of randomization by encouraging *more* risk-averse subjects to participate than might otherwise be the case. *Thus the term "randomization bias," in the context of economics experiments, should be taken to mean the net effects from these two latent sample selection effects.*

We undertake an artefactual field experiment and a complementary laboratory experiment to test directly the hypothesis that risk attitudes play a role in sample selection.[2] In both experiments we follow standard procedures in the social sciences to recruit subjects. The primary source of randomness in our experiments is the stochastic determination of final earnings, as explained below, and this uncertainty was conveyed in the recruitment procedures.

In the artefactual field experiment we exploit the fact that we know certain characteristics of the population sampled, adults in Denmark in 2003, allowing a correction for sample selection bias using well-known methods from econometrics. The classic problem of sample selection refers to possible recruitment biases, such that the observed sample is generated by a process that depends on the nature of the experiment.[3] There are two offsetting forces at work in this sample selection process. The use of randomization could attract subjects to experiments that are *less* risk averse than the population if the subjects rationally anticipate the use of randomization.[4] Conversely, the use of guaranteed financial remuneration, common in experiments in economics for participation, could encourage those who are *more* risk averse to participate.

Our artefactual field experiment allows us to evaluate the *net* effect of these opposing forces for the adult population of Denmark. We find that measured risk aversion is smaller after we correct for sample selection bias, consistent with the hypothesis that the *use of substantial, guaranteed show-up fees more than offset any bias against attending an experiment that involved randomization*. This effect is statistically significant, implying that there is, in aggregate, a net effect from sample selection due to the opposing influence from randomization and show-up fees on the estimated risk attitudes. Of course, if one had adopted different participation fees, there might have been more or less sample selection. We also find no evidence that sample selection influenced inferences about the effects of observed individual demographic characteristics on risk aversion.

We design a laboratory experiment to complement the insights from our artefactual field experiment and explore the conclusion that we might have experienced a larger *gross* sample selection effect due to randomization, but that the muted *net* sample selection effect we observed was due to our choice of the participation fee. Our field design used the same fixed recruitment fee for all subjects to ensure comparability of subjects in terms of the behavioral task. In the laboratory experiments we exogenously vary this fixed recruitment fee. If the level of the fixed fee affects the risk attitudes of the sample that choose to participate in the experiment, at least over the amounts we consider, we should then be able to see different risk attitudes in the sample directly. As expected *a priori*, we do observe samples that are *more risk averse when we have a higher fixed participation fee*. In another treatment in our laboratory experiments we vary just the *range of the prizes* possible in the task, keeping the fixed participation fee constant. In this case we observe samples that are *more risk averse when we scale the range of prizes up*, compared to the control. Hence, the level of the fixed recruitment fee and information on the range of prizes in the experiment have a direct influence on the composition of the sample in terms of individual risk attitudes.

The implication of our results is that experimental economists should pay attention to the process that leads subjects to participate in the experiment in order to make reliable inferences from any setting in which risk attitudes play a role. This is true whether one conducts experiments in the laboratory or the field.

1. Data

1.1. The task

We employ a simple experimental measure for risk aversion introduced by Holt and Laury (2002) and extended by Harrison et al. (2005b).[5] Each subject is presented with a series of choices between two lotteries, which we call A or B. All choices are presented simultaneously to the subject. In the field experiments the first choice in lottery A involves a 10 percent chance of receiving DKK2000 and a 90 percent chance of receiving DKK1600. The expected value of this lottery is DKK1640. Lottery B in the first choice gives a 10 percent chance of receiving DKK3850 and 90 percent chance of receiving DKK100, for an expected value of DKK480. Thus the two lotteries have a relatively large difference in expected values, in this case DKK1170. As one proceeds down the payoff table, the probability of winning the high prize in each lottery increases, and the expected value of lottery B steadily becomes greater than the expected value of lottery A.

[2] An artefactual field experiment is defined by Harrison and List as involving the use of artefactual instructions, task and environment with a field subject pool.

[3] More precisely, the statistical problem is that there may be some unobserved individual effects that cause subjects to be in the observed sample or not, and these effects could be correlated with responses once in the observed sample. For example, Camerer and Lovallo (1999) find that excess entry into competitive games occurs more often when subjects volunteered to participate knowing that payoffs would depend on skill in a sports or current events trivia. This treatment could encourage less risk averse subjects to participate in the experiment and may explain the observed reference bias effect, or part of it.

[4] It is well known in the field of clinical drug trials that persuading patients to participate in randomized studies is much harder than persuading them to participate in non-randomized studies (e.g., Kramer and Shapiro, 1984, p. 2742ff.). The same problem applies to social experiments, as evidenced by the difficulties that can be encountered when recruiting decentralized bureaucracies to administer the random treatment (e.g., Hotz, 1992). For example, Heckman and Robb (1985) note that the refusal rate in one randomized job training program was over 90%.

[5] Harrison and Rutström (2008) review alternative methods for eliciting risk attitudes in experiments.