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Biased Effects of Taxes and Subsidies on Portfolio Choices

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Abstract

We study how taxes and subsidies affect portfolio choices in a laboratory experiment. We find highly significant differences after intervention, even though the net income is identical in all our treatments and thus the decision pattern of investors should be constant. In particular, we observe that the willingness to invest in the risky asset decreases markedly when an income tax has to be paid or when a subsidy is paid. If we combine both a tax and a subsidy, this effect intensifies.

Keywords: tax perception, risk-taking behavior, portfolio choice, distorting taxation, tax, subsidy, behavioral economics

JEL-Codes: C91, D14, H24

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1 Introduction

In a recent experiment, Fochmann et al. (2012) find that a tax perception bias influences risk-taking behavior when subjects are able to offset losses from their taxable base. In this paper, we investigate whether a perception bias also has an effect in a more general investment problem with different types of government intervention. We look at the effects of both subsidies and taxes on portfolio choices in a laboratory experiment to see how they influence the choice between risky and risk-free assets. We find that imposing a tax and paying a subsidy both have a highly significant negative effect on the willingness to invest in a risky asset.

This paper adds to a small but growing literature on the effect of biases from government intervention. Chetty et al. (2009), for example, find that consumption decisions are influenced by the salience of sales taxes and show that the resulting distortions may have important welfare effects. Sausgruber and Tyran (2011) also find that biased tax perception can have an impact on welfare in the context of voting decisions. Gamage et al. (2010), Djanali and Sheehan-Connor (2012), Fochmann et al. (forthcoming) observe that labor market decisions are distorted by a biased tax perception. Our contribution to this literature is twofold: (1) We shed further light on the effect of government intervention on investment decision and (2) we are the first to analyze the effect of subsidy perception on risk-taking.

2 Experimental design and hypothesis

In our setting, subjects have to decide on the composition of an asset portfolio in different choice situations. At the beginning of each situation, each subject receives an endowment of 100 Lab-points where 1 Lab-point corresponds to 1 Euro cent. The participants' task is to spend their endowment on two investment alternatives: asset A and asset B. The price for one asset of either type is 1 Lab-Point.

The return of asset A is risky and depends on the state of nature. Eight states are possible and each state occurs with an equal probability of $\frac{1}{8}$.

The return of asset B is risk-free and is therefore equal in every state of nature. The returns of both assets are chosen in such a way that asset A does not dominate asset B in each state of nature, but the expected return of asset A exceeds the risk-free return of asset B. The subjects know the potential returns on both assets in each state of nature before they make their investment decision.

The experiment consists of four treatments in which the presence of a tax and a subsidy is varied. In the first treatment, the baseline treatment, no tax is levied and no subsidy is paid. In the subsidy treatment, a subsidy of 50% of the gross return is paid for each asset A, but no tax is imposed. In the tax treatment, a tax with a rate of 50% is levied on the gross return of each asset A, but no subsidy is paid. In the subsidy-tax treatment, a subsidy of 50% of the gross return is paid for each asset A, but in addition a tax has to be paid. In this case, the tax is 50% of the sum of the gross return of asset A and the subsidy. In all four treatments, the returns of the risk-free asset B are neither taxed nor subsidized. Before subjects make their investment decision, they are informed about the tax and subsidy situation.

Although the gross returns of asset A are treated differently across the treatments, they are transformed in such a way that the net returns remain the same (see table 1 for an example). This leads to identical investment settings in all four treatments and the decision pattern should therefore also be identical across the treatments. Our hypothesis is:

Hypothesis. *Investment in the risky asset A and the risk-free asset B is identical in all four treatments.*

In each treatment, we have five decision situations in which we vary both the potential returns of asset A and the return of asset B. Each subject participates in each treatment (within-subject design) and therefore makes 20 investment decisions in total. To avoid learning effects, the order of these 20 decision situations is completely randomized for each subject. Since we are only interested in the treatment differences, the risk attitude of the subjects is not of importance for our analysis. Participants with stable and unbiased

Table 1: Returns of risky asset A and risk-free asset B (example)

	risky asset A													risk-free asset B
state of	**baseline**	**subsidy**				**tax**				**subsidy-tax**				**baseline, subsidy,**
nature		gross	subsidy	tax	net	gross	subsidy	tax	net	gross	subsidy	tax	net	**tax, subsidy-tax**
1	1.000	0.667	0.333	–	1.000	2.000	–	1.000	1.000	1.333	0.667	1.000	1.000	1.300
2	1.100	0.733	0.367	–	1.100	2.200	–	1.100	1.100	1.467	0.733	1.100	1.100	1.300
3	1.200	0.800	0.400	–	1.200	2.400	–	1.200	1.200	1.600	0.800	1.200	1.200	1.300
4	1.300	0.867	0.433	–	1.300	2.600	–	1.300	1.300	1.733	0.867	1.300	1.300	1.300
5	1.400	0.933	0.467	–	1.400	2.800	–	1.400	1.400	1.867	0.933	1.400	1.400	1.300
6	1.500	1.000	0.500	–	1.500	3.000	–	1.500	1.500	2.000	1.000	1.500	1.500	1.300
7	1.600	1.067	0.533	–	1.600	3.200	–	1.600	1.600	2.133	1.067	1.600	1.600	1.300
8	1.700	1.133	0.567	–	1.700	3.400	–	1.700	1.700	2.267	1.133	1.700	1.700	1.300
subsidy	no	50% of gross return				no				50% of gross return				no
tax	no	no				50% of gross return				50% of gross return plus subsidy				no

preferences should follow the same decision pattern across the treatments independently of their individual attitude towards risk.

Despite the fact that we use a very simple setting, with simple tax and subsidy rates, several mechanisms are implemented aimed at avoiding distortions due to differences in complexity in the treatments. First, the written instructions explain the calculation of the net returns in detail and provide one numerical example for each treatment. Second, subjects receive pocket calculators to calculate their net returns. Third, each subject has to correctly solve one numerical example for each of the four treatments as a comprehension test. Finally, the most important mechanism is our "what-if"-calculator, which allows subjects to calculate their tax, subsidy, and net payoff at different investment levels in each decision situation. In order to give subjects enough time to use the calculator, there are no time restrictions.

The experiment was conducted with 119 participants at the computerized experimental laboratory at the Otto-von-Guericke University of Magdeburg (MaXLab) in March 2012 and was programmed with zTree (Fischbacher, 2007). To avoid income effects, we randomly selected five of the decision situations to be paid in cash after the experiment was finished (mean: 11.55 Euro).

3 Results

Figure 1 depicts the average share of endowment invested in the risky asset A for each treatment. The amount invested in the risk-free asset B is the residual share. In the baseline treatment, subjects invested 68.18% of their

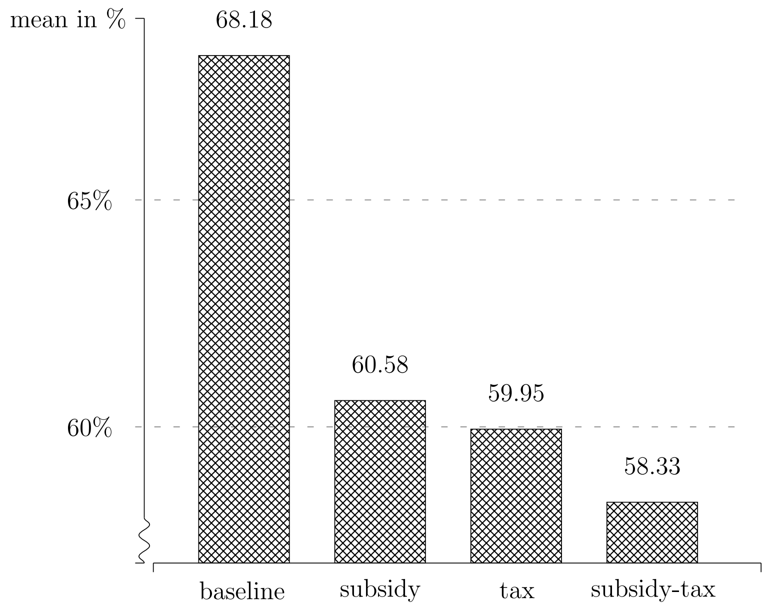

Figure 1: Share of endowment invested in the risky asset A on average for each treatment ($N = 119$)

endowment in asset A. Even though the net investments are identical in the other treatments, this share decreased markedly when a subsidy was paid (60.58%) or a tax had to be paid (59.95%). This effect intensified weakly when a subsidy was paid and a tax imposed simultaneously (58.33%). Compared to the baseline treatment, all differences are highly significant ($p < 0.001$, Wilcoxon signed-rank test, two-tailed). Our hypothesis is therefore rejected for all these comparisons. The difference between the subsidy and the subsidy-tax treatment is weakly significant ($p = 0.077$). But we found no significant differences between the tax and subsidy-tax treatment or between the subsidy and tax treatment.

In addition to these non-parametric tests, we ran linear regressions with the share of endowment invested in risky asset A as the dependent variable. The results are shown in table 2 (robust standard errors in brackets clustered at the subject level). The baseline treatment is the default. To test the treatment effects, we regress on three treatment dummies. In our first regression (model 1), we include only these dummies. The coefficients of each treatment dummy are negative and highly significant. To control for individual characteristics, we ran a second regression (model 2) which includes the variables *gender* (male = 1), *economic major* (1 if the subject studies at the faculty of economics and management), *focus on net payoffs* (1 if the subject stated that she focused rather on net payoffs), *tax knowledge* (tax knowledge exists = 1), *age*, *number of semester* studied, *time for decision* in seconds, and *order* which represents the order in which the 20 decisions were presented to the subjects. Since 10 subjects did not entirely complete the post-experimental questionnaire, the number of subjects decreases from 119 to 109 in the second model. Again, the treatment variables are negative and highly significant. All other variables are not significant. The only exemption is the variable gender. In line with the empirically literature (see, for example, Eckel and Grossman, 2008), our male subjects are more risk seeking than women. The results of both regressions support our descriptive analysis.

4 Discussion

We have found that government intervention can have a large influence on investment decisions. In our experiment introducing a tax and/or a subsidy into a portfolio choice problem was shown to have a highly significant negative impact on the willingness to invest in a risky asset even if the net payoffs are the same as those without any intervention. This result is in contrast to what a standard theory, which assumes that individuals decide on their net payoffs, would predict.

Our finding that investment in the risky asset falls in both subsidy and tax treatments is at odds with a range of possible explanations discussed in the existing literature on behavioral taxation. If subjects had tax aversion (Sussman and Olivola, 2011), tax affinity (Djanali and Sheehan-Connor, 2012), or gross payoff illusion (Fochmann et al., forthcoming) we would have expected the tax and subsidy to have opposing effects from each other. Since a subsidy is essentially just a negative tax, subjects with tax aversion (affinity) would receive a lower (higher) utility in the tax treatment and a higher (lower) utility in the subsidy treatment when compared to the baseline. They would

Table 2: Linear regressions (independent variable: share of endowment invested in risky asset A)

	model 1	model 2
Constant	**68.181****	**62.009****
	(1.741)	(15.632)
Subsidy	**-7.598****	**-7.347****
	(1.797)	(1.938)
Tax	**-8.232****	**-7.348****
	(1.636)	(1.777)
Subsidy-Tax	**-9.845****	**-8.861****
	(1.842)	(1.980)
Gender		**7.973***
(male = 1)		(3.406)
Economic major		1.371
(major in economics = 1)		(4.358)
Focus on net payoffs		3.964
(yes = 1)		(6.359)
tax knowledge		-5.565
(yes = 1)		(5.566)
Age		-0.004
		(0.618)
Number of semesters		-0.660
		(0.687)
time for decision		0.004
		(0.026)
order		0.209
		(0.134)
No. of observation	2,380	2,180
No. of subjects	119	109
Model's p-value	0.000	0.000

Note: * $p \leq 0.05$, ** $p \leq 0.01$

thus have invested less (more) when the risky asset was taxed and more (less) when it was subsidized. This is not what we observed. Our pattern does not indicate gross payoff illusion either. Since the gross payoff was higher than the net payoff in the tax treatment and lower than the net payoff in the subsidy treatment, subjects with the illusion that their gross payoffs are relevant would not have reacted the same to both types of intervention. They would have been drawn to the higher gross payoff in the tax treatment and the lower gross payoff in the subsidy treatment. The fact that we observe a fall in investment in both treatments can therefore not be readily explained by any of these existing theories.

One explanation which would fit our results is that subjects take into account a cognitive cost from evaluating their net returns, which reduces their utility from assets which have been taxed or subsidized. Since the cognitive effort required for calculating net returns would be positive for both types of intervention, the utility from the risky asset relative to the untaxed and unsubsidized risk-free asset should fall in both cases. If subjects consider this reduction in utility when making their investment decision, then the investment in the risky asset would fall. This is consistent with our findings.

Two additional features of our results support this explanation. First, the change in investment behavior was very similar in the subsidy and tax treatment. Since there is no reason to believe that the net payoff should be more difficult to calculate in the case of a subsidy than a tax, the cognitive cost of calculating net payoffs should be very similar in both treatments. Thus if subjects take this cost into account then investment should, as we observed, fall by a similar amount in both treatments. Second, investment in the risky asset was lowest in the tax-subsidy treatment, which is arguably the most complicated of the three treatments. Since subjects are required to calculate both a tax and a subsidy in this treatment, we would expect them to incur a higher cost than when calculating a tax or a subsidy. This would then lower their utility from the risky investment even further leading to a more pronounced reduction in investment level in the case with a tax and a subsidy than if we have a tax or a subsidy on their own. This is again consistent with our findings although it worth pointing out that the difference is only weakly significant and only between the subsidy and subsidy-tax treatment.

The fact that the cognitive cost of evaluating net payoffs may have a significant impact on investment decisions in the presence of government intervention is a novel implication of our results. We argue that it is worth exploring this effect further to see whether it also plays a role in other contexts such as labor or product markets.

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