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Behavioral Responses to Subsidies in Risky Investment Decisions and the Effectiveness of Tax Credits and Grants

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Abstract

We provide evidence that subsidy types that are identical in monetary terms differ in their behavioral responses and consequently in their effectiveness. In particular, we observe that investments into a subsidized asset are higher under tax credit than under grant. Both subsidy types are essentially very similar, only the mechanism of the subsidy application is different. In case of a grant, an individual gains an amount of money. In case of a tax credit, no money is received directly, but the tax to be paid is decreased by the amount of the tax credit. Our results indicate that these mechanisms have a substantial impact on the effectiveness of subsidies. Applying our findings, governments can 'nudge' the investors to support desired investment decisions by using a certain subsidy type. Particularly, our results suggest that when policymakers are indifferent from a budget perspective between providing a subsidy as a grant or as a tax credit, they should implement a tax credit.

Keywords

Behavioral taxation, subsidy, risk-taking behavior, prospect theory

JEL-Classification

C91, D14, H24

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1 Introduction

In this study we examine how subsidies influence risky investment decisions. In particular, we are interested in two research questions. First, does the investment into a subsidized asset increase when the subsidy level is raised? Second, and more importantly, if two subsidy types are identical in monetary terms, which one is more effective? Thus, we are interested in whether a certain subsidy type reveals a stronger subsidy effect given the same subsidy amount spent. To test this, we analyze two commonly used subsidies: grant and tax credit. From a pure monetary perspective, both subsidy types are identical. However, the mechanism of the subsidy application differs. In case of a grant, an individual gains an additional amount of money (gain frame). In case of a tax credit, no money is received directly, but the tax to be paid is decreased by the amount of the tax credit. If a tax payment is perceived as a loss, a tax credit reduces this loss (loss frame). In line with prospect theory (Kahneman and Tversky (1979)), we expect that individuals value the subsidy types in the gain and loss frames differently. As individuals are generally loss averse, we suggest that a reduction of a loss in case of a tax credit is more valued than an equivalent gain in case of a grant. We therefore hypothesize and observe that a tax credit leads to a stronger subsidy effect than a grant. Thus, we provide first evidence that in the field of subsidization nudging is applicable.

In literature, the analysis of subsidy's influence on investment level is based on investment theory by Jorgenson (1963) and Hall and Jorgenson (1967). A generally positive influence of subsidies on the investment level has been shown (Lach (2002), Cummins et al. (1994), Chirinko and Wilson (2008)). But that a higher level of subsidy increases the investment level has not been empirically shown. That is because it is difficult to empirically find causality. Also in experimental settings that question has not been answered yet. To close this research gap, we study in a first step how the investment level depends on the level of subsidy.

In a second step, we analyze the effectiveness of subsidy types. Morisset and Pirnia (2001) argue that governments are well-advised to use different subsidy types for intervention depending on the intended purposes. Pennings (2000) for example show in a real-option model, that a tax credit is more effective in attracting investments than accelerated depreciation. Bernstein and Shah (1995) find that investment tax credits are more effective in attracting investments than reduced tax rates. Although there is some literature on this topic, differing effects of tax credits and grants on investment levels have not been studied so far. This is surprisingly because governments can use both subsidy types as substitutes. In monetary terms, paying an amount of money as a grant or providing a tax credit is equivalent from the perspective of government's budget. We will thus study the incentive and effectiveness of both subsidy types to contribute to this discussion.

To study our research questions, we design a laboratory experiment comparing investment behavior under different subsidy scenarios. In that experiment, participants have to invest into different investment alternatives. All alternatives have the same expected net value without subsidy, but differ in risk. The subsidized alternative is the investment alternative with the highest risk. We test each subsidy type in a different treatment (tax credit treatment and grant treatment) while participants take part in only one of the two. Each treatment consists of different investment decisions during which we vary the subsidy level of the subsidized alternative. In order to be able to compare the two subsidy types, we keep the net payoffs identical in the corresponding investment decisions for both treatments. This way we are able to test Hypothesis 1: Investment in the subsidized asset increases with the subsidy level. And Hypothesis 2: When a risky investment opportunity is subsidized with a tax credit, the investment into it is higher than when subsidized with a grant.

Our results are twofold: First, we find that a higher subsidy level increases the investment into the subsidized alternative. This result confirms Hypothesis 1 and holds for both subsidy types. Second, in the tax credit treatment we find significant higher investments into the subsidized alternative than in the grant treatment. This confirms Hypothesis 2. This finding suggests that participants appreciate the avoided loss that they achieve by paying fewer taxes more than being granted a gain. The result holds for all applied subsidy levels. The only exception occurs at the lowest subsidy level where we do not observe a significant difference in the data.

Our findings are relevant for governments deciding whether and how to implement or adjust subsidy programs. When every year billions are spent on such programs means and proportions need to be justifiable. In 2016, Germany for example spent more than double on tax credit (15.4 bn Euro) than it did on grants (7.5 bn Euro).[4] Knowing what an effect the choice of subsidy type or a higher subsidy level have is therefore valuable for politicians to further optimize their tax incentive strategy. Particularly, our results suggest that when policymakers are – from a budget perspective – indifferent between providing a subsidy as a grant or as a tax credit, they should implement a tax credit. This way they give the investors an additional 'nudge' into the desired direction.

[4] See for more information the subsidy report 2016 of the German government at http://dipbt.bundestag.de/doc/btd/18/059/1805940.pdf (retrieved 2017-11-22).

The remainder of this paper is structured as follows: In Section 2 we develop our hypotheses. Section 3 describes the experimental design. We analyze investment behavior in section 4. Section 5 concludes.

2 Hypotheses

2.1 Subsidy level and investments

Jorgenson (1963) and Hall and Jorgenson (1967) developed the theory of investment behavior of firms. With classical economic theory, we assume that firms invest as long as the gains of the investment are still higher than its costs. As rational decision-makers, investors are also assumed to invest more into an asset when the investment yield is higher. When subsidization is introduced, the gain of an investment is increased by a specific amount. Therefore, it is reasonable to assume that a higher subsidization rate will evoke a higher investment into the subsidized asset.[5] For example, Lach (2002) finds an overall positive influence of a public grant on the development of corporate R&D investments. Empirical studies like Cummins et al. (1994) and more recently Chirinko and Wilson (2008) confirm the increase in investment under subsidies. In our experiment we vary the subsidy levels in order to test our first hypothesis:

> ***Hypothesis 1:*** *The higher the subsidization offered, the higher the investment in the subsidized asset.*

2.2 Effectiveness of subsidies: tax credit vs. grant

While it is rational to expect that the amount of subsidization is important to a decision-maker, one would expect that the investors are indifferent regarding the subsidy type. Following Hall and Jorgenson (1967) theory of investment behavior, there is no difference between diverse subsidy types as long as the monetary and risk consequences are the same for all. This assumption was seldomly questioned before in the scientific discussion concerning subsidies. In the field of Behavioral Economics, however, several studies have shown that framing can have a strong influence on investment behavior. Epley et al. (2006), for example, show that by presenting an unexpected earning as an improvement of a person's financial situation instead of a return to a financial starting point, the person spends the unexpected earning much more readily. Epley and Gneezy (2007) emphasize that framing these exceptional payments differently may increase citizen's willingness to spend money thus supporting the intention of

[5] Summaries regarding the measurement of the effects on investments are found in Hassett and Hubbard (2002) and Hassett and Newmark (2008).

the government. Accordingly, Lozza et al. (2010) find that framing a fiscal bonus as ‘grant’ or ‘tax rebate’ may already change the value perception of taxpayers. Their findings indicate that ceteris paribus only presenting the same amount differently changes human behavior. In line with these results, we assume that the same amount of subsidization shows a different effect when framed differently: In our setting, we should, therefore, be able to observe variations of investment behavior under the frame ‘grant’ versus ‘tax credit’.

[Figure 1]

We follow prospect theory in order to identify the subsidy type that is supposed to stimulate investment behavior more effectively. Kahneman and Tversky (1979) argue that the direction of a deviation from a certain state is more important than the state as such. This distinction influences the underlying value function: gains and losses are perceived differently. As shown in Figure 1 losses are experienced in a much stronger way than a gain of the same magnitude. Consequently, for value assessments it is important whether a change is perceived as a reduced loss or as a gain. Even though the absolute value of a change may be the same: if the effect is framed as a reduced loss its perceived value would be higher than if it is framed as a gain.

In the context of our experimental setting, we expect the investment into the subsidized asset to be higher under the subsidy type of ‘tax credit’, because through the tax credit the investor can reduce the ‘loss’ of an otherwise higher taxation. Considering a value structure that shows a steeper curvature in regards to losses than in regards to gains, reducing the loss incentivizes the investor much more than just gaining the same amount of money. In our case, a grant may be perceived as an on-top payment (gain frame). Instead, a tax credit presupposes that a tax payment has to be made. Therefore, the investor is made aware that she has to face a pending loss through taxation (loss frame). By utilizing the tax credit, she is able to reduce that loss. This way the perceived benefit of a subsidization via tax credit is higher than via grant. Hence, our second hypothesis is:

> ***Hypothesis 2:*** *When a risky investment opportunity is subsidized with a tax credit, the investment into it is higher than when subsidized with a grant.*

A theory also supporting this hypothesis is the concept of tax aversion. Studies find that some individuals dislike paying taxes not only because of the loss of utility by having less money, but also because they dislike paying taxes as a concept. For example, Sussman and Olivola (2011) show that avoiding taxes is appreciated more than just the pure benefit of paying less for a product. Following that logic, people prefer a subsidy that is lowering their taxes towards the payment of an additional amount of money like in case of a grant. Consequently, investors will be stimulated more by subsidization via tax credit even though we do not consider this to be the main incentive.

Another important effect in our context is the salience effect. Chetty et al. (2009) for instance find that customers are influenced by the way a tax is made apparent. Even if they generally know about the existence of taxes, the inclusion of taxes for example in a product price is influencing their buying decision. Chetty et al. show that the demand is lower when taxes are included in the posted product prices. From this perspective, an immediate grant seems to be much more salient and consequently more desirable than a deduction from one's taxes at year's end when the declaration of taxes is due. However, even though that might be true in some situations, it is not relevant for our setting. Here, the participants of the experiment receive either the grant or the tax credit right away. Therefore, the salience effect can be neglected for the decision of our participants.

3 Experimental setup

3.1 Experimental design

Our experiment consists of two separate treatments: the grant treatment and the tax credit treatment.[6] Only one subsidy type is considered per treatment and the participants take part in only one treatment, making it a between-subject design. Each treatment contains 16 randomly presented investment decisions. In each investment decision, the participants have to choose between three investment alternatives (alternative A, B, and C) and have no time limitations in making their choice. At the beginning of each investment decision, participants receive an endowment of 100 lab-points with 1 lab-point corresponding to 1 Euro-cent. During each investment decision, participants have to choose the amount to be invested in objects of alternative A and B. The remaining amount will automatically be invested in objects of alternative C. The price for one object of each investment alternative is always 1 lab-point. For each investment alternative eight states of nature are possible with the probability of all states being equal.

The investment alternatives are designed in such a way that they vary in risk with regards to their standard deviation. While alternative A and B are risky investments, alternative C is risk-free, therefore has an equal return in every state of nature. Alternative B is riskier than alternative A. Without subsidy, the expected gross payoff and the expected net payoff of all

[6] For detailed instructions please see our Online Appendix.

three alternatives are equal and the alternatives differ only in the standard deviation of the payoffs. In this context, we introduce a subsidy that serves as a risk premium for alternative B. Using two different subsidy types makes it possible to evaluate which one is more effective in terms of attracting investments regardless of any baseline treatment. Alternative A is introduced to enable participants to invest riskily but avoid the complexity introduced by a subsidy.

Each alternative is taxed at a tax rate of 50 percent. The actual payment the participants receive after the experiment depends on the net payoffs. During the treatment, the participants face only the gross payoffs, the subsidy type, and the subsidy level. To calculate the net payoff, participants have to subtract the tax burden from the gross payoff. The tax burden is calculated by multiplying the tax base with the tax rate. The tax base is the gross payoff minus the invested endowment.

When subsidizing with a *grant* the participant receives a tax-free direct subsidy S_g. Therefore, the net payoff of alternative B for the grant treatment is calculated by

$$net_g^i = gross_g^i + S_g - \left[gross_g^i - P\right] * t$$

Where:

net_g^i = net payoff of alternative B under grant in state of nature *i*
$gross_g^i$ = gross payoff of alternative B under grant in state of nature *i*
S_g = subsidy type grant: tax-free direct subsidy
P = paid price per purchased objects (cost per object = 1)
t = tax rate (50%).

When subsidizing with a *tax credit* S_c the taxes due are directly reduced. For the tax credit treatment, the net payoff is calculated as follows

$$net_c^i = gross_c^i - \left[\left(gross_c^i - P\right) * t - S_c\right]$$

Where:

S_c = subsidy type tax credit: creditable against the tax due.

Table 1 shows an example for calculating the net payoff of each alternative (alternative B is subsidized with a grant at the subsidy level I).

[Table 1]

In our experiment, we vary the subsidy level (denominated as I, II, III, and IV) and the risk level. The subsidy amount for the subsidy type grant is calculated as a percentage of the expected net value of the investment without subsidy (which is fixed at 7.50 lab-points in all decision situations of the grant treatment). For the subsidy level I this percentage is 10%, for subsidy level II 15%, for III 20% and for IV 25%. Under grant, subsidy paid per purchased object is therefore 0.75 for level I, 1.13 for II, 1.50 for III, and 1.88 for IV.

For the subsidy type tax credit, we calculate the subsidy amount by multiplying the invested endowment with a certain percentage. Here, we use 75% for subsidy level I, 100% for level II, 150% for level III and 200% for level IV. As the price for one object of each investment alternative is always 1 lab-point, the amount of the subsidy per purchased object equals therefore 0.75 for level I, 1.00 for level II, 1.50 for level III, and 2.00 for level IV under tax credit.

Importantly, at every subsidy level, the net values (after tax and subsidy) in case of a grant and tax credit are held identical in the corresponding investment decision. This implies that from a pure monetary perspective, the decision situations in the grant and tax credit treatments are completely the same in net terms. Consequently, a pure money maximizing decision-maker is indifferent between both subsidy types. Both treatments only differ with respect to the framing.

In order to examine the effect of the subsidy type on the investment in various situations, we implemented two settings. In the first one at the subsidy levels I and III, we hold gross values, the absolute amount of subsidy and net values absolutely identical (for illustration see Table 2). The second one at the other subsidy levels (II and IV) is designed to challenge the effect of tax credit. We use a slightly smaller absolute subsidy amount for tax credit (1.00) than for grant (1.13) at the subsidy level II. The different absolute amount of the subsidy is compensated by variating the gross payoffs in a way that the net values are the same for both treatments. This way – at the subsidy level II – the gross values for tax credit are slightly higher than for grant. We implement the opposite setting on subsidy level IV where the absolute subsidy amount of tax credit (2.00) is now slightly higher than for grant (1.88). Here, the gross values are slightly higher for grant so that the same net values are used for both subsidy types again.

[Table 2]

Risk is varied in four levels. By increasing the difference between the payoff levels of the eight states of nature in the investment situations, higher standard deviation represents a higher risk level. Risk variation is identical for both subsidy types. The 16 investment decisions are therefore a combination of the four risk levels and the four subsidy levels. This way the design allows observing the link between an increasing risk level and the benefit of a subsidy. Table 3 provides an overview of the different risk levels in the various investment decisions. To minimize learning effects the investment decisions were presented randomly to the participants.

[Table 3]

3.2 Experimental protocol

In the beginning of each treatment, we conduct the risk elicitation task of Holt and Laury (2002) to measure the risk attitude of our participants in order to avoid that an uneven distribution of risk aversion would distort our results. In our case the difference between both treatments is not significant. Therefore subjects had a similar willingness to take risk in the grant and tax credit treatment.

We then read out loud the instructions of the second part and proceed to the actual experiment after all participants pass a test of understanding. To make sure that all participants make informed decisions we provided a “what if-calculator” and a pocket calculator that are available during the whole time of the experiment. The former allows subjects to automatically calculate their net profit for the current selection of alternatives before making a final decision. At the end, the participants are asked to complete a questionnaire regarding individual characteristics such as gender, age, and education.

The experiment was conducted at the computerized experimental laboratory at the Otto-von-Guericke-University Magdeburg (MaXLab) in January 2013 and was programmed with z-Tree (Fischbacher (2007)). In sum, 46 students participated in the two treatments and 23 each took part in one treatment. The students were recruited with ORSEE (Greiner (2004)). The majority of the students majored in Economics and Management. The participants completed the tasks at individual speed but both treatments took nearly 1 3/4 hours on average and the participants earned an average of 13.63 Euros. The payoff consisted of an amount of the risk elicitation task and one randomly drawn investment decision.

4 Results

4.1 Main findings

We use the share of endowment invested in the subsidized alternative B to measure how our two dimensions of subsidy (subsidy level and subsidy type) influence investment behavior. Table 4 represents the main descriptive results.

[Table 4]

Figure 2 shows the average investment in alternative B for each subsidy level pooled over all different risk levels and both treatments. It rises from 36% on the subsidy level I, to 50% on II, to 53% on III to 61% on level IV. Kruskal-Wallis test reveals significant differences across levels ($p < 0.001$, two-sided). Pairwise comparisons show that all level differences are significant (Mann-Whitney U-test, $p < 0.1$, two-sided). The only exception is observed for the comparison of levels II and III. Although the difference between the II and III level is positive and therefore reveals the hypothesized direction, no statistically significant difference is observed ($p > 0.1$, two-sided). All other comparisons are in the hypothesized direction and statistically significant. Consequently, from a general perspective, we find that when the subsidy level is higher the participants invest on average more into the subsidized riskier alternative B. The same result holds when considering the two treatments separately (see Figure 3). Therefore, our first hypothesis is supported and we can formulate the following result:

Result 1*: Investment into a subsidized asset increases when subsidy is raised.*

[Figure 2]

[Figure 3]

The other result visible in Figure 3 is that generally the investment into the subsidized alternative B is higher under tax credit than under grant. When pooling over all subsidy levels (see Table 4), the investment in the subsidized alternative B amounts to 47.18% in the grant treatment and 52.23% in the tax credit treatment. The difference is statistically significant at the 10% level (Mann-Whitney U-Test, two-sided). This pattern is also observed for the single subsidy levels (see Figure 3). In all scenarios the investment into the subsidized asset is higher in the tax credit than in the grant treatment. The only exception is observed for the lowest subsidy level I where we do not observe a significant difference between both treatments. Generally, we can therefore conclude that the investment in the risky alternative B is higher when it is subsidized with a tax credit than with a grant.[7] Therefore our second hypothesis is supported and we can formulate our second result:

Result 2*: Investment into an asset is higher when subsidizing it with a tax credit instead of a grant.*

We conduct several linear regression analyses to confirm our descriptive and nonparametric results. Table 5 gives an overview of the employed variables. We conduct regressions displayed in Table 6 on the data pooled over all observations of all subsidy levels and both subsidy types. To control for heteroscedasticity, we use robust standard errors in all reported regressions. To verify the first hypothesis we run a regression with only the subsidy level as an independent variable (see Model 1). We find that the positive effect of a higher subsidy is significant at the 1% level. This supports hypothesis 1 and result 1. The positive

[7] Note that the risk elicitation task of Holt and Laury (2002) reveals no significant differences between both treatments. Consequently, treatment differences are not caused by risk attitude differences.

effect remains significant at the 1% level even when controlling for the subsidy type (Models 3 to 5), the risk level (Models 4 and 5), or the other control variables described in Table 5 (see Model 5). As a result, we find our above-mentioned findings confirmed.

We also conducted regressions to verify the second hypothesis. In Model 2, we use a dummy variable for the tax credit treatment and observe a positive difference between the grant and tax credit treatments. When treated with a tax credit the investment in the subsidized alternative B rises about 5 percentage points in comparison to the grant treatment. This finding is significant at the 5% level. This result remains robust even when controlling for the subsidy level (Model 3 to 5) or risk level (Model 4 and 5). In Model 5 where all control variables are included, the coefficient of the tax credit dummy variable increases to 6 percentage points and becomes significant at the 1% level. Consequently, performing regression analyses on the data is confirming our prior findings and, therefore, supporting our hypothesis 2 and result 2.

When considering the control variables we observe that if the risk level of alternative B is increased, the investment in this alternative is decreased. This effect is significant at the 1% level. The only other significant variable is gender. Male participants on average invest more into the risky alternative B than female subjects. This effect is significant at the 1% level.

[Table 5]

[Table 6]

4.2 Robustness tests

So far we looked at the data in a global manner. Our experimental design enables us to consider various data subsets to test whether our hypotheses can also be confirmed on separate subsidy levels and combinations of them.

4.2.1 Single subsidy levels

As highlighted in Figure 3, the investment level into the subsidized alternative B as well as the difference between tax credit and grant treatment depends on the subsidy level. When looking at each subsidy level separately we want to test whether the difference between the investments under tax credit is still significantly different than under grant. Considering the results of the regression analyses presented in Table 7, we observe that we only find support for the second hypothesis for the levels II and III (Model 7 and 8). Although the coefficient of the tax credit dummy is still positive in case of the subsidy level IV, the coefficient is not significant anymore (Model 9). The latter also holds for subsidy level I (Model 6). In contrast, for subsidy levels II and III, the positive tax credit effect is significant at the 5% level and even higher than in the global data set. Here the impact of utilizing tax credit instead of grant is raising the investment in alternative B about 10 percentage points. Although our second hypothesis does therefore not hold for each subsidy level, our findings clearly indicate that the subsidy type grant never outperforms the tax credit in terms of effectiveness. In contrast, investments in the tax credit treatment are either on the same level or even higher than in the grant treatment.

[Table 7]

4.2.2 Subsets of subsidy levels

In the following, we will test the difference between grant and tax credit in different subsets of the data. Regression results are presented in Table 8. In Model 10, we take a look at the subsidy levels I, II, and III for which the absolute subsidy amount under tax credit is (slightly) less than or equal to under grant ($S_c \leq S_g$) and correspondingly for which gross values under tax credit is (slightly) greater than or equal to under grant ($gross_c^i \geq gross_g^i$). See Section 3.1 and Table 2 for more details. This enables us to analyze how the absolute subsidy amount and the gross value impact our treatment effect. If the treatment effect is only driven by the absolute subsidy amount (gross value) differences between our two treatments, we would expect a higher investment level under grant (tax credit) than under tax credit (grant). Please notice that net values are still identical in both treatments (i.e., $net_c^i = net_g^i$). Again, we find that in the tax credit treatment the investment in alternative B is significantly higher than in the grant treatment. The coefficient is significant at the 5% level. Furthermore, we find that a higher subsidy level increases investment in the subsidized alternative B. The finding is in magnitude very close to the finding in the global data set and significant at the 1% level. Therefore, our hypotheses 1 and 2 are supported again.

In Model 11, we take a look at the opposite case. That means we use the subsidy levels I, III, and IV for which the absolute subsidy amount under tax credit is (slightly) greater than or equal to under grant ($S_c \geq S_g$) and correspondingly for which gross values under tax credit is (slightly) less than or equal to under grant ($gross_c^i \leq gross_g^i$). If the small subsidy amount differences and/or the small gross value differences between our two treatments are the dominating effects for our observed treatment differences, we should now observe the opposite treatment effect (compared to Model 10). However, we still find that there is a positive effect on the investment in alternative B when utilizing the tax credit rather than the grant (significant at the 10% level). Thus, we find the second hypothesis supported. As before we also find the first hypothesis confirmed at the 1% significance level. Consequently, we rule out that the small subsidy amount differences or the small gross value differences explain our treatment differences.

In Model 12, we use the two subsidy levels II and IV where the absolute subsidy amount and therefore also the gross values between both subsidy types differ. We find a very strong influence of the tax credit dummy that is with 8.35 not only higher in magnitude than in the other subsets but also significant at the 1% level. We find the second hypothesis supported. Again, also the coefficient of the subsidy level is significant at the 1% level even though with 1.18 not as high as the other subsets or the global data.

In conclusion, we can say that regardless of the subset of subsidy levels we always find higher investments into the subsidized alternative B under tax credit than under grant. Furthermore, we find in all subsets of subsidy levels that subsidy level increases investments into the subsidized alternative. Therefore, we find strong support for our hypotheses 1 and 2.

[Table 8]

5 Summary and discussion

In this study, we provide evidence that subsidy types that are identical in monetary terms can significantly differ in their behavioral responses and consequently in their effectiveness. In particular, we observe that investments into a subsidized asset are higher under tax credit than under grant. This finding is remarkable because both subsidy types are essentially very similar and lead to the same monetary consequences at the investor's and government's level. Only the mechanism of the subsidy application is different. In case of a grant, an individual gains an additional amount of money. In case of a tax credit, no money is received directly, but the tax to be paid is decreased by the amount of the tax credit. In line with prospect theory, we argue that our finding is driven by an asymmetric valuation of gains and losses. As individuals are generally loss averse, we hypothesized that a reduction of a loss in case of a tax credit is more valued than an equivalent gain in case of a grant. Consequently, we expected and observed that a tax credit leads to a stronger subsidy effect than a grant. Therefore, the results indicate that these mechanisms are enfolding a substantial impact on investment behavior. Using that knowledge, governments can 'nudge' the investors to support desired investment decisions by using a certain subsidy type. Particularly, our results suggest that when policymakers are – from a budget perspective – indifferent between providing a subsidy as a grant or as a tax credit, they should implement a tax credit.

Our finding is especially important for governments applying concepts of Behavioral Economics. The UK government, for example, founded the Behavioral Insights Team (BIT) which is developing strategies to influence people's behavior outside conventional policies. Other countries like Germany, Australia, Canada, Singapore, and Netherlands as well as international institutions such as the Wold Bank, UN agencies, OECD, and EU have also established behavioral insights units to support their programs. In this regard, tax and subsidy policies may prove to be very suitable for the application of the principles of Behavioral Economics (Congdon et al. (2009)). In fact, the combination of taxation and elements of nudging is reflected also in recent discussions. For example, Hilton et al. (2014) find that a bonus-malus tax regime seems to be a promising instrument to guide citizens towards a more environmental-friendly behavior. Keeping in mind, that originally taxation and subsidies would classify more as economic instruments and not as 'classic nudges', our results suggest that behavioral effects play a non-negligible role for the effectiveness of subsidies.

In our study we also provide evidence that a higher subsidy level increases investments into a subsidized asset. Also this is expected even from a pure monetary perspective, this robust and strong result sheds further light on the discussion of the effectiveness of subsidies and contributes to the rare literature on this topic.

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Table 1: Payoffs of all alternatives, alternative B with a subsidy type grant at subsidy level I

	Alternative A				Alternative B					Alternative C			
	gross	tax base	tax	net	gross	tax base	tax	subsidy	net	gross	tax base	tax	net
1	11.20	10.20	5.10	6.10	9.38	8.38	4.19	0.75	5.94	14.00	13.00	6.50	7.50
2	12.00	11.00	5.50	6.50	10.70	9.70	4.85	0.75	6.60	14.00	13.00	6.50	7.50
3	12.80	11.80	5.90	6.90	12.02	11.02	5.51	0.75	7.26	14.00	13.00	6.50	7.50
4	13.60	12.60	6.30	7.30	13.34	12.34	6.17	0.75	7.92	14.00	13.00	6.50	7.50
5	14.40	13.40	6.70	7.70	14.66	13.66	6.83	0.75	8.58	14.00	13.00	6.50	7.50
6	15.20	14.20	7.10	8.10	15.98	14.98	7.49	0.75	9.24	14.00	13.00	6.50	7.50
7	16.00	15.00	7.50	8.50	17.30	16.30	8.15	0.75	9.90	14.00	13.00	6.50	7.50
8	16.80	15.80	7.90	8.90	18.62	17.62	8.81	0.75	10.56	14.00	13.00	6.50	7.50
E(x)				7.50					8.25				7.50
σ_i				0.98					1.62				0.00

Note: In this table all values of one exemplary investment decision under grant and at the subsidy level I are depicted. It shows the gross value, net value, tax base, tax and subsidy for each investment alternative in each state of nature. Additionally, the expected value and the standard deviation of the net values per alternative are shown. This makes transparent that the subsidized alternative B has the highest expected value (after tax and subsidy) and is the riskiest alternative (highest standard deviation σ_i).

Table 2: Comparison of gross and net values for alternative B for all subsidy levels

Subsidy level		treatment tax credit		treatment grant
I	gross	$gross_c^i$	=	$gross_g^i$
	subsidy amount	$S_c(= 0.75)$	=	$S_g(= 0.75)$
	net	$\boldsymbol{net_c^i}$	=	$\boldsymbol{net_g^i}$
II	gross	$gross_c^i$	>	$gross_g^i$
	subsidy amount	$S_c(= 1.00)$	<	$S_g(= 1.13)$
	net	$\boldsymbol{net_c^i}$	=	$\boldsymbol{net_g^i}$
III	gross	$gross_c^i$	=	$gross_g^i$
	subsidy amount	$S_c(= 1.50)$	=	$S_g(= 1.50)$
	net	$\boldsymbol{net_c^i}$	=	$\boldsymbol{net_g^i}$
IV	gross	$gross_c^i$	<	$gross_g^i$
	subsidy amount	$S_c(= 2.00)$	>	$S_g(= 1.88)$
	net	$\boldsymbol{net_c^i}$	=	$\boldsymbol{net_g^i}$

Note: In this table, we present the differences in absolute subsidy amounts between the grant and the tax credit treatment for each subsidy level. Find in brackets the subsidy amount that is identical in all states of nature for the same subsidy level.

Table 3 Expected net payoff and standard deviation of the investment alternatives per investment decision

	sub. level I			sub. level II			sub. level III			sub. level IV		
	A	B	C	A	B	C	A	B	C	A	B	C
E(X)	7.50	8.25	7.50	7.50	8.63	7.50	7.50	9	7.50	7.5	9.38	7.50
σ_i	0.98	*1.62*	0	0.98	*1.69*	0	0.98	*1.76*	0	0.98	*1.84*	0
E(X)	7.50	8.25	7.50	7.50	8.63	7.50	7.50	9	7.50	7.50	9.38	7.50
σ_{ii}	0.98	*2.16*	0	0.98	*2.25*	0	0.98	*2.35*	0	0.98	*2.45*	0
E(X)	7.50	8.25	7.50	7.50	8.63	7.50	7.50	9	7.50	7.50	9.38	7.50
σ_{iii}	0.98	*2.69*	0	0.98	*2.82*	0	0.98	*2.94*	0	0.98	*3.06*	0
E(X)	7.50	8.25	7.50	7.50	8.63	7.50	7.50	9	7.50	7.50	9.38	7.50
σ_{iv}	0.98	*3.23*	0	0.98	*3.38*	0	0.98	*3.53*	0	0.98	*3.67*	0

Note: In this table, we present the expected values and standard deviations of the net values for all investment alternatives (A, B and C) and all 16 investment decisions. The investment decisions vary in subsidy level (I, II, III and IV) and in risk level (σ_i, σ_{ii}, σ_{iii} and σ_{iv}). The net values of each investment decision are identical for both subsidy types.

Table 4: Descriptive statistics of investment in alternative B for all subsidy levels and types

	Means of different subsidy levels (pooled over both subsidy types)				
	Subsidy levels				
	I	II	III	IV	Kruskal-Wallis
Mean	36%	50%	53%	61%	p= 0.0001
Standard deviation	31.29	32.57	52.84	61.46	
No. of obs.	184	184	184	184	
No. of par.	46	46	46	46	
	Means of different subsidy types (pooled over subsidy levels)				
	Subsidy types				
	Grant		Tax Credit		Mann-Whitney U-Test
Mean	47.18%		52.53%		p= 0.0955
Standard deviation	29.24		35.84		
No. of obs.	368		368		
No. of par.	23		23		

Note: This table presents the means, standard deviations, number of observation and number of participants per subsidy level (I, II, III and IV) and per subsidy type (grant and tax credit).Additionally, it displays the results of the non-parametric tests regarding the significance of the difference between the subsidy levels (Kuskal-Wallis) and subsidy types (Mann-Whitney U-Test).

Table 5: Definitions of variables used in the regression analyses

Dependent variable	**Description**
Investment level	Lab-points invested into alternative B (total endowment: 100 lab-points)
Independent variables	**Description**
Subsidy level	Varying level of subsidy (I, II, III and IV)
Grant	Subsidy type where the subsidy is distributed as a tax-free payment
Tax credit	Subsidy type where the subsidy is distributed as an absolute deduction from taxes
Other variables	**Description**
Risk level	Variations of the standard deviation in alternative B model different level of risks σ an investor needs to take (for the risk levels see Table 3)
Decision time	Amount of time the participants took to deciding their investment strategy for all investment decisions
Age	Age of the participant
Male dummy	Effect of the participant being male (dummy=1 if male)
Econ. major dummy	Effect of the participant majoring in economics (dummy=1 if economic major)

Note: This table lists all variables used in the regression analyses and their definitions.

Table 6: Regression analyses with dependent variable investment in alternative B

	Model 1	Model 2	Model 3	Model 4	Model 5
subsidy level	162.098***		162.098***	162.098***	162.190***
	(20.43)		(20.45)	(20.33)	(19.44)
tax credit dummy		5.345**	5.345**	5.345**	6.124***
		(2.41)	(2.32)	(2.3)	(2.23)
risk level				-3.586***	-3.604***
				(1.04)	(1)
decision time					-0.007
					(0.01)
age					-0.659
					(0.44)
male dummy					19.327***
					(2.17)
econ. major dummy					-2.819
					(2.4)
constant	21.487***	47.182***	18.815***	27.781***	30.153***
	(3.79)	(1.52)	(3.89)	(4.68)	(11.06)
adj. R^2	0.075	0.005	0.081	0.094	0.16
Observations	736	736	736	736	736

Note: This table displays the results of linear regressions of the data pooled over all subsidy levels and both subsidy types. The dependent variable in all regressions is the investment into the subsidized alternative B. Robust standard errors in parentheses. *, **, *** indicate significance at the 10%, 5% and 1% level.

Table 7: Regression analyses on each subsidy level

	Model 6 subsidy level I only	**Model 7** subsidy level II only	**Model 8** subsidy level III only	**Model 9** subsidy level IV only
tax credit dummy	-2.212	9.646**	9.988**	6.585
	(4.47)	(4.72)	(4.35)	(4.17)
risk level	-5.350***	-3.330	-4.661**	-0.874
	(2.00)	(2.02)	(2.14)	(1.86)
decision time	-0.05	0.028	0.011	-0.041***
	(0.04)	(0.02)	(0.05)	(0.02)
age	-1.730**	-0.18	-0.944	0.053
	(0.78)	(0.92)	(0.92)	(0.80)
male dummy	15.719***	13.069***	22.229***	26.479***
	(3.91)	(4.47)	(4.41)	(4.33)
econ. major dummy	-5.194	-1.481	-5.923	-0.084
	(5.31)	(4.93)	(4.71)	(4.41)
constant	83.612***	46.196**	66.573***	42.955**
	(20.30)	(21.89)	(22.80)	(19.05)
adj. R^2	0.072	0.04	0.122	0.151
Observations	184	184	184	184

Note: This table gives the results of regression analyses run on the data pooled over both subsidy types on each subsidy level (I, II, III and IV). The dependent variable in all regressions is the investment into the subsidized alternative B. Robust standard errors in parentheses. *, **, *** indicate significance at the 10%, 5% and 1% level.

Table 8: Regression analyses in three subsets of data

	Model 10 subsidy levels I, II and III	**Model 11** subsidy levels I, III and IV	**Model 12** subsidy levels II and IV
subsidy level	173.675***	173.740***	118.439***
	(31.28)	(20.09)	(31.41)
tax credit dummy	5.934**	4.688*	8.348***
	(2.61)	(2.50)	(3.16)
risk level	-4.463***	-3.691***	-2.166
	(1.18)	(1.15)	(1.38)
decision time	0.014	-0.033**	-0.006
	(0.02)	(0.02)	(0.02)
age	-0.850*	-0.889*	-0.062
	(0.52)	(0.48)	(0.62)
male dummy	16.876***	21.549***	19.736***
	(2.49)	(2.43)	(3.17)
econ. major dummy	-3.687	-3.793	-0.399
	(2.84)	(2.76)	(3.30)
constant	35.953***	33.390***	20.889
	(13.60)	(12.24)	(15.71)
adj. R^2	0.123	0.205	0.114
Observations	552	552	368

Note: This table gives the results of regressions with dependent variable investment in alternative B pooled over different subsidy levels and both subsidy types. Robust standard errors in parentheses. *, **, *** indicate significance at the 10%, 5% and 1% level.

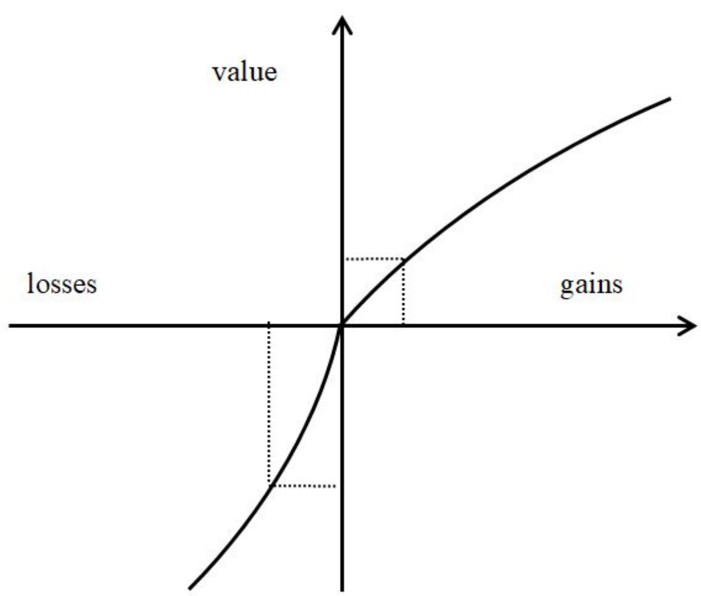

Figure 1: Value function in accordance with prospect theory

Note: In this figure, an example for a value function according to prospect theory is depicted.

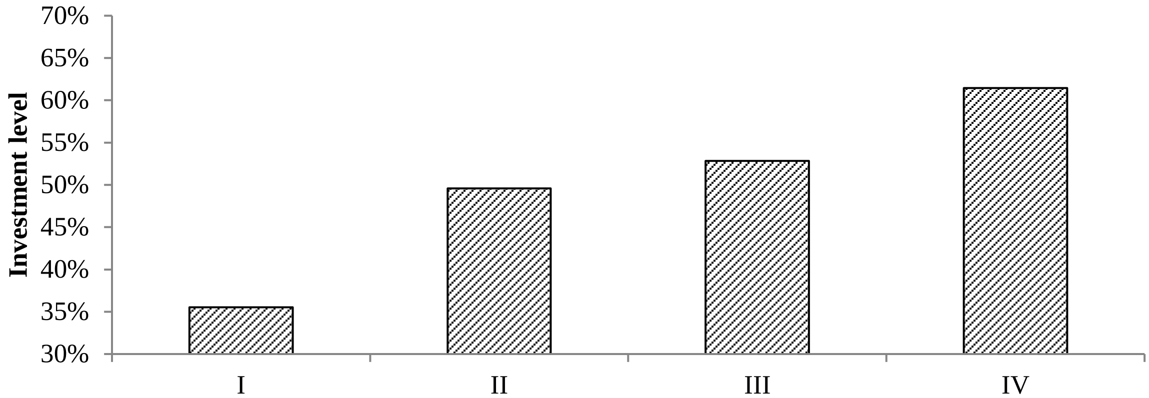

Figure 2: Average investment into the alternative B for each subsidy level

Note: This figure shows the mean investment level into the subsidized investment alternative B for each subsidy level (I, II, III and IV) pooled over both subsidy types (grant and tax credit).

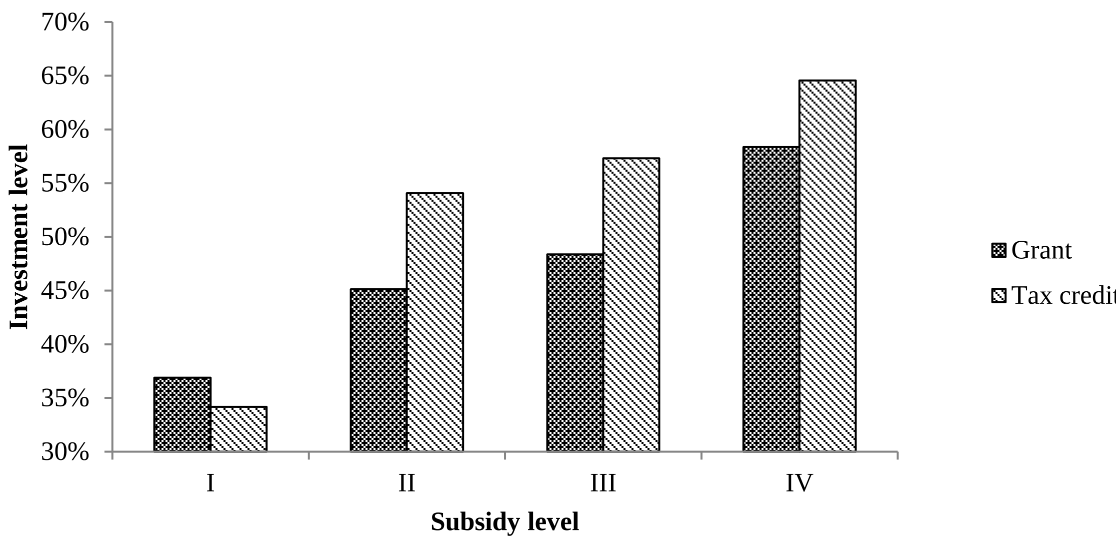

Figure 3: Average investment into the alternative B for each subsidy level and subsidy type

Note: In this figure the mean investment level into the subsidized investment alternative B for both subsidy types (grant and tax credit) is depicted according to each subsidy level (I, II, III and IV).

Online Appendix (not intended for publication)

A Instructions

We divided the instructions into two parts. The first part is identical in both treatments, whereas the second part differs in content. Following, the instructions (originally written in German) are presented.

A.1 Instructions for the first part of the experiment (same in both treatments): Holt and Laury (2002) risk elicitation task

Through the participation in this experiment, you have the possibility to earn money. The payout at the end of the experiment depends on chance and your decisions during the experiment.

We want to point out, that you are neither allowed to communicate with other participants nor allowed to leave your desk during the entire experiment. Please read the instructions thoroughly. If you have any questions, please, raise your hand. We will then come to you to answer your questions.

First, please enter your desk number on the upper right on page three.

Your task in part 1 of the experiment

The following table (see page 3) is showing 10 decision moments to you. In each situation, you have the possibility to choose either option A or option B. Both options generate two potential payouts each occurring with a certain probability.

> **Example:** *If you choose option A in situation 1, you will receive a payout of 4.00 EUR with a probability of 10% and a payout of 3.60 EUR with a probability of 90%. If you choose option B instead, you will receive a payout of 7.70 EUR with a probability of 10% and a payout of 0.20 with a probability of 90%.*

The payouts are the same in every situation whereas the probabilities of receiving the high payouts in the options A and B are raising from situation to situation.

Your payout of Part 2 of the experiment

After you finished Part 1 (you took a decision for all 10 situations) and Part 2 of the experiment we will ask you to draw a slip of paper from an urn. In the urn, there are 20 slips of paper which characterize all combinations of decision moments and states of nature. Therefore on every slip of paper, the decision moment 1 to 10 and the state of nature high or low is noted. Depending on the randomly drawn decision moment and the decision you made in that decision moment the payout (low or high) is determined. That amount will be paid out to you together with the payment from the experiment Part 1 in cash. Please be aware that the payout of Part 1 of the experiment will be determined after finishing Part 2 of the experiment.

Please choose for each of the 10 situations your preferred option. In order to do so, please tick off the checkbox A or B. Please be aware that in every situation you can only tick-off one checkbox.

	Option A Payout A1 = 4.00 EURO	 Payout A2 = 3.60 EURO	**A**
1.	10%	90%	
2.	20%	80%	
3.	30%	70%	
4.	40%	60%	
5.	50%	50%	
6.	60%	40%	
7.	70%	30%	
8.	80%	20%	
9.	90%	10%	
10.	100%	0%	

Option B Payout B1 = 7.70 EURO	 Payout B2 = 0.20 EURO	**B**
10%	90%	
20%	80%	
30%	70%	
40%	60%	
50%	50%	
60%	40%	
70%	30%	
80%	20%	
90%	10%	
100%	0%	

If you have any questions please raise your hand!

A.2 Instructions for the second part of the experiment (grant treatment)

Through the participation in this experiment, you have the possibility to earn money. The payout at the end of the experiment depends on chance and your decisions during the experiment. For reasons of simplification we will not calculate with Euro-amounts in the experiment, but with lab-points. Thereby 1 lab-point exactly corresponds to 1 Euro-cents. That means 100 lab-points exactly correspond to 1 Euro.

We want to point out, that you are neither allowed to communicate with other participants nor allowed to leave your desk during the entire experiment. Please read the instructions thoroughly. If you have any questions, please, raise your hand. We will then come to you to answer your questions.

When all participants have understood the instructions we will start with a test of understanding and then continue with part 2 of the experiment. Part 2 of the experiment has a total of 16 rounds.

Your task in part 2 of the Experiment

At the beginning of each round, you receive a start capital of 100 lab-points which you have to invest in investment objects. You can choose investment objects from three alternatives A, B and C. All investment objects are designed in a way that you can acquire several objects of a certain alternative. The price of an investment object is equivalent for all alternatives and amounts to 1 lab-point each. In each round, you have to decide how much you want to invest into alternatives A and B. The rest of your investment capital will be automatically invested in alternative C.

> **Example**: *If you decide to invest 50 lab-points in alternative A and 30 lab-points in alternative B the remaining 20 lab-points (= 100 lab-points - 50 lab-points - 30 lab-points) will be automatically invested in alternative C. This way you acquired 50 objects of alternative A, 30 objects of alternative B and 20 objects of alternative C.*

Payout of alternative A

The gross profit of alternative A depends on the realization of the state of nature. In total there are eight equally possible (p=1/8) states of nature. The possible gross earnings of the 8 states of nature will be shown to you in each round and are identical in all 16 rounds.

Your personal gross profit from alternative A is equal to the product of the actually realized gross profit of A and the number of your acquired objects of alternative A.

Example: *Is the actually realized gross profit of alternative A 12 lab-points and the number of your acquired objects of alternative A 50, your gross payout from A is resulting in 600 lab-points (= 12 lab-points/object · 50 objects).*

The gross payout will be taxed. The tax rate during the whole experiment and for all 3 alternatives A, B and C is identical and amounts to 50%. The tax base for calculating the tax is the taxable amount that results from the gross payout minus the investment costs. The investment costs correspond to the invested capital into the alternative.

Example: *Referring to the above-mentioned case the taxable amount is 550 lab-points (=600 lab-points – 50 lab-points).*

Payout of alternative B

The possible gross profit of alternative B varies across the 16 rounds. Therefore the results can differ in each round. Again, there are in total eight equally possible states of nature (p=1/8). The possible gross earnings of the 8 states of nature will be shown to you in each round.

Your personal gross profit from alternative B is equal to the product of actually realized gross profit of B and the number of your acquired objects of alternative B.

Example: *Is the actually realized gross profit of alternative B 10 lab-points and the number of your acquired objects of alternative B 30, your gross payout from B is resulting in 300 lab-points (= 10 lab-points/object · 30 objects).*

Analogue to alternative A the payout of alternative B will be taxed with a tax amount of 50% of the taxable amount. The taxable amount is again the difference between the gross profit and the investment costs i.e. the invested capital in alternative B.

Example: *Referring to the above-mentioned case of alternative B the taxable amount is 270 lab-points (=300 lab-points – 30 lab-points).*

If you choose alternative B you receive a subsidy. The subsidy is a tax-free grant. In the present example the granted grant is 2 lab-points per acquired object of type B. Therefore the net payout is the difference between the realized gross profit minus taxes plus the tax-free grant.

Example: *At a tax rate of 50% and a grant of 2 lab-points per investment the net payout after the deduction of taxes amounts to 225 lab-points (=300 lab-points – 0,5· 270 lab-points + 2 lab-points/object · 30 objects).*

Payout of alternative C

Analogue to the alternatives A and B there are in total eight equally possible states of nature (p=1/8). The possible gross earnings of the 8 states of nature will be shown to you in each round and are identical in all 16 rounds. In contrast to alternative A and B, the gross payouts of each state of nature have the same amount. That means that with certainty a constant gross profit will be realized.

The gross payout in C will also be taxed at a tax rate of 50%. The corresponding net payouts are calculated analog to alternative A.

Example: *Referring to the cases of the alternatives A and B there is a resulting investment in C of 20 lab-points (= 100 lab-points – 50 lab-points in A – 30 lab-points in B). At a tax rate of 50% and a gross payout of e.g. 11 lab-points the net profit results in 120 lab-points (= 20 objects · 11 lab-points/object – 0.5 · (20 objects · 11 lab-points/object – 20 lab-points) = 220 - 0.5 · 200).*

Total payout from A, B, and C

Your total payout of one round is the sum of the net payouts of all three alternatives. Here in the example the total payout is 670 lab-points (= 325 + 225 + 120).

Example calculation

In the following table, the example calculations are presented summarized. The following values have been assumed: 50 objects of type A; actually realized gross profit of type A is 12 lab-points/object; 30 objects of type B; actually realized gross profit of type B is 10 lab-points/object; 20 objects of type C; actually realized gross profit of type C is 11 lab-points/object.

Given values	(1) tax rate	50%
	(2) actually realized gross profit of type A	12 lab-points/object
	(3) actually realized gross profit of type B	10 lab-points/object
	(4) actually realized gross profit of type C	11 lab-points/object
	(5) investment costs	1 lab-points/object
	(6) tax-free grant for type B	2 lab-points/object
Alternative A	(7) number of objects of type A	50 objects
	(8) gross payout type A = (2) · (7)	600 lab-points
	(9) investment costs type A = (5) · (7)	50 lab-points
	(10) taxable amount = (8) – (9)	550 lab-points
	(11) amount of taxes payable = (1) · (10)	275 lab-points
	(12) net payout type A = (8) – (11)	325 lab-points
Alternative B	(13) number of objects of type B	30 objects
	(14) gross payout type B = (3) · (13)	300 lab-points
	(15) investment costs type B = (13) · (5)	30 lab-points
	(16) taxable amount = (14) – (15)	270 lab-points
	(17) amount of taxes payable = (1) · (16)	135 lab-points
	(18) tax-free grant = (13) · (6)	60 lab-points
	(19) net payout type B = (14) – (17) + (18)	225 lab-points
Alternative C	(20) number of objects of type C	20 objects
	(21) gross payout type C = (4) · (20)	220 lab-points
	(22) investment costs type C = (20) · (5)	20 lab-points
	(23) taxable amount = (21) – (22)	200 lab-points
	(24) amount of taxes payable = (1) · (23)	100 lab-points
	(25) net payout type C = (21) – (24)	120 lab-points
	(26) total payout part 2 = (12) + (19) + (25)	**670 lab-points**

Your payout from part 2 of the experiment

After you made decisions in all 16 rounds we will ask you to draw two balls from two urns respectively (urn I with the numbers 1 to 16; urn II with the numbers 1 to 8). The number on the ball from urn I gives the decision round that is relevant for your payment. The number from urn II gives the state of nature that is actually realized. Depending on how many objects of alternative A, B and C you acquired in that round the second payment of the experiment will be determined. The total payment converted in Euro in addition to the payment from Part 1 of the experiment will be handed out to you subsequent to the experiment.

General information

During the experiment, you have the possibility to perform trial calculations in each round. Here, different values (like gross and net values) will be presented to you. Additionally, you can use the pocket calculator that is provided at your desk for own calculations.

After having read the instructions we kindly ask you to first answer some questions at the computer. Please be aware that the computer program in use is dividing decimal places not with a comma but with a dot. The test of understanding is not payout relevant.

If you have any questions please raise your hand!

A.3 Instructions for the second part of the experiment (tax credit treatment)

Through the participation in this experiment, you have the possibility to earn money. The payout at the end of the experiment depends on chance and your decisions during the experiment. For reasons of simplification we will not calculate with Euro-amounts in the experiment, but with lab-points. Thereby 1 lab-point exactly corresponds to 1 Euro-cents. That means 100 lab-points exactly correspond to 1 Euro.

We want to point out, that you are neither allowed to communicate with other participants nor allowed to leave your desk during the entire experiment. Please read the instructions thoroughly. If you have any questions, please, raise your hand. We will then come to you to answer your questions.

When all participants have understood the instructions we will start with a test of understanding and then continue with part 2 of the experiment. Part 2 of the experiment has a total of 16 rounds.

Your task in part 2 of the Experiment

At the beginning of each round, you receive a start capital of 100 lab-points which you have to invest in investment objects. You can choose investment objects from three alternatives A, B and C. All investment objects are designed in a way that you can acquire several objects of a certain alternative. The price of an investment object is equivalent for all alternatives and amounts to 1 lab-point each. In each round, you have to decide how much you want to invest into alternatives A and B. The rest of your investment capital will be automatically invested in alternative C.

> **Example**: *If you decide to invest 50 lab-points in alternative A and 30 lab-points in alternative B the remaining 20 lab-points (= 100 lab-points - 50 lab-points - 30 lab-points) will be automatically invested in alternative C. This way you acquired 50 objects of alternative A, 30 objects of alternative B and 20 objects of alternative C.*

Payout of alternative A

The gross profit of alternative A depends on the realization of the state of nature. In total there are eight equally possible (p=1/8) states of nature. The possible gross earnings of the 8 states of nature will be shown to you in each round and are identical in all 16 rounds.

Your personal gross profit from alternative A is equal to the product of the actually realized gross profit of A and the number of your acquired objects of alternative A.

> **Example**: *Is the actually realized gross profit of alternative A 12 lab-points and the number of your acquired objects of alternative A 50, your gross payout from A is resulting in 600 lab-points (= 12 lab-points/object · 50 objects).*

The gross payout will be taxed. The tax rate during the whole experiment and for all 3 alternatives A, B and C is identical and amounts to 50%. The tax base for calculating the tax is the taxable amount that results from the gross payout minus the investment costs. The investment costs correspond to the invested capital into the alternative.

> **Example:** *Referring to the above-mentioned case the taxable amount is 550 lab-points (=600 lab-points – 50 lab-points).*

Payout of alternative B

The possible gross profit of alternative B varies across the 16 rounds. Therefore the results can differ in each round. Again, there are in total eight equally possible states of nature (p=1/8). The possible gross earnings of the 8 states of nature will be shown to you in each round.

Your personal gross profit from alternative B is equal to the product of actually realized gross profit of B and the number of your acquired objects of alternative B.

> **Example:** *Is the actually realized gross profit of alternative B 10 lab-points and the number of your acquired objects of alternative B 30, your gross payout from B is resulting in 300 lab-points (= 10 lab-points/object · 30 objects).*

Analogue to alternative A the payout of alternative B will be taxed with a tax amount of 50% of the taxable amount. The taxable amount is again the difference between the gross profit and the investment costs i.e. the invested capital in alternative B.

> **Example:** *Referring to the above-mentioned case of alternative B the taxable amount is 270 lab-points (=300 lab-points – 30 lab-points).*

If you choose alternative B you receive a subsidy. The subsidy is a reduction of your tax payable. In the present example, 100% of the investment costs can be deducted from the taxes payable. Therefore the net payout is the difference between the realized gross profit of alternative B minus a part of the taxes that have to be paid.

> **Example:** *At a tax rate of 50% and reduction of the tax payable by 30 lab-points the net payout after the deduction of taxes amounts to 195 lab-points (=300 lab-points – 0,5· 270 lab-points - 30 lab-points/object).*

Payout of alternative C

Analogue to the alternatives A and B there are in total eight equally possible states of nature (p=1/8). The possible gross earnings of the 8 states of nature will be shown to you in each round and are identical in all 16 rounds. In contrast to alternative A and B, the gross payouts of each state of nature have the same amount. That means that with certainty a constant gross profit will be realized.

The gross payout in C will also be taxed at a tax rate of 50%. The corresponding net payouts are calculated analog to alternative A.

> **Example:** *Referring to the cases of the alternatives A and B there is a resulting investment in C of 20 lab-points (= 100 lab-points – 50 lab-points in A – 30 lab-points in B). At a tax rate of 50% and a gross payout of e.g. 11 lab-points the net profit results in 120 lab-points (= 20 objects · 11 lab-points/object – 0.5 · (20 objects · 11 lab-points/object – 20 lab-points) = 220 - 0.5 · 200).*

Total payout from A, B, and C

Your total payout of one round is the sum of the net payouts of all three alternatives. Here in the example the total payout is 640 lab-points (= 325 + 195 + 120).

Example calculation

In the following table, the example calculations are presented summarized. The following values have been assumed: 50 objects of type A; actually realized gross profit of type A is 12 lab-points/object; 30 objects of type B; actually realized gross profit of type B is 10 lab-points/object; 20 objects of type C; actually realized gross profit of type C is 11 lab-points/object.

Given values	(1) tax rate	50%
	(2) actually realized gross profit of type A	12 lab-points/object
	(3) actually realized gross profit of type B	10 lab-points/object
	(4) actually realized gross profit of type C	11 lab-points/object
	(5) investment costs	1 lab-points/object
	(6) tax deductible investment costs of type B	100%
Alternative A	(7) number of objects of type A	50 objects
	(8) gross payout type A = (2) · (7)	600 lab-points
	(9) investment costs type A = (5) · (7)	50 lab-points
	(10) taxable amount = (8) – (9)	550 lab-points
	(11) amount of taxes payable = (1) · (10)	275 lab-points
	(12) net payout type A = (8) – (11)	325 lab-points
Alternative B	(13) number of objects of type B	30 objects
	(14) gross payout type B = (3) · (13)	300 lab-points
	(15) investment costs type B = (13) · (5)	30 lab-points
	(16) taxable amount = (14) – (15)	270 lab-points
	(17) amount of taxes payable = (1) · (16) – (6) · (15)	105 lab-points
	(18) net payout type B = (14) – (17) + (18)	195 lab-points
Alternative C	(19) number of objects of type C	20 objects
	(20) gross payout type C = (4) · (20)	220 lab-points
	(21) investment costs type C = (20) · (5)	20 lab-points
	(22) taxable amount = (21) – (22)	200 lab-points
	(23) amount of taxes payable = (1) · (23)	100 lab-points
	(24) net payout type C = (21) – (24)	120 lab-points
	(25) total payout part 2 = (12) + (18) + (24)	**640 lab-points**

Your payout from part 2 of the experiment

After you made decisions in all 16 rounds we will ask you to draw two balls from two urns respectively (urn I with the numbers 1 to 16; urn II with the numbers 1 to 8). The number on the ball from urn I gives the decision round that is relevant for your payment. The number from urn II gives the state of nature that is actually realized. Depending on how many objects of alternative A, B and C you acquired in that round the second payment of the experiment will be determined. The total payment converted in Euro in addition to the payment from Part 1 of the experiment will be handed out to you subsequent to the experiment.

General information

During the experiment, you have the possibility to perform trial calculations in each round. Here, different values (like gross and net values) will be presented to you. Additionally, you can use the pocket calculator that is provided at your desk for own calculations.

After having read the instructions we kindly ask you to first answer some questions at the computer. Please be aware that the computer program in use is dividing decimal places not with a comma but with a dot. The test of understanding is not payout relevant.

If you have any questions please raise your hand!

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