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THE IMPACT OF TAXES ON INDIVIDUAL LONG-TERM SAVINGS DECISION

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Abstract: This paper uses experimental methods to analyze how different forms of taxation influence the decision between immediate consumption and saving. The parameters are chosen in such a way that the treatments *No Tax*, *Immediate Taxation* and *Deferred Taxation* have identical net payoffs, which should induce the same decision-making patterns. However, we find that these expectations only apply to the treatments *No Tax* and *Immediate Taxation*. The participants in the *Deferred Taxation* treatment show a significantly weaker preference for saving which hints at a misperception of this form of taxation. This result also has political implications as many OECD countries try to incentivize voluntary saving for retirement through deferred taxation. In the experiment, however, this type of taxation leads to less saving than an economically equivalent immediate taxation of savings. Furthermore, the paper shows that individuals only partially recognize the advantages of immediate or deferred taxation compared to a classic income tax. While the periodic yield is tax exempt in systems of immediate or deferred taxation, it is taxable under a classical income tax. The latter should have a negative effect on saving decisions. However, these theoretical predictions do not hold in our experiment.

■■■ INTRODUCTION

Saving for retirement is always a matter of time preferences: saving for old-age provision as well as saving in general means diminishing present consumption while increasing consumption in the future. It is usually assumed that individuals prefer present consumption to future consumption whereas costs and unpleasant activities are shifted to the future.

The theory of discounted utility shows that the utility (and the burden or disutility) of a future event can be expressed in present values for a given utility function by discounting with an individual's time preference rate. In the case of a positive time preference, the time factor has a devaluing effect, i.e. the utility is lower in terms of present value than of future value. It is generally accepted that individuals have a positive time preference rate for monetary inflows and therefore prefer early income to later income¹. The theory of discounted utility also applies to long-term savings decisions such as saving for retirement. Excluding risk and non-monetary parameters an individual's time preference can be interpreted as discount rate in the decision on how to dis-

¹ Empirical studies also provide evidence for this assumption. Cf. for example the work of Hausman (1979) and Landsberger (1971), who tried to measure individual discount rates empirically. Also Olson and Bailey (1981), who initially explicitly questioned this assumption conclude that the assumption of positive discount rates is convincing.

tribute one's income on today's and future consumption². An individual will only save if the future payment, discounted with the individual time preference rate, exceeds the possible immediate payment in case of non-savings. The higher the individual discount rate, the higher the return on saving must be so that the individual decides to save.

Besides time preference rates, the tax treatment of pension contributions and consequent benefits influences the willingness to save for retirement as well. In many OECD countries (e.g. Germany, the UK) pension plans are subject to deferred taxation which means that both contributions and return on investment are tax-exempt whereas pension benefits are taxable during the retirement phase. Since the yield is tax-free with deferred taxation, this represents an advantage compared to regular income taxation. When the income tax schedule is progressive, deferred taxation implies another benefit as the income usually declines during retirement and thus a lower tax rate usually applies. However, certain pension plans are taxed up front such as Roth IRA or Roth 401(k) plans in the US. Income is taxed when it is first earned, but when invested in a respective scheme any return on investment as well as withdrawals in retirement are tax-free. Assuming a constant tax rate over time deferred and immediate taxation are equivalent. Despite this equivalence, taxpayers may perceive those regimes differently due to misperceptions.

We investigate individual savings behavior in regard to different tax regimes using experimental methods. In the following study, a world without any taxation serves as a reference point. Comparing immediate and deferred taxation allows us to observe whether these regimes lead to different amounts of savings despite their economically equivalent effects and thus distort the saving decision of individuals. In addition, "classic" income taxation is included in the study in order to examine whether individuals recognize the above-mentioned advantages of immediate or deferred taxation, i.e. a tax-free return of investment. We believe that our findings are applicable to pension planning and other long-term savings decisions in real life which are dominated by tax considerations and are subject to no or low risk.

² Therefore we use the terms *time preference rate* and *discount rate* synonymously.

RELATED LITERATURE

Previous experimental research shows that people often do not integrate tax regulations correctly into their decisions, which leads to unexpected distortions in their decision-making behavior³. Domar and Musgrave (1944), for example, show that a proportional tax with full loss relief increases an investor's risk tolerance compared to a situation without loss relief. Tobin (1958) confirms this result in the case of a transition from a world without taxes to a proportional tax with full loss compensation. Swenson (1989) provides one of the first empirical verifications of these results. Using a laboratory experiment, he examines investment decisions in four different tax systems that differ, among other things, in the tax treatment of losses⁴. Contrary to expectations, he observes no significant increase of risky investments when a tax system with a linear tax rate is implemented.

Fochmann, Kieseewetter and Sadrieh (2012) focus in particular on the influence of different loss deduction options. They find that participants overestimate the possibility of loss deduction due to a misperception of the tax burden⁵. Fochmann and Hemmerich (2018), among others, use a laboratory experiment as well to investigate the theoretically proven effects of taxation on risky investment decisions. They focus on the perception effect caused by taxation and try to isolate it from a real tax effect. They show that for both tax treatments the investment in the risky investment is significantly lower compared to the situation without taxes. While this result is expected for the case without loss compensation, the effect in the treatment with full loss deduction should point in the opposite direction⁶.

The above-mentioned research analyzes the relationship between taxes and risky investment decisions. On the other hand, there are only very few experimental studies on the influence of taxes on decisions to re-allocate one's income stream over the whole life cycle as is the case with retirement planning. This

³ For an overview see Chetty (2015) and Czerwonka (2015).

⁴ See Swenson (1989, p. 61).

⁵ See Fochmann, Kieseewetter and Sadrieh (2012, p. 239).

⁶ Fochmann, Hemmerich and Kieseewetter (2016) examine the perception effect more closely. The authors conclude that there is a positive correlation between the cognitive load of the participants and the tax-related perception effect. Nevertheless, the effect remains even with very low cognitive load.

kind of savings decision is typically characterized by rather low investment risk but considerable tax incentives and tax risks. One of the first such studies was conducted by Meade (1995). She uses an experimental design to investigate how income and consumption tax systems and future uncertainties about the tax rate affect saving and risk taking⁷. The results show that a consumption tax system is neutral with respect to proportional saving and risk taking when both current and future tax rates are certain. An income tax system, however, reduces relative saving and increases risk taking. Under uncertainty about future tax rates the effects are more complex. Nevertheless, they suggest that such an uncertainty affects the savings and risk neutrality of a consumption tax system while reducing the risk incentive of an income tax system.

Beshears, Choi, Laibson and Madrian (2017) use a survey experiment to analyze savings behavior when retirement contributions are taxed up front. Participants have to make savings decisions for a married couple in such a way as to ensure a constant standard of living. Depending on the respective treatment, either an immediate or deferred tax regime is applied or the participants can choose between both. The authors would have expected participants to recommend a lower relative savings rate with immediate taxation. However, the results show that there are hardly any differences between treatments. Therefore, the authors suspect that the respondents do not understand the tax rules and/or ignore them.

Brown, Cederburg and O'Doherty (2017) use an online experiment to investigate how immediate or deferred taxation of retirement plans affect participants' savings behavior. If certain after-tax monetary goals are specified, participants will invest in riskier and more profitable assets under immediate taxation than under deferred taxation. The authors conclude that under deferred taxation, investors do not take enough risk to accumulate sufficient savings. With immediate taxation, on the other hand, taxation does not distort the savings decision. However, this effect can be avoided if monetary targets are reframed into pre-tax amounts or if participants are informed about the consequences of their specific savings decision.

Blaufus and Milde (2020) provide evidence of misperceptions of certain tax regulations with respect to savings formation by using a two-phase life cycle model in a laboratory experiment. The first phase represents the acquisition phase, the second the retirement phase. In the acquisition phase, the partici-

⁷ See Meade (1995, p. 636).

pants perform a task to earn money. After each working period, the participants decide how much of this money they want to save. Depending on which treatment a participant is assigned to, taxation of the savings is up front or deferred. The authors show that a deferred taxation leads to inefficiently low savings compared to an economically equivalent immediate taxation, which they explain by a misperception of deferred taxation.

All in all, experimental economic studies often reveal decision patterns that do not correspond to behavior that is rational from a theoretical point of view. In particular, individuals often do not correctly integrate certain tax regulations into their decisions. One explanation is the perception effect introduced by Fochmann and Hemmerich (2018). The question therefore arises whether such distortions triggered by taxation also occur in retirement planning which is characterized by a special tax regime and low investment risk.

ECONOMIC BACKGROUND AND HYPOTHESES

To investigate the influence of different tax regimes on individual long-term savings decision we conducted a laboratory experiment with four different treatments: *No Tax* (NT), *Deferred Taxation* (DT), *Immediate Taxation* (BT), and *Income Tax* (IT). In the following section we show how these treatments affect the amount of savings. Therefore, we consider a model with only two periods and payment dates t_1 and t_2 . Let Z be the gross amount that the individual spends on savings at t_1 . Assuming a world without tax (treatment *No Tax*), the investment amount, return i , and savings are not subject to taxation. Therefore, the available amount S^{NT} at time t_2 is calculated as follows

$$S^{NT} = Z \cdot (1+i) \quad (1)$$

In a world with taxes, the amount Z at time t_1 should now be subject to the tax rate s_b , whereas the tax rate at time t_2 is s_q . Considering an immediate (back-loaded) tax regime, the investment amount has to be paid from taxed income, i.e. the gross amount Z is subject to taxation at the tax rate s_b . The remaining amount after taxes generates the return i . This results in the amount S^{BT} at time t_2 :

$$S^{BT} = Z \cdot (1-s_b) \cdot (1+i) \quad (2)$$

On the other hand, assuming a deferred taxation regime, the gross amount Z in whole can be invested since there is no taxation in t_1 . Z generates the yield i . After taxation in t_2 with s_d , this results in the amount:

$$S^{DT} = Z \cdot (1+i) \cdot (1-s_d) \tag{3}$$

This simple formal representation shows that immediate and deferred taxation are exactly equivalent in case of $s_b = s_d$, since the result is $S^{BT} = S^{DT}$.⁸ Thus, the timing of taxation is irrelevant for profitability if the tax rate during the savings phase equals the tax rate during the payout phase and if the return on investment is tax-free.

Considering regular income taxation, however, the income generated during the savings phase is taxed periodically. This means that the gross amount Z is subject to taxation at the tax rate s_b and the return on capital is subject to capital gains tax at the tax rate s_{cgt} . The periodic net payments are calculated by applying net interest i_s instead of gross interest i . The following net amount remains in t_1 :

$$S^{IT} = Z \cdot (1-s_b) \cdot (1+i) - s_{cgt} \cdot i \cdot Z \cdot (1-s_b) = Z \cdot (1-s_b) \cdot (1+i_s) \\ \text{with } i_s = i \cdot (1-s_{cgt}) \tag{4}$$

The net amount S^{IT} is apparently lower than the net amount considering immediate or deferred taxation if $s_{cgt} > 0$.

In order to derive the hypotheses to be tested, it is necessary to specify the payout options that have so far only been presented in general terms. In principle, an individual is assumed to maximize his or her utility. In the experiment, this utility depends only on the amount of cash flow (monetary component) and the time of payment (temporary component). It is assumed that the higher (lower) the cash flow and the earlier (later) this cash flow occurs, the higher (lower) the utility. We argue under certainty, so that the individual's attitude to risk is not relevant to the decision. It is conceivable, however, that the participants over- or underestimate the influence of taxation and that distorting effects occur. In order to assess these effects, the three treatments *No Tax*, *Deferred Taxation* and *Immediate Taxation* are used. Therefore, we select the pa-

⁸ This also applies in a multi-period setting.

rameters in such a way that the possible payouts in all three treatments are net equivalent. Hence, the participants are confronted with the same net values in each treatment. Only the specified amounts of the immediate payout as well as the taxation rules differ. The following relationships ensure net equivalence. $Z^{(i)}$ represents the value of the possible immediate payout indicated in the respective treatment:

$$Z^{DT} = Z^{BT} = \frac{Z^{NT}}{1-s} \quad (5)$$

Thus, the gross immediate payouts in the two treatments *Immediate Taxation* and *Deferred Taxation* are higher than in treatment *No Tax*, while the net payouts are the same. Therefore, the possible payouts in case of savings formation are net equivalent in the three aforementioned treatments because the given gross yield i is the same. The following formula represents this relationship, where $S^{(i)}$ stands for the net payment resulting in the respective treatment in case of saving:

$$S^{DT} = S^{BT} = Z^{DT} \cdot (1+i) \cdot (1-s) = \frac{Z^{NT}}{1-s} \cdot (1+i) \cdot (1-s) = Z^{NT} \cdot (1+i) = S^{NT} \quad (6)$$

Furthermore, the experiment is intended to determine whether participants actually realize the advantage of an immediate or deferred taxation regime compared to an income tax⁹. For verification, the payout structure in the treatment *Income Tax* is chosen in such a way that the gross values correspond to those in the treatments *Deferred Taxation* and *Immediate Taxation*. Consequently, gross equivalence applies, i.e.:

$$Z^{IT} = Z^{DT} = Z^{BT} = \frac{Z^{NT}}{1-s} \quad (7)$$

If the participant decides to save in treatment *Income Tax*, he will receive a lower net payout than in the remaining three treatments, in which the net payments are equivalent. Under the assumption $s > 0$, the following applies:

⁹ As explained above, this advantage results because the return on investment is tax-free.

$$S^{IT} = Z^{IT} \cdot (1-s) \cdot (1+i_s) = \frac{Z^{NT}}{1-s} \cdot (1-s) \cdot (1+i_s) = Z^{NT} \cdot (1+i_s) < S^{NT} = S^{BT} = S^{DT} \quad (8)$$

Table 1 provides an overview of the four treatments and summarizes the payout structure.

Table 1. Characteristics of treatments and payout structure

Treatment	type of taxation	payment structure			
		immediate payout	saving		
NT	No Tax	Z^{NT}	$S^{NT} = Z^{NT} \cdot (1+i)$		
DT	Taxation of immediate payout at tax rate s	$Z^{DT} = \frac{Z^{NT}}{1-s}$	$S^{DT} = Z^{DT} \cdot (1+i) \cdot (1-s)$ $= \frac{Z^{NT}}{1-s} \cdot (1+i) \cdot (1-s)$ $= S^{NT}$		Payout after taxation is equivalent to the payout in treatment NT
	Investment and return on investment are tax free				
	Taxation of late payout at tax rate s				
BT	Taxation of immediate payout at tax rate s	$Z^{BT} = \frac{Z^{NT}}{1-s}$	$S^{BT} = Z^{BT} \cdot (1-s) \cdot (1+i)$ $= \frac{Z^{NT}}{1-s} \cdot (1-s) \cdot (1+i)$ $= S^{NT}$		Payout after taxation is equivalent to the payout in treatment NT
	Taxation of invested amount at tax rate s				
	Payout and yield are tax free				
IT	Taxation of immediate payout at tax rate s	$Z^{IT} = \frac{Z^{NT}}{1-s}$	$S^{IT} = Z^{IT} \cdot (1-s) \cdot (1+i_s)$ $= \frac{Z^{NT}}{1-s} \cdot (1-s) \cdot (1+i_s)$ $< S^{NT}$		Payout before taxation is equivalent to the payout in treatment NT
	Taxation of invested amount & yield at tax rate s				
	Payout is tax free				

Source: own representation.

If participants in the treatments *Deferred Taxation* and *Immediate Taxation* integrate the respective tax regulations correctly in their decisions, they should reveal the same preference for or against the formation of savings as participants in the treatment *No Tax*, since they are faced with identical net payments. Also a bilateral comparison of the *Deferred Taxation* and *Immediate Taxation* treatments should not reveal different savings decisions. This results in the following hypotheses:

- Hypothesis 1a:* Participants in treatments **No Tax** and **Immediate Taxation** show the same decision pattern concerning the number of decisions in favor of saving.
- Hypothesis 1b:* Participants in treatments **No Tax** and **Deferred Taxation** show the same decision pattern concerning the number of decisions in favor of saving.
- Hypothesis 2:* Participants in treatments **Deferred Taxation** and **Immediate Taxation** show the same decision pattern concerning the number of decisions in favor of saving.

Regarding an income tax regime, the periodically accruing returns on capital are taxable. Consequently, the participants' preference for savings formation in the *Income Tax* treatment should be lower than in the other treatments:

- Hypothesis 3:* Participants in the treatment **Income Tax** decide less often in favor of saving than those in the other treatments.

RESEARCH METHODOLOGY AND RESEARCH PROCESS

We analyze whether and to what extent taxation influences savings decisions in two steps: Part 1 of the experiment is based on the contribution of Harrison, Lau and Williams (2002). At first, we measure the time preferences of participants, since these influence their savings decisions.

In part 2 each participant is randomly assigned to one of four treatments, which represents a between-subjects design. Here, the participants decide between an early payout, which represents immediate consumption, and a late payout, which represents savings. This part also determines the participants' remuneration, which depends on the decisions made during the experiment (and on chance). In order to get this additional reward, the participants have to fulfill a task before ("real effort task"). This ensures that the participants have to work for the additional reward and do not just get it without any effort. After part 2 of the experiment, participants answer a questionnaire on socio-demographic and economic characteristics¹⁰.

¹⁰ The socio-demographic and economic characteristics were included in several logistic regression analysis, which are available from the authors upon request.

The experiment was conducted in August 2018 at the Julius-Maximilians-University of Wuerzburg with a total of 80 students¹¹ (30 women and 50 men) in seven sessions. The instructions for the experiment were displayed to the participants on the computer screen and additionally provided in paper form. Apart from a calculator, the participants were not allowed to use any other tools. The experiment was created with the browser-based application *Enterprise Feedback Suite (EFS) Survey*.

On average each session lasted about 75 minutes¹². At the end of a session, each participant received a show-up fee of five euros in cash. In addition, only one randomly selected decision from part 2 of the experiment determined the amount of the total payout for a participant. The mean of the additional payout over the 80 participants was 14.89 euros¹³. Thus, the mean value of the total payout including the participation fee was 19.89 euros. Based on the average duration of a session of approximately 75 minutes, this results in an average hourly wage of approximately 15.80 euros.

We measure the participants' time preferences using the binary choice method. This means that the participants are confronted with a series of decisions in which they have to choose between an early payout and a late payout. The two options are mutually exclusive¹⁴.

Each participant faces a total of 60 decision in Part 1 of the experiment, divided into three parts with 20 decisions each. In each of these parts a different time horizon for late payout is chosen. While the (hypothetical) early payout

¹¹ A common criticism of experimental studies is that students are not representative of the entire population. While this may be true in principle, various studies show that students and non-students, on the other hand, behave similarly, see for example Alm, Bloomquist and McKee (2015). Using experiments on tax compliance, they show that students and non-students exhibit almost identical behavior.

¹² The number of participants in the individual sessions varied between five and 21. Sessions with a larger number of participants lasted longer than those with fewer participants. The shortest session with only five participants lasted 63 minutes and the longest session with 21 participants lasted 95 minutes. The reason for these differences is mainly due to the fact that the participants were paid individually one after the other after the experiment.

¹³ Minimum: 7.50 €, maximum: 25.00 €, median: 12.00 €; standard deviation: 5.94 €.

¹⁴ The structure of this part is based on the procedure in Harrison, Lau and Williams (2002), with the difference that in this part of the experiment the participants make only hypothetical decisions. Consequently, they do not receive separate remuneration for these decisions.

always takes place one month after the experiment¹⁵, the (hypothetical) late payout is made either in seven months (corresponding to a six-month time horizon between early and late payout), in 13 months (one-year time horizon) or in 25 months (two-year time horizon). For each of these three time horizons, the participants make 20 decisions. The early payout is always 3,000 euros, the late payout is always higher than 3,000 euros. To determine the late disbursement, nominal yields vary between 2.5 and 50 percent p.a., resulting in an effective interest rate between 2.52 and 60.18 percent¹⁶. The assumed yields are the same for the 12- and 24-month time horizon. In the experiment, nominal and effective returns are not given. Using the binary choice method, it is not possible to determine a specific value for the time preference rate, but only an interval.

After measuring the time preferences the participants have to complete a real effort task by digitizing exam results from a handwritten list. The participants do not need any special knowledge for this, but it requires a certain mental and real work effort, which avoids the “house money effect”.¹⁷ The reward that the individual participants can earn in the further course of the experiment does not depend on the results of the real effort task. This means that all participants have the same initial setup for the following decision situations.

In the second part of the experiment, a classic consumption-savings decision of an individual is simulated. The subjects earn a certain (fixed) amount of money through the real effort task described above. This amount of money

¹⁵ The time of early payment is therefore also in the future (“front end delay”). This prevents participants from combining different transaction costs with the two payment alternatives. Thus, participants could ascribe higher transaction costs and possibly a higher risk to a future payment than to an immediate payout. These effects might distort the time preference rate of this participant, see also Harrison et al. (2002, p. 1607).

¹⁶ As with Harrison et al. (2002, p. 1610) we assume quarterly interest payment periods for the relation between nominal and effective interest rates.

¹⁷ The house money effect is usually found in investment decisions under risk. However, it is also conceivable that a similar effect occurs in decisions between early and late payouts, so that it could become relevant for the experiment. For example, a participant might be more willing to wait a longer time for his payout if he considers this payout to be a “gift” from the outset. The results of the literature with regard to the house money effect are presented in Clark (2002) and Weber and Zuchel (2005) for instance. On the house money effect of risky investment decisions, see in particular Thaler and Johnson (1990, p. 657).

can be paid out or saved instead. If the participant decides to save, the saved amount will yield interest. However, if the amount is paid out, the individual receives the saved amount at face value. In reality, the decision regarding savings respectively retirement provisions usually covers several years or decades. Yet such a long time horizon can hardly be depicted in an experiment. In order to be able to integrate the time component of a savings decision into the experiment, two periods are modelled. If immediate payout is chosen, payout occurs at an early point in time but not immediately after the experiment as a front-end delay was integrated in order to avoid distortions. In contrast, payout occurs four months after the experiment took place, if savings are chosen. Lump-sum payments are made both for immediate payout and for savings formation.

In the experiment, the participants each make 20 independent decisions between immediate payout and saving. The amount of the immediate payout as well as the safe return on savings are known in advance in each situation. The amount of payout and the rate of return vary in each situation. Depending on the treatment, information on taxation is given. The order of the 20 decisions is randomized for each participant to avoid order effects.

The reward for each subject depends on his decisions during part 2 of the experiment and on chance. On the one hand, the participants are randomly assigned to one of the four treatments and on the other hand, only one of the 20 decisions from part 2 determines the additional reward. The decisive decision situation is determined by rolling a 20-sided dice after the experiment. The number thrown then represents the decision situation relevant for the additional payment.

The way in which this additional payment is made is of particular importance in the experiment, since the additional payment is made at different times depending on the decision of the participants. The participants receive their additional payment by bank transfer to a German bank account they have specified before the experiment. Due to internal procedures at the university, the early payment cannot be transferred to the participants earlier than 14 days after the experiment. In the case of savings, however, the transfer deadline is exactly four months after the experiment, so that the difference between earlier and later payment is about 3.5 months. For the amounts of money selected in the experiment, this period should be considered sufficiently long to put the participants in an actual “trade-off situation” between an early and a late payout.

FINDINGS

In the following section we examine whether and to what extent the different tax regimes influence the participants' decisions for or against savings. Therefore, we will first verify hypotheses 1a and 1b. With regard to descriptive statistics, the absolute number of decisions to save is determined for each participant, which can be a maximum of 20. We compare the treatments to see if they differ in terms of the absolute number of savings decisions. Table 2 presents the relevant values.

Table 2. Number of decisions for late payout

Treatment	mean	median	standard deviation	number of participants	number of observations
all	12.50	12.5	5.28	80	1.600
NT	13.89	14.5	5.64	18	360
IT	12.05	12	5.90	22	440
BT	13.44	15	4.47	18	360
DT	11.05	12	4.43	22	440

Source: own data.

The data show that mean and median in the treatment *No Tax* only slightly deviate from the respective values in the treatment *Immediate Taxation*. Due to the net equivalence of the payments and the fact that the individual discount rates of the participants do not differ significantly, the amount of decisions in favor of late payout should be the same in these two treatments. Descriptive statistics suggest that this is the case, which is why hypothesis 1a seems to be confirmed. On the other hand, the results show that both mean and median in the treatment *Deferred Taxation* are lower than in the treatment *No Tax*. Since net equivalence applies here as well and no significantly different discount rates of the subjects were found, this result does not meet expectations. Rather, according to hypothesis 1b, we would have expected the decisions in favor of saving to be similarly high in both treatments. Based on descriptive statistics, hypothesis 1b must therefore be rejected.

We verify these findings by Mann-Whitney U tests (two-sided) for independent samples. The underlying null hypothesis in each case is: When comparing two treatments, the decisions in favor of saving is the same. If this null hypothesis is rejected, the participants in the compared treatments show different decision behavior. The Mann-Whitney U test, which compares the *No Tax* and *Immediate Taxation* treatments, yields a p-value of $p = 0.6227$. The decision behavior of the participants in the *No Tax* and *Immediate Taxation* treatments is not significantly different and hypothesis 1a is confirmed.

Comparing the treatments *No Tax* and *Deferred Taxation*, the p-value is $p = 0.0719$. Thus, there is a significant difference between the treatments *No Tax* and *Deferred Taxation* at the 10%-level. This confirms the perception of the descriptive statistics. Participants in the treatment *No Tax* and *Deferred Taxation* actually choose to save less often, although the net payouts are the same and the time preferences of the participants in these treatments are not significantly different. Accordingly, the null hypothesis of this Mann-Whitney U test is rejected, which also leads to a rejection of hypothesis 1b.

Analogous to the test of hypotheses 1a and 1b, hypothesis 2 is verified. Table 2 shows that both mean and median in the treatment *Deferred Taxation* are lower. A Mann-Whitney U test (two-sided) reveals the difference as significant at the 10% level ($p = 0.0881$). What was already suspected based on the findings for hypotheses 1a and 1b is confirmed for the pairwise comparison of the treatments *Immediate Taxation* and *Deferred Taxation*. Accordingly, hypothesis 2 must be rejected.

At this point, we put these findings into the context of the experiment. The results show that participants are less likely to opt for saving despite net-equivalent parameterization and similar time preferences in the treatment *Deferred Taxation*. This suggests that the deferred taxation in the experiment distorts the decisions of the participants. According to the terminology used in Fochmann and Hemmerich (2018), there is a perception effect of taxation. The subjects apparently assume that deferred taxation burdens savings more than it is actually the case. As a result, they decide to save less often, i.e. the deferred taxation distorts the decisions of the participants in the experiment. On the other hand, there are no relevant differences in the decision behavior between the treatments *No Tax* and *Immediate Taxation*. The median for the number of decisions for late payout is even slightly higher in the treatment *Immediate Taxation* than in the treatment *No Tax*. However, the differences between these treatments are not statistically significant. Thus, this type of taxation seems not to

distort the savings behavior. Hence, there is no perception effect regarding immediate taxation.

In the following section we include the treatment *Income Tax*. In this treatment the payments are gross equivalent to the treatment *No Tax*. Since the return on savings is also subject to taxation, however, there are lower net returns on savings and correspondingly lower net payments. Descriptive statistics (see table 2) indicate that the median and mean value of decisions to save are lower than in the treatments *No Tax* and *Immediate Taxation*. However, this does not apply to the treatment *Deferred Taxation*, as the participants show the lowest share of saving. Using pairwise Mann-Whitney *U* tests (two-sided), we examine whether these differences are statistically significant. The *p*-values are shown in the following table 3.

Table 3. Verification of hypothesis 3 – Mann-Whitney-U test (two-sided)

	NT	BT	DT
IT	0.3117	0.5392	0.6209

Source: own data.

As expected (hypothesis 3), descriptive statistics suggest that participants in the *Income Tax* treatment decide less often to save than those in the *No Tax* and *Immediate Taxation* treatments. However, the differences are not statistically significant. When comparing the treatments *Income Tax* and *Deferred Taxation*, it should be noted that the median and mean in the treatment *Deferred Taxation* are even lower, although the net returns are higher compared to the treatment *Income Tax*. A Mann-Whitney *U* test (two-sided) also reveals that this difference is not significant. Consequently, participants in the *Income Tax* treatment do not choose to save less often, even though the net return on saving in this treatment is lower than in the other treatments. Instead, subjects decide even more often to save than in the treatment *Deferred Taxation*. This illustrates the perception effect of the deferred taxation once again. Despite higher net yields participants save less often than in the treatment *Income tax*. This may be due to the fact that the differences between the possible net payouts were not large enough as the maximum difference in net yield between the three net-equivalent treatments (*No Tax*, *Immediate Taxation* and *Deferred Taxation*) and the *Income Tax* treatment is 20 percentage points, which equals a difference in the

net payout of 30 CU¹⁸ or three euros. Differences are smaller in the other decision situations. Therefore, it is possible that the participants did not attach great importance to the taxation of the yield, or rather ignored it. As shown above, the immediate taxation does not seem to distort the decisions of the participants. Consequently, if the yield taxation were not taken into account, identical decision patterns would be expected in the treatments *No Tax* and *Income Tax*. The paired comparison using a Mann-Whitney *U* test supports this result, as a significant difference between the treatments *No Tax* and *Income Tax* could not be proven. Similarly, the differences between the treatments *No Tax* and *Immediate Taxation* are not statistically significant. Nevertheless, since descriptive statistics show a tendency towards a lower amount of decisions in favor of late payments, participants apparently did not completely ignore the taxation of returns, but its effect was at least underestimated.

However, these observations can be put into a different perspective. While in one half of the decision situations in the three tax treatments a low tax rate of 20 percent was set, a high tax rate (40 percent) applied in the other situations. In the treatment *Income Tax*, the respective tax rate applied to both the payouts and the return on savings. Consequently, the differences in net yield and net payout between the *Income Tax* treatment and the other three treatments are greater in situations with a high tax rate than in those with a low tax rate. Considering only the situations with a high tax rate, the mean of the absolute number of decisions to save in the *Income Tax* treatment is 1.41 less than in the *No Tax* treatment and the median difference is 1.5. Given that in ten situations the maximum number of decisions in favor of a late payout is ten, these differences appear to be significant. Therefore, we use once again a Mann-Whitney *U* test (two-sided) to statistically verify the differences. Regarding the decisions with a high tax rate, there is a significant difference between the treatments *No Tax* and *Income Tax*.¹⁹ Moreover, a comparison of the treatment *Income Tax* with the other two tax treatments shows that there is a significant difference to the

¹⁸ In the experiment the payouts were given in currency units (CU). Thus, the participants were confronted with larger amounts and mostly whole numbers resulted as net values. The participants were explicitly informed about this in the instructions and were given the conversion rate of 1 CU = 0.10 Euro.

¹⁹ In addition, a Mann-Whitney *U* test (two-sided) was conducted for the decision situations with low tax rate. The result is a p-value of 0.7629, so there is no significant difference. This was to be expected, since there is no significant difference for all 20 situations, whereas for the ten situations with a high tax rate there is.

treatment *Immediate Taxation* regarding the situations with a high tax rate.²⁰ However, there are no statistically significant differences to the treatment *Deferred Taxation*.²¹

Regarding only the decision situations with a high tax rate, hypothesis 3 is largely confirmed. As expected, participants in the treatment *Income Tax* decide less frequently for saving than in the remaining three treatments. Since the taxation of the net return has a stronger effect in the treatment *Income Tax*, the net return and net payment deviate more strongly. This seems to be recognized by the participants, whereas they almost completely ignore the taxation of returns when a low tax rate applies.

In summary, descriptive statistics and non-parametric tests²² show that the participants

- largely assess the burden of an immediate taxation (no perception effect of taxation) correctly,
- deferred taxation affects the savings decision negatively (negative perception effect of taxation) and
- partially ignore or underestimate the tax on returns in the treatment *Income Tax* but pay attention to it in situations with high tax rates.

This means that based on descriptive statistics and non-parametric tests

- hypothesis 1a can be accepted,
- hypotheses 1b and 2 are rejected and
- hypothesis 3 is rejected for the entire sample but is accepted for situations with high tax rates.

■■■ CONCLUSION

This paper examines the impact of different tax systems on the consumption-savings decision of individuals. Due to the parametrization, the treatments *No Tax*, *Immediate Taxation* and *Deferred Taxation* lead to identical net payments despite different tax regulations. Nevertheless, participants reveal the same decision behavior only with respect to the treatments *No Tax* and *Immediate*

²⁰ p-value of a Mann-Whitney *U* test (two-sided): 0.0736.

²¹ p-value of a Mann-Whitney *U* test (two-sided): 0.2406.

²² In order to verify the previous results, we performed several logistic regression analyses in addition to the non-parametric tests. Derived data supporting the previous findings are available upon request from the authors.

Taxation. Regarding the treatment *Deferred Taxation*, however, nonparametric tests as well as logistic regression analysis show that participants save less compared to the other treatments. Since participants perceive the impact of deferred taxation to be more negative than it actually is, a negative perception effect occurs. This result also has political implications, since many OECD countries promote savings formation and old-age provision via deferred taxation. In the experiment, however, this type of taxation results in less frequent savings. This result is in line with the findings from Blaufus and Milde (2020), who show that deferred taxation distorts the savings behavior, whereas immediate taxation does not.

Furthermore, the results suggest that participants only partially comprehend the benefits of deferred or immediate taxation compared to a classic income tax. Since the periodic return is taxable regarding the classic income tax, participants should choose to save less often than in the other treatments. Comparing immediate and deferred taxation, the findings confirm these expectations. However, the results show no difference between deferred taxation and income taxation, due to the misperception of deferred taxation.

Nevertheless, it should be noted that the actual legislation and the trade-off between immediate consumption and savings could only be represented in an abstract way. In particular, the assumption that the tax rate is the same for immediate consumption and savings formation will rarely be fulfilled in reality. Generally, the tax rate should be lower during the payout phase, which makes deferred taxation advantageous compared to immediate taxation. Moreover, the setup of the experiment was kept simple. Further studies could choose a more realistic setting, e.g. by extending the time horizon between earlier and later payments and using recurring payments instead of one-off payments. If such modifications of the present experiment are possible, the framing could also be adjusted accordingly. Thus, the two alternatives could actually be called “immediate consumption” and “old-age provision”.

Regardless of these limitations, we believe that the results of this experiment are relevant for real life savings decisions. Like Blaufus and Milde (2020), we show that deferred taxation can have a negative and distorting effect on savings decisions. This is even more remarkable because the structure of the experiment and the decisions to be made by the participants differ significantly from those in Blaufus and Milde (2020). Whereas these authors’ experiment puts the focus on the smoothing of consumption over the life cycle through saving, our design makes salient the main effect of any risk-free investment which

is that earning a return on an investment comes at the cost of postponing consumption. Both experiments make sure that a rational participant who does not care about the framing but tries to maximize her earnings from participating acts exactly as if she were in a comparable real-life situation. We therefore are confident that the observed tax effects play a significant role in people's investment and retirement planning. Deferred taxation seems to have a negative effect on the willingness to invest unless other effects like learning from repetitive actions or from periodic information on future pay-offs moderate this effect.

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