Tax evasion and state productivity - An experimental study*

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November 5, 2002

Abstract

In an overlapping generations-experiment with multiple families participants can either support their parents directly and thereby reduce their tax burden or hope for tax-financed old age support. State productivity is captured by the factor with which total tax revenues are multiplied to determine old age support. This factor is systematically varied from 0.75 to 1.25. Tax payments depend on declared endowment. Tax evasion is possible, but monitored. Surprisingly state productivity influences neither direct support of own parents nor tax evasion. The main effect is that rich endowment triggers relatively low support of own parents and high (and more frequent) tax evasion.

JEL-classification code: C91, C92, H26, H55

Keywords: tax evasion, state productivity, experiment, overlapping generations-model

*Financial support from the Center for Experimental Economics at the University of Innsbruck (sponsored by *Raiffeisen-Landesbank Tirol*) is gratefully acknowledged.

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1 Introduction

Empirical studies of tax evasion can help to design optimal tax systems in the light of actual rather than assumed tax compliance (see Andreoni, Erard and Feinstein, 1998). Although one finally will want to rely on field studies, tax evasion by its definition is very unlikely to be systematically explored with the help of field data. It seems that field studies try to guess the iceberg by measuring its tip.

In experimental economics and even more in economic psychology there exists quite a tradition of studying tax evasion experimentally (see Kirchler and Maciejovsky, 2001, 2002). Most of the studies have tried to vary systematically (exogenously and endogenously) directly related parameters like the tax rate, the monitoring probability or the fines in case of detected tax fraud (see Alm, Jackson and McKee, 1992; Alm, McClelland and Schulze, 1999). One also has tried to guarantee entitlement of taxable income by making participants first earn their income before declaring it (Webley, 1991, Anderhub, Giese, Güth, Hoffmann and Otto, 2001).

Here we focus on another aspect which is neglected in usual tax evasion experiments, namely the way in which taxes are used. In a usual tax evasion experiment, tax revenues are lost for the participants meaning that experimenters collect and keep what participants pay as taxes. Anderhub et al. (2001) have tried to avoid this by allowing their participants to choose charities which would receive twice their tax payment. Another approach has been taken by Bayer and Sutter (2002) who design a contest between a taxpayer and a tax authority, where the latter receives the tax as income. Both approaches certainly give paying taxes an ethical appeal, but hardly reflect the way how states spend tax money.[1]

Our study focuses on the effects of (i) state productivity, i.e. of the productivity in using collected taxes, and (ii) the income level on tax evasion. Analysing the role of state productivity on private and public solidarity (via a tax system) and to link the issue of tax

[1] Tax revenues are mainly used for government expenditures and redistributive purposes. There is little research to elicit how citizens would like to see their taxes used. Techniques like the marginal dollar-question ("for which purpose would you like to see an additional dollar spent?") may be revealing but have obvious drawbacks. Government expenditures can be experimentally implemented by providing public goods or by redistributing taxes (Güth and Mackscheidt, 1984).

evasion to this problem is, to the best of our knowledge, a novel paradigm in experimental economics as well as in economic psychology.

In our view, it is important that taxes

- are at least partly used to help others, resp. other families,
- affect intergenerational solidarity, e.g. by being invested into a safer future, and
- are usually seen as being rather unproductively used due to shirking officials and inefficient public institutions.

Our experimental design tries to capture all three aspects although, as we readily admit, it cannot rule out artificiality altogether. More specifically, we rely on (i) multiple (two) families with (ii) three generations each which are more or less richly endowed (one family and some family members are richer than the other(s)). Taxes are used to provide old age support (one of its major purposes also in reality) without, however, ruling out intra-family solidarity. Family solidarity is possible by direct and tax deductible support of own parents. Thus the usually discussed question whether compulsory solidarity (of the modern tax and pension systems) crowds out family solidarity can be answered in an institutionally richer setup: One can avoid public solidarity either in form of legal tax evasion (by supporting the own parents) or by tax fraud (underdeclaring).

We use the overlapping generations-framework with multiple families of Güth, Sutter, Verbon and Weck-Hannemann (2001). In this overlapping generations-experiment consumption smoothing requires intergenerational transfers from young to old. This can be done directly (within-family transfer from child to parent) or publicly via redistributed taxes (paid by the presently young participants to support the presently old ones). Without intergenerational transfers everybody would suffer seriously so that the need for redistributive taxation is obvious.

More specifically, a life cycle consists of three periods: one starts young and productive, becomes old and needy and finally non-existing. After such a life cycle one is reborn.[2]

[2] (Experimental) Reincarnation allows for learning and experience effects.

Only when young a participant has to decide, namely the transfer to one's parent and the declaration of taxable income. Declaration of income is monitored randomly. When old, participants have no income, but rely on voluntary transfers from their 'children' and on their public pension. When non-existing a participant is completely inactive. Our only treatment variable is the factor capturing state productivity. Total tax revenues are multiplied by a factor, ranging from 0.75 to 1.25, which determines the level of public pensions. All participants first experience the factor 1, i.e. tax revenues are simply redistributed. Then this factor either decreases or increases (first 0.75 or 1.25, then 1.25, resp. 0.75); our conjecture being that the order does not matter much.

In the following sections 2 and 3 we describe and analyze the intergenerational model which has been used previously for studying intergenerational solidarity (Güth et al., 2001). After illustrating the details of the experimental protocol in section 4 we report the experimental results in sections 5 and 6 and offer some final remarks in section 7.

2 The model

We rely as far as possible on the notation of the experimental instructions (see Appendix) which refer to the two families as groups A and B. Both families have the same number m of members $1, 2, ..., m$. Both families together form a 'society'.

Endowments E are unequal within and across members of both families, but are only privately known. A player i has either a low ($\underline{E}$) or a high $\left(\overline{E}\right)$ endowment with $\overline{E} > \underline{E} > 0$. Rich (poor) families have more (less) members with endowment $\overline{E}$ than $\underline{E}$.

A participant receives an own endowment E_o only when young. Then he has to decide, first, on the endowment E_o^d he wants to declare for taxation, and, second, on a voluntary transfer T_o to his parent where $0 \leq T_o \leq E_o^d$. The residual $E_o^d - T_o$ is then taxed according to the prevailing tax rate τ with $0 < \tau < 1$. The available income and consumption level for a player i when young is thus

$$C_y(i) = [E_o(i) - E_o^d(i)] + (1 - \tau)\,[E_o^d(i) - T_o(i)].$$

The declared endowment is randomly verified with probality $p = 0.25$. If a subject is caught with $E^d < E$ he has to pay a fine $s > 0$, and his full endowment is taxed. Note, however, that private transfers T_o are tax deductible (with or without endowment evasion).[3] Tax revenues are used for public solidarity, i.e., for financing old-age support. Tax revenues, however, are multiplied by a factor $f \in \left[\underline{f}, \overline{f}\right]$ with $0 < \underline{f} \leq 1 \leq \overline{f}$. Factor f captures state productivity. If $f > 1$, total old-age support is larger than the total sum of collected taxes. If $f < 1$, the state is unproductive in the sense of redistributing less than the total sum of tax revenues.

In particular, old-age support thus consists of two components: When being old, one receives the voluntary transfer T_c of one's child (with endowment E_c) and half of the tax revenue paid by the two then young members of society, adjusted by the factor f of state productivity. Thus the consumption level C_o when old is given for i by

$$C_o\left(i\right) = T_c\left(i\right) + f\frac{\tau}{2}\left[E_c^d\left(i\right) - T_c\left(i\right) + E_c^d\left(j\right) - T_c\left(j\right)\right]$$

where the lower index c indicates one's child's variables, the index i (or j) the own (other) family and the superscript d the declared endowment.

The life time utility U of player i is the product of his consumption C_y when young and C_o when old, i.e.

$$U(i) = C_y(i) \cdot C_o(i).$$

The payoff is thus

$$U\left(i\right) = \left[E_o(i) - E_o^d(i) + (1-\tau)\left\{E_o^d(i) - T_o(i)\right\}\right] * \left[T_c\left(i\right) + f\frac{\tau}{2}\left\{E_c^d\left(i\right) - T_c\left(i\right) + E_c^d\left(j\right) - T_c\left(j\right)\right\}\right]$$

The game starts in period 1 when two young players ($i \in A$ and $j \in B$) decide about the declared endowments, $E_o^d(i)$ and $E_o^d(j)$, respectively the transfers, $T_o\left(i\right)$ and $T_o\left(j\right)$. Transfers in period 1 are transfered to the last generation (who thus receive $T_o\left(i\right)$ and $T_o\left(j\right)$).[4] The two players are old in period 2 where they rely on the solidarity of the then young generation etc.

[3] In many continental European countries, like Austria, Germany or the Netherlands, certain types of expenditures arising from caring for one's disabled children or parents are (partly) tax deductible.

[4] We see two major advantages of such a rule: Neither are the first transfers wasted, nor are initial conditions imposed.

Table 1 summarizes our experimental parameterization with $m = 3$. Players have either endowment $\underline{E} = 10$ or $\overline{E} = 40$, which are only private information, but not common knowledge. The rich family B receives, in total, a 50% higher endowment than family A. Note that total endowment per period $(E(i) + E(j))$ is constant, i.e. 50. The tax rate has been set at $\tau = 0.25$. The detection probability is $p = 0.25$, with a fine $s = 50$. The parameters for state productivity f are either $0.75, 1.00$ or 1.25.

		member 1	member 2	member 3
Family A	endowment E	10	40	10
Family B	endowment E	40	10	40
Tax rate τ	0.25			
Detection probability	0.25			
Fine	50			
State productivity f	0.75 / 1.00 / 1.25			

Table 1: Parameters of the model (as used in the experiment)

3 Theoretical analysis

Compared to the model of Güth et al. (2001) our model additionally varies state productivity, allows for tax evasion and keeps endowment as private information. To start with, it is profitable to choose $T_o = 0$ - even when $f = 1.25$ - since $\frac{\partial U}{\partial T_o} = -(1-\tau) < 0$ due to $0 < \tau < 1$. Evading taxes is optimally done by declaring $E_o^d = T_o$, i.e. $E_o^d = 0$, due to the fixed fine in case of detected tax fraud, given that the detection probability is $p < 1$. Thus the game theoretic benchmark solution is general opportunism with no intra-family and no voluntary public solidarity.[5] This, of course, denies any effects of our treatment variable (the state productivity parameter f).

However, for the constellation in Table 1 both, a rich and a poor participant would earn very little in case of general opportunism because C_o would be zero, except for the cases where tax evasion is detected, what happens on average in every fourth round. Therefore, positive transfers and no or at least less tax fraud would be beneficial for all subjects.

[5] Involuntary public solidarity is due to detected tax fraud.

A social optimum would aim for consumption smoothing in the sense of $C_y = C_o$ for all and full income declaration $\left(E_o = E_o^d\right)$ by all. Given the parameters in Table 1, however, general consumption smoothing would require negative transfers of some members which were not admitted.[6] Thus, the intent to smooth consumption may be the driving force for behavior, but consumption smoothing cannot be guaranteed in full extent.

Subjects were only told that endowment E *may* be different for different members of a society (see Appendix). They therefore might have considered how consumption smoothing could be achieved when all would have the same endowment E_o and declare it truthfully.[7] Then, consumption smoothing would require

$$(1-\tau)(E_o - T) = T + f\frac{\tau}{2}(2E_o - 2T)$$

or an optimal transfer T^+ of

$$T^+ = \frac{(1-\tau-f\tau)E_o}{2-\tau-f\tau}$$

For state productivity $f = 1$, that would imply transfers $T^+ = E_o/3$. With $f = 1.25$, transfers would rise to $T^+ = 0.36E_o$, and with $f = 0.75$, transfers would be smallest with $T^+ = 0.30E_o$. Hence, regarding our treatment variable f one should have expected that an increasing factor f representing state productivity and a strong concern for general consumption smoothing will lead to

- crowding out of intra-family solidarity, i.e. lower T-levels, by (the relatively more productive) state solidarity and
- a lower frequency and degree of underdeclaring due to the better use of tax revenues.

[6] This holds for all state productivity parameters f. Our numerical simulations show that member 1 of family A and member 3 of family B should give negative transfers. [Güth et al. (2001) show that the model with unequal endowments of different members - as in our case - can only be solved numerically. In case of equal endowments an analytical solution can be derived.]

[7] One interpretation is that E_o may represent the same expected endowment for all which, in the tradition of false consensus effects (see Engelmann and Strobel, 2000, for a discussion), could be specified by one's own endowment. Another interpretation, of course, is that of falsely neglecting the non-negativity of T_o.

4 Experimental design

Two families A and B consist of three members each and interact with each other during the whole experiment. The three family members of each family are in a fixed order such that own child and own parent are always identical. Each member experiences repeatedly the following life cycle: When young, one receives an income E and has to declare income (E^d) and a transfer (T). In the next period, one becomes old and has no own income, but depends on the transfer from the own child and on public solidarity through the collective tax and pension scheme whose reliability is endangered by tax fraud. After that a member becomes inactive for one period, and is finally reborn as the newly young family member in the subsequent period, etc.

The computerized experiment (using the software z-Tree by Fischbacher, 1999) consisted of three phases á 12 periods. Three periods constitute one 'round', which encompasses one complete 'life cycle' of a subject: Young, old, inactive. In each session the first four rounds (phase 1) assumed $f = 1.00$. Then the state productivity parameter changed to $\underline{f} = 0.75$ ($\overline{f} = 1.25$) in the second four rounds (phase 2) and to $\overline{f} = 1.25$ ($\underline{f} = 0.75$) in the third four rounds (phase 3).[8]

Subjects did not know in advance how many periods the experiment would last. They were only informed that after some periods there might be slight changes in the rules of the experiments.[9] After phase 1, respectively phase 2, they were given a new sheet of instructions explaining the corresponding change in the productivity parameter f. However, they were not told how many periods the new parameters would apply.

Information conditions in single periods were as follows: When young one was informed of own (fixed) endowment, of the declared endowment of own parent and about own parent's (absolute) transfer to own grandparent. With this information a subject decided on the declared endowment E^d and the transfer T to his parent.

[8] By alternating the order in which subjects face the high ($\overline{f}$) or low ($\underline{f}$) state productivity we wanted to control for (unexpected) order effects.

[9] However, when registering for the experiment, subjects were told that the experiment would last for about 2 hours. Hence, they could be sure that the experiment would not end after a few periods only.

When old, one was reminded of own C_y and informed about own C_o and how C_o is composed of T_c, the child's voluntary transfer, and of the public pension. One also got information about this round's payoff ($U = C_y \cdot C_o$), as well as about the cumulated sum of payoffs earned so far.

5 Overall Results

We ran 2 experimental sessions with 24 participants each at the University of Innsbruck in January 2002. Both sessions lasted about 1 hour and 45 minutes. Since 24 students were in one session we obtained four independent observations of 6 participants each per session, i.e. in total 8 independent observations. The participants were between 19 and 30 years old. In total, we had 23 male and 25 female students, about two thirds of them studying business administration and economics, the rest mainly enrolled in psychology and medicine. Average earnings were 23,14 Euro per subject.[10]

Since we have not found any statistically significant differences between both sessions concerning the order of facing the high or low state productivity parameter, we will pool data for a given state productivity parameter f in the following.

Table 2 provides an overview of the basic results. 'Relative transfer' is defined as T/E. The 'degree of evasion' denotes the average relation between the undeclared endowment $\left(E_o - E_o^d\right)$ and the true endowment (E_o). The 'frequency of evasion' reports the average absolute number of cases (out of 12) with subjects declaring less than their true endowment ($E^d < E$).

	All subjects	Rich ($\overline{E} = 40$)	Poor ($\underline{E} = 10$)
relative transfers	0.13	0.08	0.18
degree of evasion	0.47	0.65	0.28
frequency of evasion	7.40	9.54	5.25
average profit (per round)	95.21	156.50	33.92

Table 2: Overview of basic results

[10] Average earnings included a show up fee of 6 Euro.

The first column in Table 2 presents overall data for all 12 rounds, pooled over both sessions and all participants. The next two columns separate the data for rich and poor subjects. In general relative transfers are only about one eighth (0.13) of subjects' true endowment. Rich subjects, however, give significantly lower relative transfers (0.08) than poor subjects (0.18) ($p < 0.05$; Wilcoxon signed ranks test[11]; $N = 8$). A similar difference emerges with respect to the degree of evasion[12] which is significantly larger for rich subjects (0.65) than for poor subjects (0.28) ($p < 0.05$). Likewise, the absolute frequency of rich subjects evading own endowment is almost twice the corresponding value for poor subjects (9.54 versus 5.25; $p < 0.05$). Looking at individual data we find a significantly negative correlation ($r = -0.47$; $p < 0.01$; $N = 48$) between a subject's average relative transfers and the average degree of evasion.

Figure 1 shows average relative transfers, separated for rich and poor members, in single rounds for given state productivity factors f. Relative transfers of poor members are in any round on average higher than those of rich members. Table 3 reports average relative transfers over all four rounds with a given factor f. The difference between rich and poor subjects is significant for any factor ($p < 0.05$ for any factor). The pattern of the degree of evasion, presented is Figure 2, shows a reverse order. Rich subjects evade a larger share of their initial endowment than poor subjects, i.e. rich subjects declare a smaller fraction of their real income (taking averages for a given factor, as shown in Table 3, we have $p < 0.05$ for any factor).

	Overall			Rich			Poor		
state productivity	1.00	0.75	1.25	1.00	0.75	1.25	1.00	0.75	1.25
relative transfers	0.15	0.11	0.12	0.10	0.07	0.06	0.21	0.16	0.18
degree of evasion	0.45	0.49	0.45	0.63	0.67	0.65	0.28	0.30	0.26
frequency of evasion	2.58	2.38	2.44	2.98	2.88	2.98	1.96	1.63	1.67

Table 3: State productivity and decisions

[11] For the statistical testing we separated rich and poor members within a society of two families and considered relative transfers (and the degree of evasion) of rich, respectively poor, subjects as matched observations for which we can use a Wilcoxon signed ranks test.

[12] The degree of tax evasion, of course, takes into account tax deductible transfers, i.e. is defined as $E^d/[E-T]$.

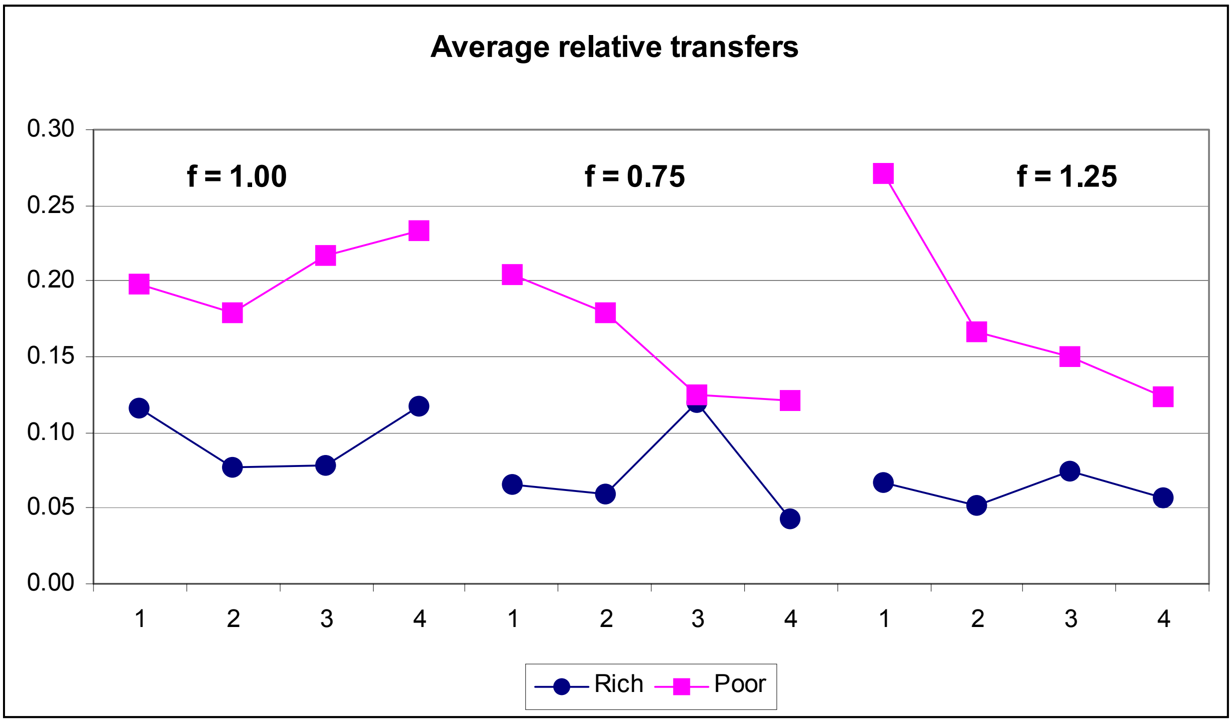

Figure 1:

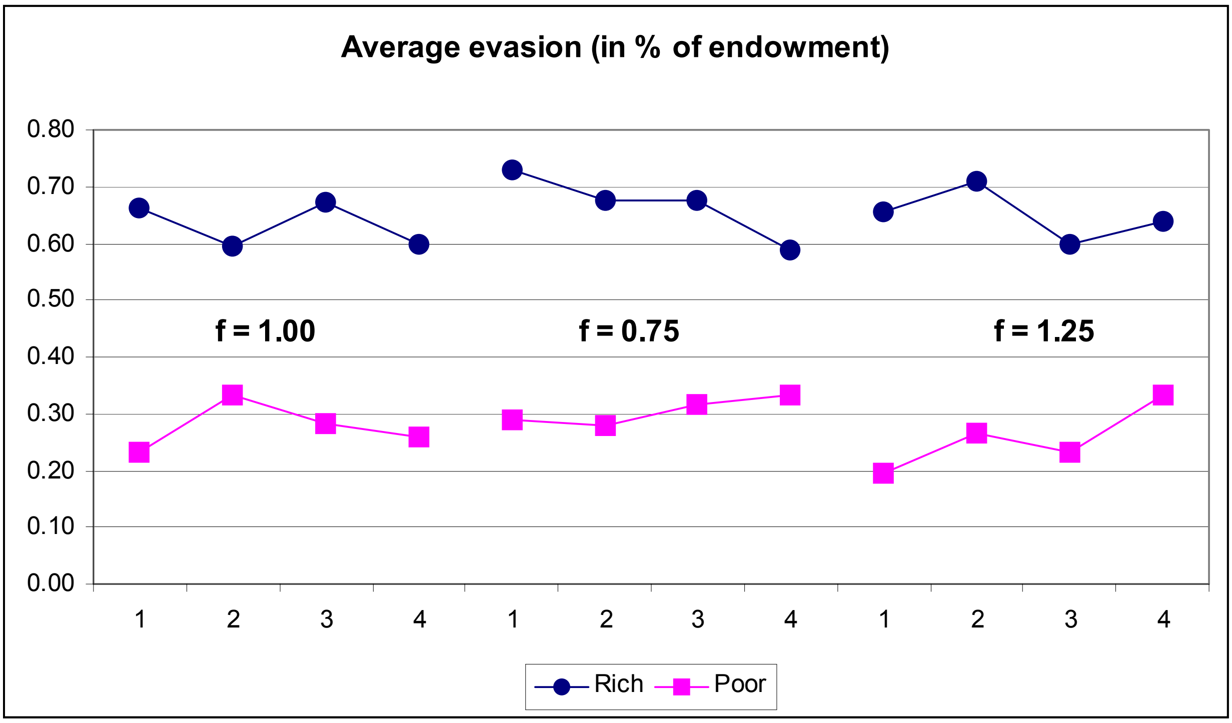

Figure 2:

Testing for the effects of the state productivity parameter f on relative transfers and the degree of evasion we only find that average relative transfers are significantly higher with productity $f = 1$ (which applies in the first four rounds in any session) than with either $\underline{f} = 0.75$ or $\overline{f} = 1.25$ ($p < 0.05$ for any pairwise comparison; Wilcoxon signed ranks test; $N = 8$). Hence, besides a decline in the relative transfers in the course of the experiment, we find no systematic effect of state productivity with respect to relative transfers. Concerning the degree of evasion, we also do not find any significant difference of evasion rates between any state productivity parameters.

Conclusion 1: Although poor state productivity is often used as an excuse for not paying taxes properly this cannot be confirmed by our experiment allowing to vary state productivity parametrically. Rather those who are luckily rich try to remain so by neither paying taxes properly nor helping their parents.

6 Why do the rich want to become even richer?

Rather than with respect to the treatment variable (state productivity) we find significant differences in the behavior of rich and poor subjects which will be analysed in more detail in the following. Figure 3 shows the number of rich, respectively poor, subjects who evaded at least parts of their endowment a given number of times (out of a maximum of 12). Although only (four) poor subjects always declared their full endowment, only rich (nine of 24) subjects evaded (at leasts parts of) their endowment in each single round.[13]

Figure 4 reveals a strong relation between the frequency of evading own endowment and the degree of evasion. For instance, if subjects do not declare fully in 3 out of 12 rounds, the average degree of evasion is about 20%. But if subjects evade 10 times or more, then their average degree of evasion is 60% or higher. However, as can be seen from Figure 5, the relationship between the frequency and the degree of evasion is only true for rich subjects. This justifies

[13]Looking at the round-to-round frequency of evasion we find a rather stable pattern. 11 (9) out of 24 poor subjects evade in the first (last) round of the experiment. The maximum (minimum) is 14 (7) subjects. 21 out of 24 rich subjects evade in the first and the last round, the maximum, respectively minimum is 21 and 16.

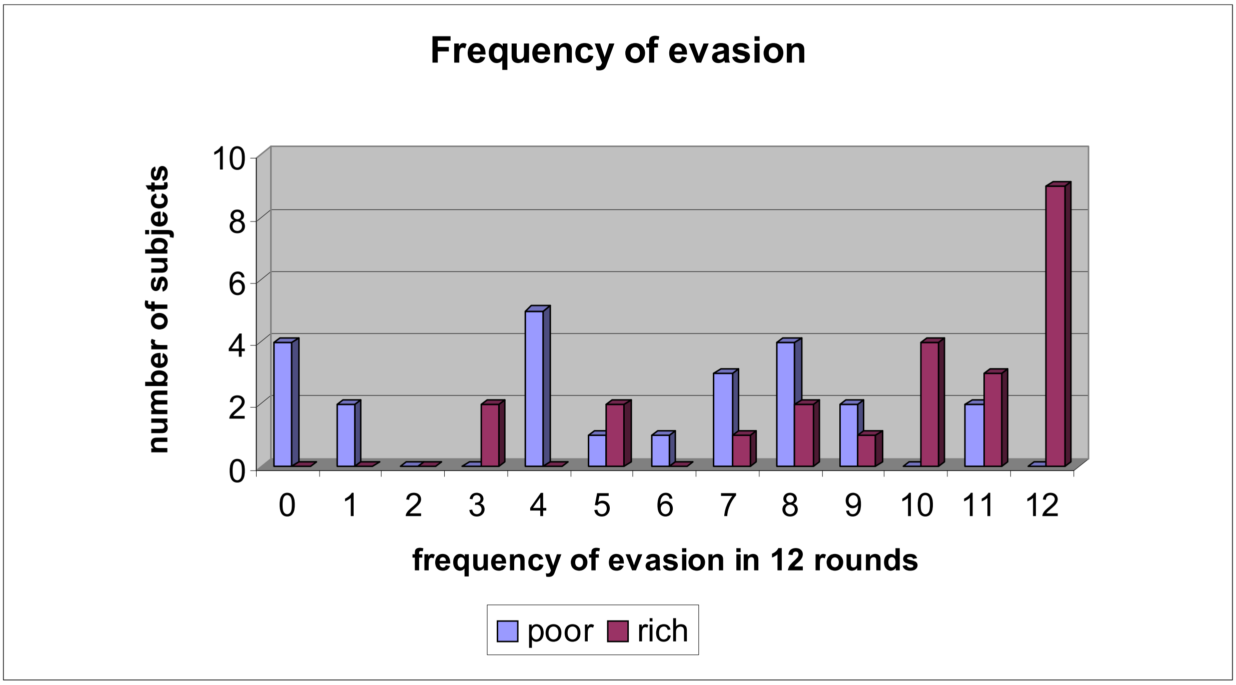

Figure 3:

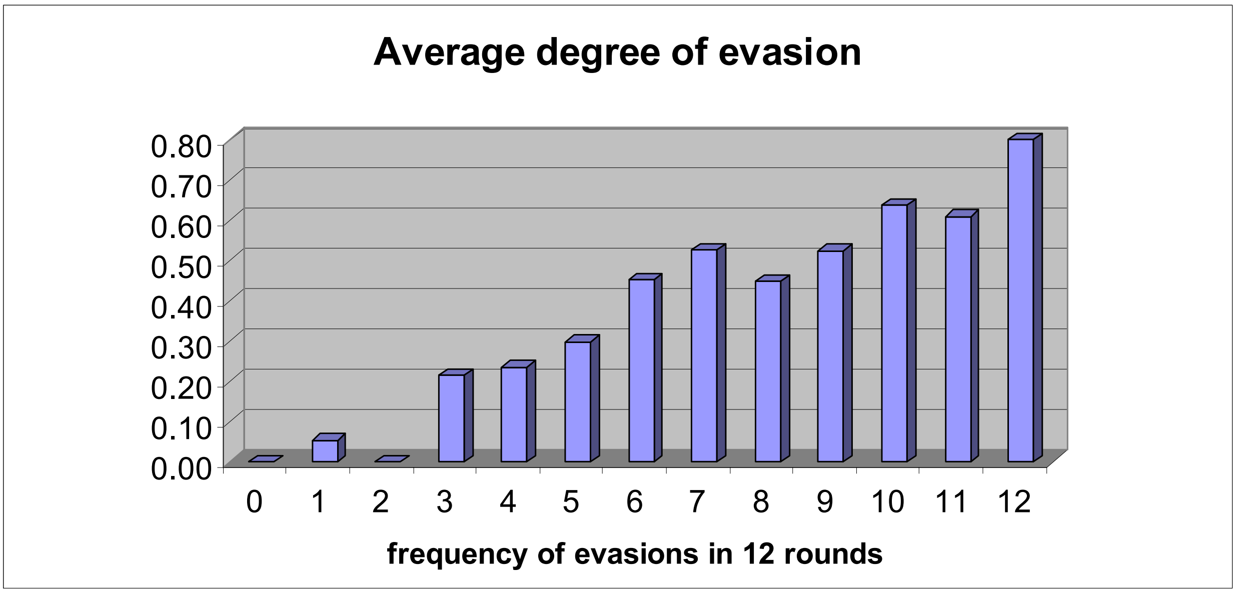

Figure 4:

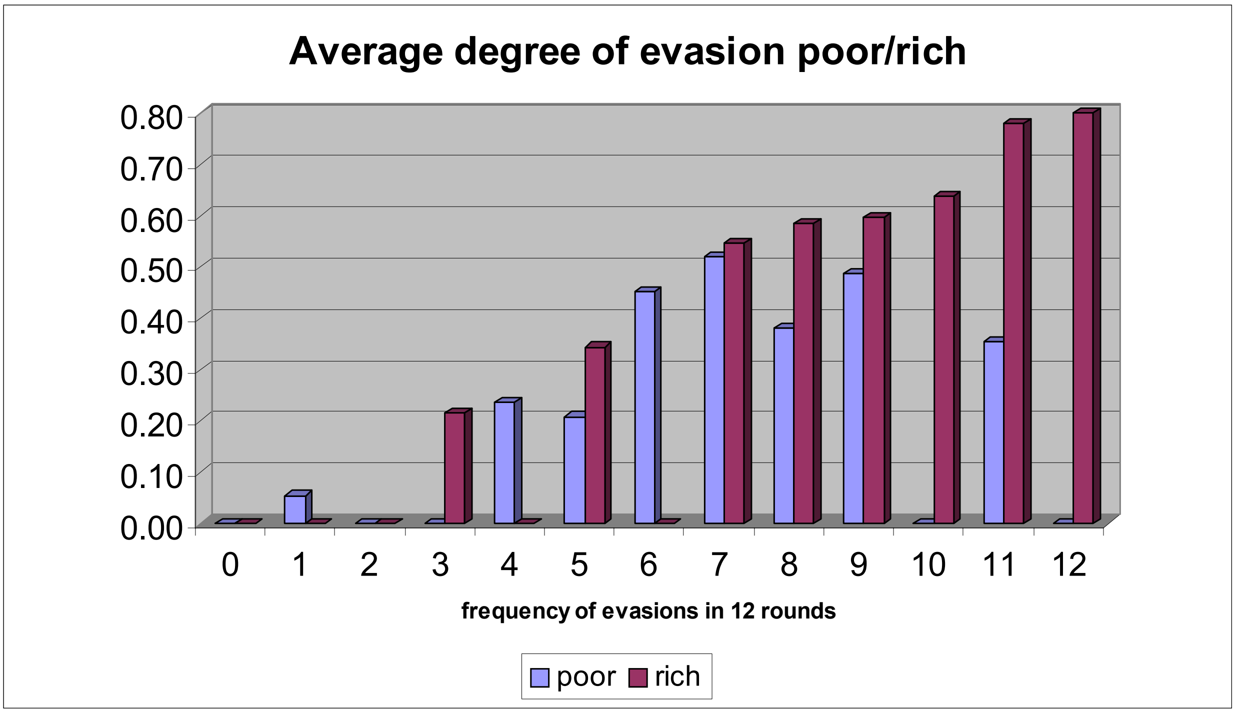

Figure 5:

Conclusion 2: Rich subjects evade more often than poor subjects. Further the more often rich subjects evade, the higher the degree of evasion. The latter relation does not hold for poor subjects.

Finally, let us examine the effects of randomly monitoring tax declarations and of possible fines. The fine was fixed at 50 points which is about one third of rich subjects' average earnings per round, but 50% above poor subjects' average earnings. Hence, the size of the fine may explain why poor subjects evade significantly less often (and to a smaller degree) than rich subjects. More generally, the frequently observed tax fraud is not in line[14] with any reasonable degree of risk attitudes (in the sense of expected utility theory).

We also checked how often a subject which had to pay a fine in round t declared his full endowment in round $t+1$. Poor subjects had to pay a fine 30 times and declared truthfully in the following round in 11 cases (37%). Rich subjects, who evaded more often, had to pay a fine 59 times, what was followed by truthful declarations in 17 cases (29%). The difference in the reaction to a fine is not significantly different according to a χ^2-test.

[14]The expected fine in case of tax fraud is $\frac{1}{4} \cdot 50 = 12.5$ and the expected maximal advantage $\frac{3}{4} \cdot \frac{1}{4} \cdot 40 = 7.5$ (if one is rich and has chosen $T = 0$).

7 Final Remarks

Clearly, our design can be used also to vary the usual treatment aspects in tax evasion studies like the tax rate, the monitoring and/or detection probabilities, or the fines (see the survey of Kirchler and Maciejovsky, 2001, and more related to the environment at hand Güth et al., 2001). In the context of an overlapping generations model with multiple families it seems quite possible that such variations yield qualitatively similar but quantitatively quite different effects. Here we have, however, focused on varying a novel design feature of tax evasion experiments, namely the factor representing state productivity in providing old age support.

Although (low) state productivity is often claimed as a major reason of (low) tax morality, we could not confirm this experimentally. Even the rather considerable change from $f = .75$ to $f = 1.25$ did not seem to matter much, neither for the degree of family solidarity, measured by intra-family support T, nor for tax morality, measured by tax fraud in the form of underdeclaring. At least according to our experimental results (low) state productivity is just an excuse but not the true cause of (low) tax morality.

A more serious drawback of our design like of most other experimental studies of tax evasion is that we did not provide entitlement in the sense that participants had to earn their income (see for a discussion of entitlement Hoffman and Spitzer, 1985). Making people earn or produce the endowments E, e.g. by investing efforts, would have complicated our design a lot and has therefore been discarded. So one might have expected a lot of solidarity, e.g. of "rich" participants who care for their more or less poor "relatives" or even co-citizens, what could have raised the criticism that we try to observe and explain how people distribute "manna from heaven". The (statistically confirmed) fact that "rich" participants support their parent less, evade taxes more often and to a higher degree than "poor" ones is therefore very astonishing. The rich like to stay rich and go a long way to achieve this. Thus if one hopes for solidarity according to our experimental results one should hope for the solidarity among the needy ones.

It is not that there is no field evidence for solidarity only among the poor and needy ones. In Germany, for instance, the mandatory health insurance and public pension schemes only apply when income does not exceed an upper bound. Although these systems impose substantial solidarity, they do allow the richer ones to opt out, a rather absurd institution if one is interested in overall solidarity. Apparently the rich are not just avoiding solidarity by neither directly supporting the needy ones nor paying their taxes properly, they also have managed to institutionalize such effects by successful lobbying.

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Appendix - not necessarily for publication (in case of publication, the instructions would be made available at one of the authors' homepages)

Instructions (originally in German)

Welcome to the experiment!

Please read the following instructions carefully. In case you have any questions, an instructor will come to you and clarify them. Please don't hesitate to ask questions.

Your decisions will remain anonymous throughout as well as after the experiment. At the end of the experiment, you will be paid privately.

Groups A and B

In the experiment, groups of 3 members each will be formed. There are groups A and groups B. At the beginning of the experiment, you will be randomly assigned to one group. A group's composition remains fixed throughout the whole experiment. One group A will be paired with one group B in the experiment. The group your group is paired with will be referred as 'parallel group' in the following. Your decisions will not only influence your group, but also the members of your parallel group.

Members of a group will be ordered randomly at the beginning of the experiment. There will be a member 1, a member 2 and a member 3. The order will be fixed throughout the experiment. Interaction within a group is characterized by a sequence of group members' decisions in the following order: member 1, member 2, member 3, member 1, ... This ordering fixes each member's predecessor as well as successor in the sequence of decisions. Each group member has a 'parallel member' in the other group he is paired with. Your parallel member has the same number as you have. At the start of the experiment, you will be informed about your member number.

The experiment lasts for several periods. In each period, there is one group member who is in an 'active' state, another one in a 'passive' state, and yet another one in a 'resting' state. The sequence of states is always the following: active, passive, resting, active ...

If you are active, your predecessor is passive and your successor is resting. For instance, if you are member 1 in your group, and you are in the active state. This means that member 3 is passive, and member 2 is resting. In the next period, member 2 is active, you are passive and member 3 is resting. And so on.

If you are active, then you have to make two decisions.

If you are passive, then you have no decision to make. However, you will be informed about your successor's decision. Furthermore, in the passive state, you receive an income.

If you are resting, then you simply have to wait until you become active again.

Endowment

In each active period, you will receive a fixed endowment. The endowment may be different for different participants in the experiment, but the same participant will always get the same endowment. If you are passive or resting, you do not get an endowment.

Decisions and income

In the active state, you have to decide on (1) how much of your endowment you would like to declare, and (2) on a transfer (in points) to your predecessor. Note that your transfer must not exceed the declared endowment. The difference between your declared endowment and your transfer will be liable to an automatic deduction of 25%. Hence, when you are active, you keep the following 'intermediate amount':

$$\text{Intermediate amount} = \text{Endowment - declared endowment} + 0.75^*(\text{Declared endowment - transfer}).$$

The same rules apply also to your parallel member who is also active.

The deductions from you and your parallel member will be pooled and transferred in equal parts to your predecessor and the predecessor in your parallel group.

After you have made your decisions in the active state, there will be a random monitoring of your declared endowment. With probability 0.25 (i.e., one out of four), your declaration will be monitored. In case your declared endowment is smaller than your true endowment, the automatic deduction will be applied to your true endowment (less the transfer). Furthermore, you will have to pay a fine of 50 points.

In the passive state, you receive no endowment, but you can get points out of two sources.

First, you can get a transfer from your successor who is then in the active state and receives an endowment for his own.

Second, you get half of the automatic deductions from your successor's and the parallel successor's intermediate amount. The other half is given to your parallel member.

The sum of revenues from both sources will be called 'allocation' henceforth. In other words

$$\text{Allocation} = \text{received transfer} + \text{half of automatic deductions from successors}$$

In the passive state, you receive an income, which is the product of your 'intermediate amount' and of your 'allocation'. To repeat

$$\text{Income} = \text{Intermediate amount} * \text{Allocation}$$

Your income from the experiment is the sum of incomes you receive when you are in a passive state. At the end of the experiment, the exchange rate will be

$$100 \text{ points} = 1.5 \text{ Euro}$$

At the end of the experiment, we will also pay a show-up fee of 400 points (= 6 Euro) for every participant.

Note that in the first period of the experiment, member 1 has no predecessor. Hence, the transfer that will be given by member 1 in the first period will be given to member 3 in the very final period of the experiment.

Information conditions and report of expectations

If you are in an active state, you receive the following information:

- your endowment,

- the transfer of your predecessor to his predecessor (who is your successor),

- the declared endowment of your predecessor.

If you have made your decisions on your declared endowment and on your transfer to your predecessor, then you will face a new screen which reports whether your declaration has been monitored and which states your 'intermediate amount'.

If you are in a passive state, then you get the following information:

- your 'intermediate amount' of the previous period (in which you were active),

- your allocation from the current round,

- how your allocation is split into the transfer from your successor and the points from the automatic deduction scheme,

- your income in this period (in points), and

- your income in the whole experiment (accumulated incomes).

The information on your income will remain private and will not be communicated to any other participant in the experiment.

After 12 periods, participants were informed that the proceeds from the successors' automatic deductions would be multiplied by a factor (0.75 in session 1, 1.25 in session 2) (phase 2). Hence, they received as formula for calculating the allocation the following equation (in session 1).

Allocation = received transfer + 0.75 * half of automatic deductions from successors

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Allocation = received transfer + 1.25 * half of automatic deductions from successors