Family Versus Public Solidarity

Güth, W.; Sutter, M.; Verbon, H.A.A.; Weck-Hannemann, H.

Publication date:
2001

No. 2001-86

FAMILY VERSUS PUBLIC SOLIDARITY - THEORY AND EXPERIMENT

By Werner Güth, Matthias Sutter, Harrie Verbon and Hannelore Weck-Hannemann

November 2001

ISSN 0924-7815

Discussion paper

Family versus public solidarity - Theory and experiment¤

Werner Güth[y], Matthias Sutter[z],
Harrie Verbon[x], and Hannelore Weck-Hannemann[z]

November 2, 2001

Abstract

We present an overlapping generations model with two families who can guarantee old age support either by intra-family transfers from child to parent or via a tax-financed public pension system encompassing both families. We derive the individually and family-specific optimal decisions and present some more behavioristic hypotheses. Our experimental observations allow conclusions on (1) whether raising taxes crowds out voluntary transfers, (2) how income distributions influence family and public solidarity, and (3) whether participants prefer more to less public solidarity.

JEL-classification code: C91, C92, D72, H55

Keywords: pension system, family decisions, solidarity, experiment, voting, crowding-out, overlapping generations-model

¤We would like to thank Richard Hule for valuable help with the numerical solution of our model, and Karim Sadrieh, Luca Rigotti and Jeroen van de Ven for helpful comments. Financial support through EU-TMR Research Network 'Structural analysis of household savings and wealth positions over the life cycle' (FMRX-CT96-0016) and through Industriellenvereinigung Tirol is gratefully acknowledged.

[y]Max-Planck-Institute for Research into Economic Systems. Strategic Interaction Unit. Kahlaische Strasse 10, D-07745 Jena, Germany

[z]University of Innsbruck, Department of Public Economics, Universitaetsstrasse 15, A - 6020 Innsbruck, Austria

[x]Corresponding author: Tilburg University, Department of Economics, P.O. Box 90153, NL - 5000 LE Tilburg, The Netherlands; e-mail: H.A.A.Verbon@kub.nl

1 Introduction

In the early development of mankind and even today in some developing countries family solidarity is the only hope for support when being old and unproductive. Modern societies have partly substituted this by compulsory pension schemes in the form of taxes redistributing income from young to old citizens. This development seriously questions the role of families as the basic solidarity units in society although intrafamily transfers are still an important factor.[1]

The paper presents an overlapping-generations (OLG) model with two families to study the interrelation between family solidarity through voluntary transfers from children to their parents and public solidarity in the form of a compulsory, tax-…nanced pension system of the pay-as-you-go type. We derive hypotheses from our model which are then tested experimentally.

It can be expected that if kinship plays a role in behavior towards others, as in real-world families, the development of transfer ‡ows will be ameliorated. As we used students as subjects, motives for giving transfers that derive from kinship can be excluded. There is a growing evidence, however, that other-regarding motives are also important determinants of behavior between unrelated subjects in economic experiments. In a very detailed study Charness and Rabin (2000) establish that a wide range of motivations among participants can be detected. Our paper is not a test of existing models of social preferences that predict concern about the payo¤ of others. For such a test we would need simple games, such as those used by Charness and Rabin (2000), that make disentangling and identifying subjects' motives possible. Rather, in setting up our model and its experimental implementation our purpose is to investigate whether in a 'family-like' context, but in the absence of feelings of empathy that may exist between parent and child, voluntary transfers will emerge, and how these transfers will react to di¤erent treatments. With the size of public solidarity, and the degree of income inequality as our treatment variables, we address three central research questions: (1) Is family solidarity (if any) crowded out

[1] In the U.S. 80% of total assets are estimated to be transferred from parents to adult children with about 50% inter vivos (see, e.g. Kotliko¤, 1988; Gale and Scholz, 1994). However, old-age support from children to parents is also non-negligible. McGarry and Schoeni (1995) report that about 7% of adult children give …nancial transfers to their parents.

by an increasing degree of public solidarity? (2) How does the distribution of disposable income a¤ect family and public solidarity? (3) Do subjects prefer a relatively small or relatively large degree of public solidarity?

In order to answer the …rst question, subjects are confronted with two di¤erent tax rates to …nance a pension system, which complements voluntary transfers within families for old-age support. In the context of public goods provision, Warr (1982, 1983) has shown that government provision of public goods can crowd out voluntary (private) contributions dollar for dollar. If crowding out prevails also in the context of old-age support, we should observe lower voluntary transfers within families in case of the higher tax rate.

The second question is addressed by comparing behavior in case of an egalitarian society with behavior under a rather unequal distribution of income in society. In our set-up voluntary intergenerational transfers have the characteristics of a public good: if a subject gets a transfer from his successor, this will enable him better to sustain his predecessor. So, a transfer from an (experimental) child to the parent can indirectly bene…t the grandparent as well. This characteristic links our paper to a strand of the literature which considers how voluntary contributions to a public good depend on the income distribution. Chan et al. (1996, 1999) have explored Warr's (1982, 1983) conjecture that group contributions should be invariant under redistributions of income. They …nd that "on average" this turns out to be true. In deviation from Warr's income-neutrality postulate, however, the rich tend to undercontribute and the poor tend to overcontribute. In contrast to this neutrality postulate, Durham et al. (1998), based on experimental evidence, and Persson and Tabellini (1994), based on analyses with cross-country time-series data, claim a negative relationship between inequality and cooperation. They use a rent-seeking type of argument for explaining their …ndings: in societies with distributional con‡icts subjects will be more inclined to adopt behavior that has damaging e¤ects on others, and possibly themselves. Apparently, both on theoretical and on empirical grounds the e¤ect of inequality on voluntary transfers is not clear-cut.

Finally, in our experiments we endogenize the degree of public solidarity via voting. Thus, we can investigate the third question, in particular whether preferences for a high or low degree of public solidarity depend on individual or family characteristics. The pay-as-you-go pension system achieves consumption smoothing in a way that is more valuable

in monetary terms to rich than to poor subjects. As a result, we expect rich subjects to vote more often for the high tax rate than poor subjects.

Experimental studies with overlapping generations (OLG) have become more frequent in recent years, and have addressed topics closely related to our paper. One issue is the condition for the emergence of cooperation by giving transfers to the preceding generation. It is well-known that if generations have an in…nite horizon, cooperation can be sustained as an equilibrium if the generations employ trigger strategies. For example, Hammond (1975) shows that under this condition an e¢cient pay-as-you-go pension scheme can arise. O¤erman et al. (2001), however, …nd in an experimental OLG-game where the horizon is simulated to be in…nitely long that subjects are not inclined to use trigger strategies. Cooperation is thus not always the most likely outcome in an OLG context. In O¤erman et al., employing a trigger strategy is quite risky as the potential loss if the successor deviates from the strategy is substantial. Van der Heijden et al. (1998) study the occurrence of cooperative behavior in a …nite OLG game where the young can give transfers to the old. Strictly speaking, in their experiments cooperation is not an equilibrium due to the employed …nite horizon. On the other hand, subjects can play cooperatively, without running into the risk of losing a considerable amount of money. Transfers appear to be about halfway between the non-cooperative and the fully e¢cient level, and do neither increase nor decrease with repeated play of the game. Van der Heijden et al.'s OLG game consists of only one family. Therefore, unlike in our experiment, there is no interaction between di¤erent families of a society. Furthermore, Van der Heijden et al. do not consider the e¤ect of government intervention and its possible crowding out e¤ects by tax rate increases.

The study by Güth et al. (2000) addresses speci…cally the issue of crowding out of voluntary transfers[2] through exogenous government intervention. In their experiment, a society consists of two families which are connected through the public pension system. Family members have equal endowments, i.e. income when young. The treatment variable is an exogenous variation in the tax rate to …nance the pension system. As predicted by the crowding-out hypothesis, a system of higher taxes leads to lower voluntary transfers in

[2] In Güth et al. (2000), transfers can be given from young to old family members, but also in the reverse direction. The possibility of transfers in both directions, and the additional taxation of young members' income to …nance old-age support make their experiment rather complex.

their experiment. However, they do not …nd much evidence of direct or indirect reciprocity in the emergence of voluntary transfers.

Like Güth et al., our experiment builds on societies with two families. We also vary the tax rate exogenously in the beginning of our experiment. But later on, participants can endogenously decide on the size of the tax rate to …nance public solidarity. Furthermore, we consider the case of an unequal income distribution within and across families and compare it with the case of an egalitarian income distribution. Even though the assumption of an unequal distribution of wealth within a society seems much more realistic, the consequences for family and public solidarity have not been explored so far in an experimental study.

In the following section 2 we describe the overlapping-generations model with multiple families. Section 3 provides a theoretical analysis and derives testable hypotheses. Details of the experimental design are discussed in section 4 before analyzing the data and testing our hypotheses in section 5. Section 6 summarizes our main …ndings.

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 of members $m = 1; 2; :::; n$. Let reserve i for an arbitrary member of A and j for one of B. Both families together form a 'society'.

Endowments E can be either equal or unequal within and across members of both families. In case of unequal endowments an equal number of players $i \in A$ and $j \in B$ has either a low ($\underline{E}$) or a high ($\overline{E}$) endowment with $\overline{E} > \underline{E} > 0$. Rich (poor) families have more (less) members with endowment $\overline{E}$ than $\underline{E}$. If endowments are equal all members within and across families receive endowment E^e with $E^e = 1/2(\overline{E} + \underline{E})$.

Each player only receives an own endowment E_o when young. His only decision is the transfer T_o to his parent where, of course, $0 \leq T_o \leq E_o$. The residual $E_o - T_o$ is then

taxed according to the prevailing tax rate ¿ with $0 < ¿ < 1$. The available income and consumption level when young is thus

$$C_y = (1 ¡ ¿)(E_o ¡ T_o).$$

Notice that private transfers T_o are tax deductible.[3] Tax revenues are used for public solidarity, i.e., for …nancing old-age support. 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. Thus the consumption level C_o when old is given for $i \in A$ by

$$C_o(i) = T_c(i) + \frac{¿}{2}[E_c(i) ¡ T_c(i) + E_c(j) ¡ T_c(j)]$$

and for $j \in B$ by

$$C_o(j) = T_c(j) + \frac{¿}{2}[E_c(i) ¡ T_c(i) + E_c(j) ¡ T_c(j)]$$

where the lower index (o or c) indicates own or child's variables and the one in brackets (i or j) the family a¢liation.

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

$$U = C_y ¢ C_o:$$

For player $i \in A$ and $j \in B$ the payo¤ is thus

$$U(i) = (1 ¡ ¿)[E_o(i) ¡ T_o(i)] ¤ \left[T_c(i) + \frac{¿}{2}\{E_c(i) ¡ T_c(i) + E_c(j) ¡ T_c(j)\}\right]$$

and

$$U(j) = (1 ¡ ¿)[E_o(j) ¡ T_o(i)] ¤ \left[T_c(j) + \frac{¿}{2}\{E_c(i) ¡ T_c(i) + E_c(j) ¡ T_c(j)\}\right]:$$

The game starts in period 1 when two young players decide about $T_o(i)$ and $T_o(j)$, respectively, whose parents (in the experiment) are the latest generation (who thus receive $T_o(i)$ and $T_o(j)$).[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 …rst transfers wasted, nor are initial conditions imposed.

The basic parameters of the model are the tax rate ¿ plus the sequences of endowments $E(i) = (E_1(i); E_2(i); :::; E_n(i))$ and $E(j) = (E_1(j); E_2(j); :::; E_n(j))$ for both families. Table 1 summarizes our experimental parameterization with $n = 3$. In our UN-model, players have endowment $\underline{E} = 10$ or $\overline{E} = 40$. The rich family B receives, in total, a 50% higher endowment than family A. In our EQ-model we have $E^e = 25$. Note that in both models total endowment per period ($E(i) + E(j)$) is constant, i.e. 50. In UN, one rich individual ($E = 40$) always coexists with a poor one ($E = 10$) in the other family. Tax rates have been set at $\underline{\tau} = 0{:}05$ and $\overline{\tau} = 0{:}25$, respectively.

		endowment of member		
model	family	1	2	3
UN	A	10	40	10
	B	40	10	40
EQ	A; B	25	25	25

Table 1: The endowment sequences E

3 Theoretical analysis

3.1 Decisions on voluntary transfers

If subjects consider their transfers unrelated to their family members' transfers, and if they are not motivated by non-monetary incentives like reciprocity or inequality aversion, maximization of their own material payo¤ implies $T_o = 0$, i.e. no intra-family transfers, regardless of what other players in the own or the other family do. Hence, we arrive at our

Hypothesis 1: Individual rationality with respect to own material incentives dictates $T_o = 0$ always.

However, if subjects behave according to this benchmark, they forego considerable payo¤ opportunities. This is due to the chosen utility function with $U = C_y ¢ C_o$, which requires consumption smoothing. In our overlapping generations model, consumption smoothing cannot be achieved by tax-…nanced public solidarity alone, but depends crucially on family solidarity in the form of voluntary transfers from young to old family members. As noted in the introduction, what motivates subjects to adhere to a system of voluntary transfers is not the subject of our investigation. Di¤erent motives might lead to di¤erent con…gurations of voluntary transfers. As a useful benchmark against which to evaluate actual voluntary transfers, we simply postulate a 'family contract' where the sum of family members' utility is maximized under the condition that all family members receive the same utility.[5;6]

Maximizing U_m with respect to the common transfer T_o, and assuming symmetric behavior within and across families, yields as an analytic solution for the EQ-model:

$$T_o = \left(\frac{2 ¡ 3¿}{4 ¡ 3¿}\right) E$$

Regarding the family contract in the UN-model, maximizing U_m with respect to the transfer T_o does not yield an analytic solution due to the asymmetry of the endowments. Therefore, we calculated the solutions numerically for the experimental parameters. Table 2 reports the optimal transfer rates t_{opt} and corresponding utility levels, given a family contract is established. Notice that optimal transfer rates should decrease when the tax rate is raised from ¿ to $\bar{¿}$, as can be deduced from Table 2. This observation leads to Hypothesis 2.

[5]Note that this condition restricts the sum of family members' utilities to a local maximum - which is smaller than the global maximum - in our model. In the global maximum subjects act as surplus maximizers, giving away all their endowment when this endowment is more valuable to another player, a motivation detected by Andreoni and Miller (2002). Imposing the condition of equal utilities may be justi…ed by the existence of inequality aversion, as in the models of Fehr and Schmidt (1999) or Bolton and Ockenfels (2000), or by maximin preferences, as in Rawls (1971). Notice here that Charness and Rabin (2000) subsume all these di¤erent motivations under one model and identify them by very focused simple games.

[6]In principle, one can also think of a 'societal' contract in which payo¤s within and across families should be equalized. There is no trace of such a contract in our experimental data. Furthermore, the numerical solution for the UN-model would require negative transfers for some members which was not allowed in the experiment.

	model	UN						EQ
		poor family			rich family			
	member	1	2	3	1	2	3	i 2 n
	E	10	40	10	40	10	40	25
¿ = 0:05	t_{opt}	0.70	0.48	0.24	0.28	0.46	0.69	0.48
	$U(t_{opt})$	56.6	56.6	56.6	143.5	143.5	143.5	156.2
	U(t = 0)	11.9	47.5	11.9	47.5	11.9	47.5	15.2
¿ = 0:25	t_{opt}	0.53	0.39	0.06	0.22	0.26	0.61	0.38
	$U(t_{opt})$	68.7	68.7	68.7	153.8	153.8	153.8	155.3
	U(t = 0)	46.9	187.5	46.9	187.5	46.9	187.5	117.2

Table 2: Optimal transfer rates under a family contract

Hypothesis 2: In EQ and UN transfer rates decrease with a rise in the tax rate ¿. Hence, we expect crowding out of private transfers when the tax rate is increased from ¿ to ¿.

Table 2 also includes the available utilities in case of no voluntary transfers, i.e. U(t = 0). Comparing the latter utility levels with those obtained under the family contract, we see that in the EQ-model, the family contract leads to higher utilities than U(t = 0) under any feasible tax rate. Therefore, we expect that in EQ a family contract will be established, since $U(t_{opt}) > U(t = 0)$ for both feasible tax rates. The situation is di¤erent in the UN-model. With the lower tax rate (¿ = 0:05) the family contract generates larger utility levels for rich and poor subjects in both the rich and the poor family, even though utilities di¤er substantially between the rich and poor family (U = 143:5 and U = 56:6 for members of the rich and poor family, respectively). In case of the high tax rate (¿ = 0:25), however, the family contract will generate higher payo¤s than the individualistic solution (with t = 0) only for the poor subjects in both families. Rich subjects, on the contrary, have an incentive to default on the family contract, since $U(t = 0) > U(t_{opt})$. That leads us to

Hypothesis 3: In the EQ-model, we expect a family contract under any feasible tax rate. In the UN-model, a family contract will only be established under the low tax rate ¿, but will break down under the high tax rate ¿.

This hypothesis provides an ideal setting for examining whether subjects are motivated in their transfer behavior by mere self-interest or by such a motive as inequality aversion. If we …nd traces of a family contract under the high tax rate, we may conclude that also rich subjects, who have an incentive to default, are not only driven by self-interest, but also by other-regarding motives.

So far, our de…nition of a family contract and the consequences for transfer rates have been presented in a rather rigorous way. Several reasons can be cited for a failure of the family contract to emerge exactly. First, a lot of coordination is needed to establish a family contract, in particular in the UN-model on which we will concentrate for the moment. If subjects are willing to enter into a family contract then they …rst have to …nd out how large the transfer rates have to be, and second, they have to …nd out whether the other family members are willing to enter the family contract and whether they have calculated the right transfer rates. Second, Table 2 makes it clear that for the poor subjects the potential gain to be achieved under the family contract is much higher than for the rich. The poor subjects can, therefore, be expected to put more e¤ort in attempting to realize equalization of utilities than the rich subjects. This might lead to higher payo¤s for the rich than for the poor. Finally, if (at least some of) the poor subjects turn out to be surplus maximizers (cf. note 6), a bias towards transfers to the rich by the poor can be expected as well.

We postulate from Table 2, however, that tendencies in the data can reveal whether individuals are aiming at establishing a family contract. The pattern of transfer rates in Table 2 stipulates that these should be higher if your parent is poor and/or your child is rich. So, assuming that subjects try to establish a family contract, we arrive at the following hypothesis, which predicts qualitative patterns of transfer rates, given the low tax rate under which a family contract is expected to be established.

Hypothesis 4: Under the low-tax (high-tax) treatment the following tendencies do (do not) occur:

(i) Rich (poor) subjects with a poor parent should give higher transfer rates t than rich (poor) subjects with a rich parent.

(ii) Rich (poor) subjects with a rich child should give more than rich (poor) subjects with a poor child.

(iii) Optimal transfer rates di¤er across subjects both within and across families. If members of a family try to smooth income across family members (in an optimal way) we should observe decreasing transfer rates in the poor family ($t_p^1 > t_p^2 > t_p^3$, where the superscript denotes family member m and the subscript denotes the family type) and increasing transfer rates in the rich family ($t_r^1 < t_r^2 < t_r^3$).

This hypothesis makes clear that optimal transfer rates under a family contract depend not only on a subject's own income, but also on the income of his parent and his child. In order to see whether we should expect di¤erent transfer rates between the group of rich subjects as a whole and the group of poor subjects, or between rich families and poor families, we calculated average transfer rates for di¤erent subject types and family types (see Table 3).

	family (UN)		subject (UN)		model	
	poor	rich	poor	rich	UN	EQ
¿ = 0:05	0.47	0.48	0.47	0.48	0.48	0.48
¯ = 0:25	0.33	0.36	0.28	0.41	0.35	0.38

Table 3: Optimal average transfer rates under a family contract

Noteworthy, under the low-tax regime we should …nd, at best, marginal di¤erences only between rich or poor subjects and rich or poor families. Under the high-tax regime some di¤erences can be discerned, e.g. that rich subjects should have considerably higher transfer rates than poor subjects, but in that case we do not expect a family contract to emerge according to Hypothesis 3. The di¤erence between family types remains marginal also with the high-tax regime, provided that rich subjects do not default on the family contract. So, we have

Hypothesis 5: In the UN treatment we expect:

(i) No signi…cant di¤erence in transfer rates between poor families and rich families under the family contract.

(ii) Rich subjects to have the same average transfer rates as the poor with the low tax rate ¿. Under the family contract rich subjects should have higher average transfer rates than the poor with the high tax rate ¿.

Comparing optimal transfer rates between the EQ- and UN-model (see Table 3), we see that income distribution has no (¿) or only a marginal (¿) in‡uence on transfer rates. However, as indicated in our Hypothesis 3, rich subjects have an incentive to default on the family contract with ¿, which might also induce poor subjects to reduce their transfers. Since there is no such incentive in the EQ-model, we expect transfer rates to be higher in EQ than in UN with the high tax rate ¿. We summarize our reasoning in

Hypothesis 6: The EQ-model inspires larger transfer rates than the UN-model with the high tax rate ¿, but not with the low tax rate ¿.

3.2 Voting on tax rates

Tax rates are given exogenously at the beginning of the experiment, but can be determined endogenously by voting later on. The exact voting procedure will be described in detail in Section 4 on the experimental design. The endogenous determination of tax rates allows us to examine the preferences for a low or high degree of public solidarity.

When players determine the tax rate via democratic voting with simple majority, they can choose between ¿ and ¿ either (a) for a complete life cycle, i.e. for 3 consecutive periods, or (b) in a speci…c period where they either receive (when old) or give a transfer (when young). The following hypotheses 7 and 8 refer to case (a).

From Table 2 we can infer that in UN the high tax rate is the most favorable position for all subject types, given that a family contract exists. For the rich, however, the high tax

rate implies the temptation to default on the family contract. Poor types expecting the rich types to default on the family contract might, therefore, vote for the low tax rate, because utilities with a family contract and ¿ (U = 56:6) are higher than those without a family contract and ¿ (U = 46:9). Given that the high tax rate is relatively more advantageous for rich subjects, a larger proportion of the rich than of the poor subjects can be expected to vote for the high tax rate. A somewhat surprising implication of this is that a large collective tax system to …nance public solidarity can be more attractive - and more pro…table - for the rich than the poor.

Hypothesis 7: In the UN-model the proportion of rich subjects voting for the high tax rate will be larger than the proportion of poor subjects voting for the high tax rate.

Even though the public pension system collects taxes as a ‡at proportion of income, and distributes the revenue in equal amounts among rich and poor elderly, higher tax rates help the rich to increase utility by smoothing consumption without the help of a family contract. For the poor, a family contract is needed in addition to raise lifetime utility. In the EQ-model, on the other hand, a family contract is needed under any tax rate to increase lifetime utility. Moreover, under voting on the lifetime tax the high tax rate is always more advantageous than the low tax rate. This leads to our

Hypothesis 8: In the UN-model the voting share for the higher tax rate will be smaller than in the EQ-model.

Hypotheses 7 and 8 predict the proportion of votes in case subjects are able to cast a long-term vote on the tax system. If, however, subjects only vote on the tax rate in the current period (case (b)), we expect them to vote in a self-serving way, because a lower tax rate in the current period increases C_y, whereas it has no e¤ect on C_o in the next period when there is a new vote on the tax rate.

Hypothesis 9: Subjects are less willing to vote for the high tax rate when they have to give a transfer than when they can receive a transfer or when they have to vote on the tax rate for a complete life cycle.

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 …xed order such that one's child and one's parent are always identical. The overlapping generations-model means that each member passes repeatedly through the following life cycle: When young, a subject receives an income E and has to choose a transfer T. In the next period, a subject becomes old and has no income of his own, but depends on his child's transfer and on public solidarity through a collective tax scheme. After that a member becomes inactive for one period, and is …nally reborn as the newly young family member in the subsequent period, etc.

After 9 (unpaid) trial periods, allowing each participant to go three times through a life cycle (young, old, inactive)[7], the experiment consisted of four phases.

- Phase 1 has 12 periods (rounds 1-4), with ¿ = 0:05 being exogenously determined.
- Phase 2 has 12 periods (rounds 5-8), with ¿ = 0:25 being exogenously determined.
- Phase 3 has 9 periods (rounds 9-11). The tax rate ¿ is determined endogenously. All six participants (i.e., all members of a society) can vote for either ¿ = ¿ or ¿ = ¿. The tax rate with more votes is then valid for three periods (i.e. one complete round) after which participants can vote again. In case of a tie, one of the two tax rates is randomly chosen by an unbiased chance move and applies for the next round. Thus, there are three elections in phase 3.
- Phase 4 has 3 periods (round 12). It di¤ers from phase 3 as voting takes place before each period and the inactive family members are not allowed to vote. Again, this implies three elections.

[7] Henceforth, we will refer to a 'life cycle' by 'round'.

Subjects did not know in advance how many periods the experiment would last or whether there would be a change in the rules of the experiments after some periods. After phase 1 they were given a new sheet of instructions explaining the change for phase 2. However, they were not told how many periods phase 2 would last. The same procedure was applied for phases 3 and 4.

Information conditions in single periods are as follows: When young a participant is informed of his (…xed) endowment and that of his parent, about his parent's (absolute) transfer, his parent's consumption level C_y and his parent's expectation $\dot{T}^e_c$ concerning one's own decision T_o. After choosing T_o in the light of such information, the own consumption C_y as well as the endowment of one's own child is announced so that one can state one's own expectation $\dot{T}^e_c$, i.e. which transfer one expects from the own child.[8]

When old, one is 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 gets information about this period's utility ($U = C_y \cdot C_o$), as well as about the cumulated sum of U earned so far. Additionally, participants are informed about the income of own family members, but not of the other family. Note that participants get only information on the transfer of the child to oneself, but not of the grandchild to the child. In phases 3 and 4, when participants have to vote on the tax rate, they are only informed about the aggregate outcome of the vote, but not about individual voting decisions.

Corresponding to our two models we set up two treatments. The UN-treatment has unequal endowments within and across families. The EQ-treatment has equal endowments for all participants (see Table 1). The instructions (see Appendix) use a neutral terminology as far as possible, like groups (for families), deduction (for taxes), active (for young), passive (for old) etc. The reason for this was to avoid possible demand e¤ects by employing value-laden terminology. At the end of the experiment subjects had to answer the question 'Have the rules of the experiment been clear to you?'. 66 out of 72 participants (92%) in the UN-treatment and all 36 participants (100%) in the EQ-treatment answered 'Yes'.

[8] We were fully aware that "expectations" will signal aspirations rather than express what one really expects. But in view of the anonymity of the computerized experiment (using the software z-tree of Fischbacher, 1999) such a possibility to coordinate aspirations seemed necessary and rather realistic.

6 experimental sessions with 18 participants each were run at the University of Innsbruck in March and April 2001. Sessions lasted, on average, 1 hour and 50 minutes. Since 18 students were in one session, we obtained three independent observations (of 6 participants each) per session. We ran four sessions with treatment UN (giving us 12 independent observations) and two sessions with treatment EQ (6 independent observations). Overall average earnings were 241 Austrian Schillings (about 18 Euro) per subject.

5 Results

5.1 Transfer rates

Table 4 gives an overview of transfer rates in the two treatments, separately for single phases and di¤erent types of members or families in UN. According to Hypothesis 1, claiming sel…sh behavior, there should be no transfers at all. This is clearly rejected by our data and summarized in Result 1.[9]

Result 1: Participants transfer signi…cant shares of their endowment, with an overall average of 30% in EQ, and 26% in UN. I.e., Hypothesis 1 is clearly rejected.

Result 2: Raising the tax rate from 5% to 25% in phase 2 leads to a decline of transfer rates from 33% to 25% in UN and from 33% to 31% in EQ, respectively. Thus, there is crowding out of private transfers by compulsory intergenerational solidarity. This holds in particular for UN, where the crowding out of voluntary transfers is statistically signi…cant ($p < 0:01$; Wilcoxon signed ranks test; $N = 12$). Note, however, that crowding-out is incomplete since optimal transfer rates were predicted to fall by 13 percentage points in UN, and 10 percentage points in EQ (see Table 3).

[9] Results in this section refer always to the hypothesis with the respective number in section 3.

	endowment of			phase				
treatment	parent	own	child	1 (¿)	2 (¿)	3	4	all
EQ ¡ overall average	25	25	25	0.33	0.31	0.25	0.28	0.30
UN ¡ overall average				0.33	0.25	0.21	0.19	0.26
UN ¡ averages for								
poor members		10		0.35	0.26	0.20	0.20	0.27
rich members		40		0.31	0.24	0.22	0.18	0.25
poor families		$\sum E = 60$		0.32	0.23	0.19	0.17	0.25
rich families		$\sum E = 90$		0.33	0.27	0.23	0.21	0.28

Table 4: Transfer rates

Figure 1 shows transfer rates for rounds 1 to 12. The breaks in Figure 1 separate the four di¤erent phases of the experiment. In the following, we will concentrate on phases 1 and 2, where tax rates are determined exogenously. Note that in UN there is no statistically signi…cant decline of transfer rates within a given phase, i.e. from round 1 to round 4, respectively from round 5 to round 8 ($p > 0:3$ in any case; Wilcoxon signed ranks test). Hence, we may conclude that it is the exogenously determined change of the tax rate that reduces private solidarity rather than a decline of transfer rates due to erosion of solidarity via repetition. In EQ we …nd no signi…cant di¤erences in transfer rates between low or high tax rates (phase 1 versus phase 2). However, there is a rather marked decline of transfer rates within both phases (with $p < 0:05$ for phase 2; Wilcoxon signed ranks test; $N = 6$).[10]

Table 5 reports average actual transfer rates (t_{act}), and utilities (U_{act}) for the …rst two phases of the experiment. Data refer to speci…c members in UN and to the overall average in EQ. For ease of comparison, the transfer rates that should hold in the optimal family contract, i.e. t_{opt}, as well as the utilities in case of zero transfer rates ($U(t = 0)$) as well as with a family contract ($U(t_{opt})$) have also been included in Table 5. As can be clearly seen, actual utilities are far from being equalized, leading to

Result 3: We do not …nd a family contract in the strict sense of equal utilities for all members of a given family, neither in phase 1 nor in phase 2.

[10] The strong rise of relative transfers from round 4 (with ¿) to round 5 (with ¿) is very similar to what is known as 'restart e¤ect' in public goods experiments.

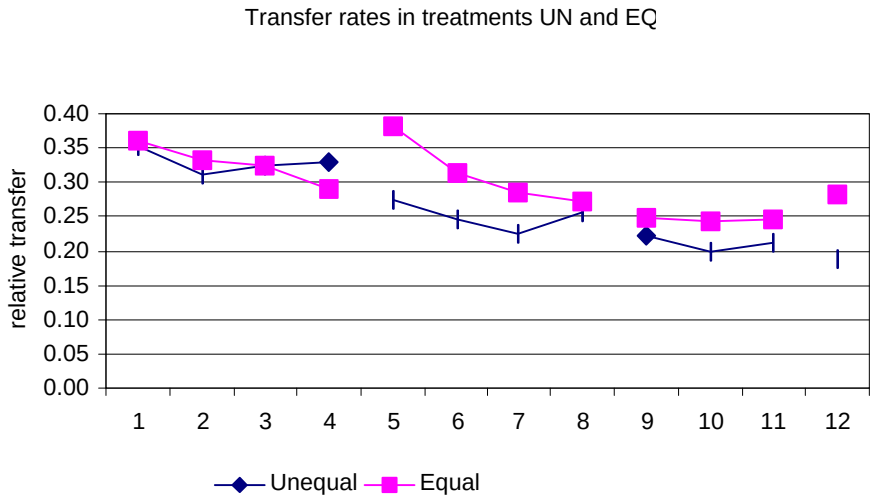

Figure 1:

	UN								UN	EQ
	poor family				rich family				average	i 2 n
	1	2	3	avg.	1	2	3	avg.		i
E	10	40	10	20	40	10	40	30	25	25
phase 1										
t_{act}	0.39	0.27	0.31	0.32	0.24	0.35	0.41	0.33	0.33	0.33
t_{opt}	0.70	0.48	0.24	0.47	0.28	0.46	0.69	0.48	0.48	0.48
U_{act}	63.4	101.7	29.8	65.0	122.8	98.0	210.1	143.6	104.3	138.0
$U(t = 0)$	11.9	47.5	11.9	23.8	47.5	11.9	47.5	35.6	29.7	15.2
$U(t_{opt})$	56.6	56.6	56.6	56.6	143.5	143.5	143.5	143.5	100.1	156.2
phase 2										
t_{act}	0.30	0.20	0.18	0.23	0.18	0.29	0.35	0.27	0.25	0.31
t_{opt}	0.53	0.39	0.06	0.33	0.22	0.26	0.61	0.36	0.35	0.38
U_{act}	65.6	145.1	49.0	86.6	191.7	93.2	205.8	163.6	125.1	150.5
$U(t = 0)$	46.9	187.5	46.9	93.8	187.5	46.9	187.5	140.6	117.2	117.2
$U(t_{opt})$	68.7	68.7	68.7	68.7	153.8	153.8	153.8	153.8	111.3	155.3

Table 5: Transfer rates and utilities of speci…c members

Even though we do not …nd equal utilities of all members of a given family, we can see from Table 5 that actual utilities, U_{act}, for single members are always larger than utilities with zero transfer rates, $U(t = 0)$, with the single exception of subjects 2 of the poor family

in phase 2. Comparing speci…c members' actual utilities, U_{act}, with those obtainable in a perfect family contract, $U(t_{opt})$, we …nd the following pattern.

In the poor family, the rich subjects gain quite a lot (101.7 vs. 56.6) in phase 1, while the poor family members gain little (subjects 1 obtain 63.4 vs. 56.6), or not at all (subjects 3 obtain 29.8 vs. 56.6). In phase 2 both poor subjects in the poor family are worse o¤ than under the family contract. The average utility obtained by the family as a whole is larger than under the family contract in both phases (from the column 'family avg.' we read 65.0 vs. 56.6 in phase 1, and 86.6 vs. 68.7 in phase 2, respectively).

In the rich family rich subjects 3 are better o¤ under the actual transfers compared to the family contract in phase 1 (210.1 vs. 143.5). In phase 2 both rich subjects (i.e., 1 and 3) see their utility increase compared to the family contract. The average utility for the rich family is larger than under the family contract (143.6 vs. 143.5 in phase 1, and 163.6 vs. 153.8 in phase 2, respectively).

From the column 'UN-average' we see that both families taken together obtain higher average actual utilities in UN than in case of zero transfers as well as in case of a perfect family contract. So, although families are to some extent able to smooth consumption in order to raise utilities, they are not going all the way to perfect income equality within a family. Apparently, some surplus maximization is playing a part here and families are able to achieve higher levels of collective utilities than in case of an egalitarian distribution of utilities. In other words, the poor doing relatively badly is due to their relative generosity towards the rich, as we will see below in more detail.

In UN, even though families do not achieve perfect equality of utilities, they succeed in reducing the inequality that would prevail with zero transfers. Given that all family members would choose zero transfer rates, the Gini coe¢cient for inequalities in utility would be 0.33 in poor families and 0.22 in rich families. The Gini coe¢cients for actual utilities are 0.25 in poor families and 0.17 in rich families, both in phase 1 and in phase 2. Gini coe¢cients for actual utilities are signi…cantly smaller than in the case of $t = 0$ for poor families only ($p < 0{:}1$ in phase 1, $p < 0{:}01$ in phase 2; binomial test; $N = 12$), but not for rich families. Hence, we detect tendencies to establish a family contract, even though only the qualitative predictions of a family contract can be con…rmed, as will become clear in more detail from

Result 4:

(i) This part examines how transfers depend on the parent's endowment. Transfer rates of rich subjects with a poor (rich) parent are 0.34 (0.24) in phase 1 ($p < 0:01$), respectively 0.27 (0.18) in phase 2 ($p < 0:01$)[11]. Transfer rates of poor subjects with a poor (rich) parent are 0.39 (0.33) in phase 1 ($p < 0:1$), and 0.30 (0.23) in phase 2 ($p < 0:1$). Thus, subjects condition their transfer rates systematically on the income of their parent, which is in line with the qualitative predictions of a family contract. For further illustration, Figures 2 and 3 show transfer rates of rich (poor) members to their rich (poor) parent for single rounds. Remarkably, average transfer rates to poor parents are, on average, always above the transfer rates to rich parents, with a larger difference for rich subjects than for poor subjects.

(ii) The influence of the child's endowment is also in line with our theoretical prediction. Transfer rates of rich subjects with a rich (poor) child are 0.41 (0.26) in phase 1 ($p < 0:01$) and 0.35 (0.19) in phase 2 ($p < 0:05$). Transfer rates of poor subjects with a rich (poor) child are 0.37 (0.31) in phase 1 ($p < 0:1$) and 0.30 (0.18) in phase 2 ($p < 0:01$). Figures 4 and 5 illustrate nicely the dependence of transfer rates on the child's endowment in single rounds. Average transfer rates to parents, irrespective of their endowment, are higher with a rich than with a poor child.

(iii) According to part (iii) of Hypothesis 4, we should expect $t_p^1 > t_p^2 > t_p^3$, respectively $t_r^1 < t_r^2 < t_r^3$, if members aim for consumption smoothing. Overall average data in Table 5 are in line with this order of transfer rates in all cases except for poor families in phase 1. Checking data on the family level ($N = 24$) we find that in phase 1 a total of 12 families satisfies the order of transfer rates predicted by part (iii) of Hypothesis 4. The corresponding numbers for phases 2 to 4 are 10, 8, and 7 families. Note that the ordering $t_p^1 > t_p^2 > t_p^3$, respectively $t_r^1 < t_r^2 < t_r^3$, is one out of six possible orderings of transfer rates in poor or rich families. Applying a binomial test on the actual frequencies of the pattern we find that this pattern shows up systematically more often than in case of random ordering. This holds true for all four phases and rich and poor families alike ($p < 0:05$ in phases 1 to 3; $p < 0:1$ in phase 4).

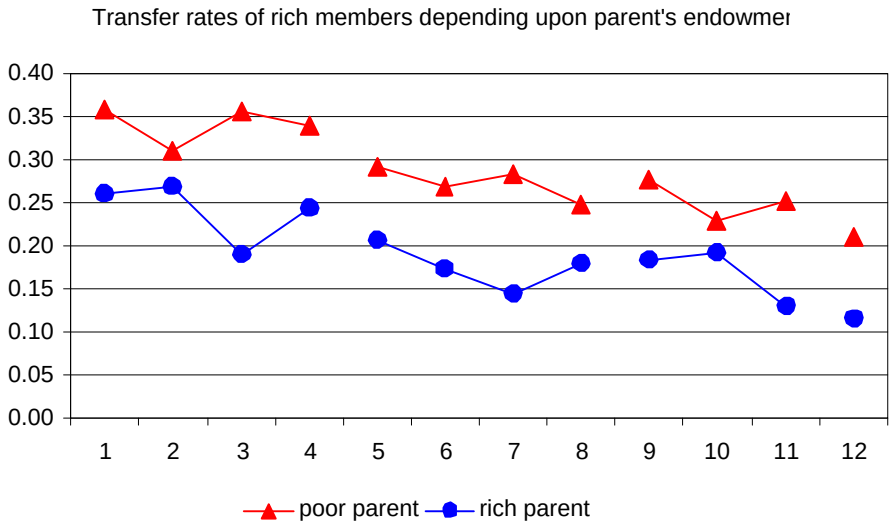

Figure 2:

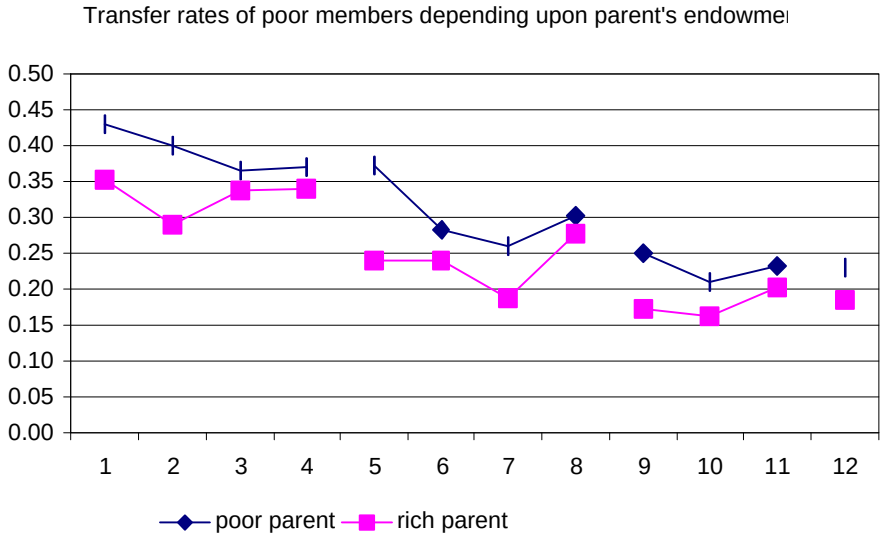

Figure 3:

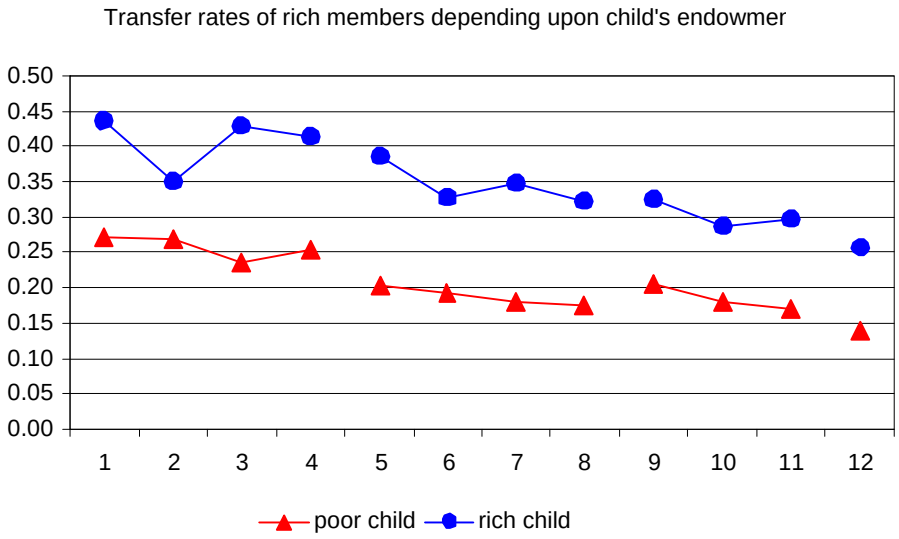

Figure 4:

Result 4 leads us to conclude that, although a family contract in the strict sense of equalizing utilities does not come about, subjects condition their transfer rates systematically on parent's or child's income, as we would predict from a family contract. They give relatively more to poor parents and in case they have rich children. This e¤ect is particularly strong when a member has a high endowment himself. Low own endowment weakens the e¤ect, the basic reason being that the poor give too much if their parent is rich, or do not give enough if their child is rich. In other words, the poor are too generous towards the rich, which might be due to either the relatively large gain they obtain if some family contract comes about (so they work harder to get it in place), or to the poor being surplus maximizers (so they give more to the rich as the money is more valuable to the rich). We thus …nd in UN that subjects smooth utilities across members of the own family to some extent in phase 1 and, unlike the prediction of our Hypothesis 3, in phase 2 as well. However, as the poor 'work harder' to get the family contract realized, their

[11] For the statistical testing of parts (i) and (ii) of result 4 we separated rich and poor members within a society and compared relative transfers to rich and poor parents, respectively, depending upon own income. We applied a one-sided Wilcoxon signed ranks test to average relative transfers in phase 1 and 2, respectively, with societies as observational units, i.e., N = 12.

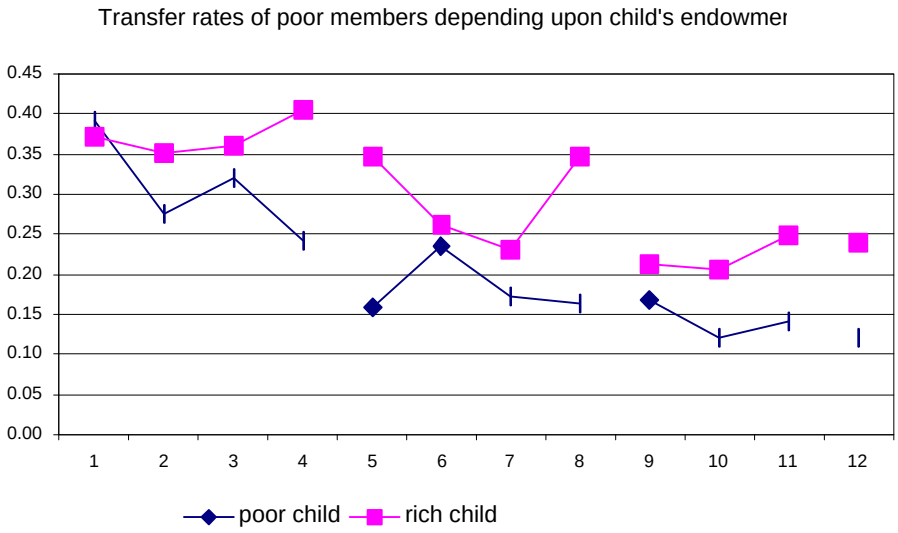

Figure 5:

utility levels are below those of the family contract, while those of the rich are above the family-contract levels. In the rich family the two rich members even obtain utility levels above the non-cooperative t = 0-level. Looking more speci…cally at di¤erences in transfer rates between rich and poor families (subjects) in the UN-treatment, we arrive at

Result 5:

(i) Transfer rates do not di¤er signi…cantly between rich families and poor families in UN, neither in phase 1 (0.33 for rich families vs. 0.32 for poor families) nor in phase 2 (0.27 vs. 0.23). This con…rms part (i) of Hypothesis 5.

(ii) Rich subjects do not have higher transfer rates[12] than poor subjects in the …rst two phases of the experiment.[13] On average, transfer rates of rich subjects are even smaller than those of poor subjects, both in phase 1 (0.31 vs. 0.35) and in phase 2 (0.24 vs. 0.26). Whereas no di¤erence has been predicted for phase 1, this is not true for phase 2. Under a family contract in phase 2, rich subjects should have had

[12] Of course, rich subjects give higher absolute transfers than poor subjects.

[13] It is interesting to note that poor subjects consistently expect signi…cantly larger transfers than rich subjects do, even though the actual transfer rates do not di¤er between rich and poor subjects and are sign…cantly lower than expected transfer rates ($p < 0:01$; U-test). Poor (rich) subjects expect a transfer rate of 0.52 (0.44) in phase 1, respectively 0.50 (0.45) in phase 2 ($p < 0:1$ in any phase; two-sided Wilcoxon signed-ranks test; $N = 12$). We checked whether expected and actually received transfers or expected and donated transfers are signi…cantly correlated, but found no evidence for that.

average transfer rates of 0.41, versus 0.28 of poor subjects. Poor subjects' actual transfer rates are very close to the optimal transfer rates under the family contract. However, rich subjects' transfer rates fall considerably short of the family contract-benchmark. This indicates that the incentives to deviate from a family contract and actual deviations are, indeed, larger for the rich than for the poor subjects, even though rich subjects give still about one quarter of their endowment as a voluntary transfer.

Our data enable us to test a variant of Warr's (1982, 1983) conjecture that inequality has no e¤ect on private contributions to a public good. As noted before, a transfer to one's predecessor can be considered as a contribution to a public good as the transfer ameliorates the realization of consumption smoothing for both other family members. Referring back to Figure 1, it can be noticed that the average transfer rates are not signi…cantly di¤erent between EQ and UN in phase 1, while in phase 2 they seem to be slightly higher in EQ. This is corroborated by Result 6, which deals with di¤erences in transfer rates between the UN and EQ treatments.

Result 6: In phase 1, average transfer rates are identical in the EQ and UN treatments (0.33), as predicted by Hypothesis 6. Transfer rates in phase 2 (0.31 in EQ, and 0.25 in UN) are not signi…cantly di¤erent for the whole phase, but larger in EQ in round 5 ($p < 0:05$; U-test; $N = 18$) and round 7 ($p < 0:1$).

Thus, for phase 2 our result does not unambiguously reject Hypothesis 6, but in phase 1 we do not …nd any signi…cant di¤erence in average transfer rates between EQ and UN. Strikingly, although the context of our experiment is completely di¤erent from the Chan et al. (1996, 1999)-context, like them we …nd that this result on 'averages' does not imply neutral e¤ects on contributions by di¤erent types, but that the poor tend to overcontribute relatively to the rich. This phenomenon occurs in both phases, but is especially strong in phase 2 (high tax) where two of the poor subjects have transfer rates above those of the family contract, and the rich subjects have lower transfer rates than the poor, while, if they adhered to the family contract, they should have higher rates according to Table 3. In that phase, the overcontribution by the poor even tends to lead to lower average transfer rates in UN than in EQ.

5.2 Voting behavior

We now turn to phases 3 and 4 where subjects can endogenously determine the degree of public solidarity by voting on the level of the tax rate. Recall that in phase 3 subjects have to vote on the tax rate applying for a complete round. I.e., the outcome of the vote determines the prevalent tax rate both when giving as well as receiving a transfer in a given round. On the contrary, in phase 4 voting takes place in every period. That means subjects can vote both before giving a transfer as well as before receiving a transfer. Compared to phase 4, phase 3 captures relatively better the situation of constitutional voting under the veil of ignorance.[14]

	phase			
treatment	3	4 - giving	4 - receiving	all
EQ ¡ overall average	0.57	0.61	0.83	0.63
UN ¡ overall average	0.70	0.40	0.83	0.67
UN ¡ averages for				
poor members	0.65	0.36	0.78	0.62
rich members	0.75	0.44	0.89	0.72
poor families	0.71	0.31	0.83	0.66
rich families	0.69	0.50	0.83	0.68

Table 6: Average voting share for the high tax rate

Table 6 presents the average share of votes for the high tax rate. Overall, both in EQ as well as in UN, about two thirds of votes were cast for the high tax rate. Voting outcomes re‡ect higher preferences for the high than the low tax rate: In phase 3, the 12 societies in the UN-treatment implemented the high tax rate 12 times in round 9, 9 times in round 10, and 10 times in round 11. In EQ, 4 out of 6 societies implemented the high tax rate in any round of phase 3. In phase 4, the frequencies of implementing the high tax rate in the three periods are 8, 9, and 5 out of 12 in UN and 6, 5, and 3 out of 6 in EQ. Referring to our hypotheses on voting behavior, we …nd the following:

[14] Note, however, that the veil of ignorance is only partial, since participants know their endowment.

Result 7: As can be seen from Table 6, rich subjects vote on average more often for the high tax rate than poor subjects. The average difference of about 10 percentage points is, however, not statistically significant, which leads us to reject Hypothesis 7.

Hypothesis 7 was based on the assumption that rich subjects might vote for the high tax to make consumption smoothing easier to achieve, and default on the family contract afterwards. Even though we could not confirm the emergence of a strict family contract in the previous subsection, Result 4 has indicated a clear tendency to go in the direction of a family contract, both for poor and rich members alike in phases 1 and 2. From Table 4 one can see that rich subjects, on average, have higher transfer rates (0.22) than poor subjects (0.20) in phase 3. Table 7 presents average transfer rates of specific members in a UN-society. Interestingly, for the rich subjects the decrease in the transfer rates in going from phase 2 to phase 3 is rather moderate (a decrease of 0, 1, and 5 percentage points, respectively), while for the poor subjects the analogous decrease is larger (7, 4 and 8 percentage points). Hence, poor subjects can perceive rich subjects not to default in their transfer rates. Therefore, poor subjects have no reason to vote for the low tax rate anymore, because the low tax rate is better for them only if rich subjects transfer nothing. As a consequence, the share of votes for the high tax rate should not differ between rich and poor subjects, which is what we find.[15]

	UN						EQ
	poor family			rich family			
member	1	2	3	1	2	3	i
E	10	40	10	40	10	40	25
phase 1	0.39	0.27	0.31	0.24	0.35	0.41	0.33
phase 2	0.30	0.20	0.18	0.18	0.29	0.35	0.31
phase 3	0.23	0.20	0.14	0.17	0.21	0.30	0.25
phase 4	0.23	0.16	0.12	0.11	0.25	0.26	0.28

Table 7: Transfer rates in different phases

[15] We checked whether the accumulated frequency of voting for the high tax rate in phase 3 depends on the income level of the child or the parent per se, but found no general evidence for that. Given a poor parent (child), voting behavior did also not depend on the income level of the child (parent). Finally, voting behavior was not contingent on the transfers received from one's child.

Result 8: Voting shares for the high tax rate do not di¤er signi…cantly between EQ and UN. On average, subjects vote even more often for the high tax rate in UN (67%) than in EQ (63%), contrary to our hypothesis.

Given that the poor subjects do not vote for the low tax signi…cantly more often than the rich subjects in UN, it is no surprise that we have to reject Hypothesis 8 which is based on Hypothesis 7. Comparing transfer rates in phase 2 with those in phase 3 - provided the high tax rate is implemented - we …nd a signi…cant decrease of average transfer rates, both for UN and for EQ ($p < 0:05$ in any treatment; Wilcoxon signed ranks test; societies as units of observation).[16]

Result 9: Subjects vote signi…cantly less often for the high tax rate when they have to give a transfer in phase 4, than when they receive a transfer in phase 4 or when they vote on the tax rate for a complete life-cycle in phase 3. This result holds …rmly for UN, but only partly for EQ.

When subjects have to give a transfer in phase 4, they vote for the high tax rate in 40% (61%) of cases in UN (EQ). However, the support for the high tax rate rises to 83% in both treatments in periods where subjects have no endowment of their own, but can only receive income from either receiving a transfer or from tax revenues.

In UN, 33 out of 72 subjects vote for the low tax rate when they have to give the transfer and vote for the high tax rate when they bene…t from the tax revenues. Only two individuals vote the other way round. The change in voting behavior under the two di¤erent conditions is highly signi…cant ($p < 0:001$; McNemar change test; see Siegel and Castellan 1988) and con…rms self-serving voting behavior of about half of subjects in phase 4. 10 (27) individuals vote in both situations for the low (high) tax rate. We do

[16] It is hard to judge whether this decline of transfer rates is driven by some kind of downward trend in transfer rates - as suggested by Figure 1 - or by the e¤ects of endogeneity. Sutter and Weck-Hannemann (2001) …nd in the context of a public goods game that the endogenous choice of minimum contribution levels to a public good crowds out voluntary contributions, compared with an exogenous determination of minimum contributions through the experimenter.

not …nd any signi…cant di¤erences in voting behavior between rich and poor members or between rich and poor families.

In EQ, self-serving voting behavior in phase 4 is less pronounced, but still detectable. 9 out of 36 subjects vote for the high tax rate when receiving and for the low tax rate when paying the tax. Only one subject votes the other way round ($p < 0:05$; McNemar change test). 21 (5) subjects vote for the high (low) tax rate in both conditions.

Comparing the frequency of voting for the high tax rate between phase 3 and phase 4, we …nd a signi…cant decline in UN ($p < 0:1$; Wilcoxon signed ranks test; $N = 12$), which is in line with our predictions. However, in EQ, there is a rise in the frequency of voting for the high tax rate from phase 3 to phase 4 ($p < 0:1$; $N = 6$), contrary to our predictions.

6 Conclusion

We have been interested in three central research questions concerning the interdependence of family and public solidarity under di¤erent conditions. Based on our detailed analysis of experimental results in the previous section, we summarize the answers to our research questions.

(1) Is family solidarity crowded out by an increasing degree of public solidarity? We have found crowding out, even though incomplete, of voluntary transfers through increases in the tax rate. In the 'world' of our model, crowding-out is rational and does not necessarily lead to lower individual payo¤s. Indeed, just like in Güth et al. (2000), crowding-out has no negative e¤ects on a society's welfare in an egalitarian society. In our treatment with unequal endowments, crowding-out does not go along with a loss in average payo¤ as well, but the rich subjects fare better with lower voluntary transfers (and higher tax rates) than the poor subjects[17], especially in rich families where the poor subjects see their payo¤ decrease.

[17] It might be noted here that our crowding-out result is consistent with empirical results such as those by Cigno and Rosati (1996) who found in an international study that an expansion of the social security system displaces intrafamily solidarity.

(2) How does the distribution of disposable income a¤ect family and public solidarity? As already implied by the theoretical analysis of our model, the type of income distribution has no marked e¤ect on 'average' experimental behavior. Voluntary transfer rates are slightly higher with an egalitarian income distribution than with an unequal income distribution, but not signi…cantly so[18]. Preferences for a large public pension system, expressed by voting for the high tax rate, do also not di¤er signi…cantly between the egalitarian and the unequal income distribution. Moreover, in our treatments with an unequal income distribution (UN), we …nd a tendency to redistribute income among family members and, by doing so, to reduce inequalities in payo¤s within families (although not signi…cantly within rich families). This tendency follows from the transfer rates being dependent on how well o¤ the other family members are: poor parents of rich children, especially, receive more help if also their grandchildren are rich[19]. Rich participants, however, do not have higher transfer rates than the poor. Rather, poor subjects appear to be too generous towards the rich, as they do not decrease their transfer rate by much if their parent is rich instead of poor (or if their child is poor, instead of rich).

(3) Do subjects prefer a relatively small or relatively large degree of public solidarity? About two thirds of our participants vote for the high tax rate in order to establish a large public pension system. Given that a larger public pension system makes consumption smoothing easier, the relatively high frequency of voting for the high tax rate re‡ects reasonable behavior. This is in particular true if voting decisions apply for a relatively longer time horizon. When a voting decision is valid for one period only, myopic and self-serving voting behavior is more prevalent. In spite of this, voluntary transfers within the family do not decay remarkably under short-horizon voting, and even increase in the equality treatment. In other words, self-serving behavior in the collective sphere does not have to go along with an abolishment of solidarity in the private sphere.

[18] Our results are unambiguously in line with the 'inequality-neutrality' postulate of Warr (1982, 1983) for phase 1 (with ¿). For phase 2, the EQ-treatment is leading to higher average transfer rates in some rounds. Taking the average over all phases, transfer rates are higher in EQ (0.30) than in UN (0.26).

[19] Notice that this implies that voluntary transfers are negatively related to the recipient's pre-transfer welfare, as has also been found in a …eld study by McGarry and Schoeni (1995)

References

[1] Andreoni, J, Miller, J. (2002), Giving according to GARP: an experimental study of rationality and altruism. Econometrica, forthcoming.

[2] Bolton, G. E., Ockenfels, A. (2000), ERC – A theory of equity, reciprocity and competition. American Economic Review 90: 166-193.

[3] Chan, K. S., Mestelman, S., Moir, R., Muller, R. A. (1996), The voluntary provision of public goods under varying income distributions. Canadian Journal of Economics 29: 54-69.

[4] Chan, K. S., Mestelman, S., Moir, R., Muller, R. A. (1999), Heterogeneity and the voluntary provision of public goods. Experimental Economics 2: 5-30.

[5] Charness, G., Rabin, M. (2000), Social preferences: Some simple tests and a new model.

[6] Cigno, A., Rosati, F. C. (1996), Jointly determined saving and fertility behaviour: Theory, and estimates for Germany, Italy, UK and USA. European Economic Review 40: 1561-89.

[7] Durham, Y, Hirshleifer, Smith, V.L. (1998), Do the rich get richer and the poor poorer? Experimental tests of a model of power. American Economic Review 88: 970-983.

[8] Fehr, E., Schmidt, K. (1999), A Theory of fairness, competition, and cooperation. Quarterly Journal of Economics 114: 817-868.

[9] Fischbacher, U. (1999), Z-tree: Zurich toolbox for readymade economic experiments, Working paper No. 21, Institute for Empirical Research in Economics, University of Zurich.

[10] Gale, W. G., Scholz, J. K. (1994), Intergenerational transfers and the accumulation of wealth. Journal of Economic Perspectives 8 (4): 145-60.

[11] Güth, W., O¤erman, T., Potters, J., Strobel, M., Verbon, H. (2000), An experimental study on the crowding-out e¤ect of public transfers in a model with multiple families. Discussion Paper 156, April 2000. Humboldt-University Berlin.

[12] Hammond, P. (1975), Charity: Altruism or cooperative egoism. in: Phelps, E. (ed.), Altruism, Morality and Economic Theory. Sage. New York.

[13] Kotliko¤, L. J. (1988), Intergenerational Transfers and Savings. Journal of Economic Perspectives 2 (2), 41-58.

[14] McGarry, K., Schoeni, R. F. (1995), Transfer behavior in the health and retirement study. Journal of Human Resources 30: S184-S226.

[15] O¤erman, T., Potters, J., Verbon, H. (2001), Cooperation in an overlapping generations experiment. Games and Economic Behavior 36: 264-275.

[16] Persson, T, Tabellini, G. (1994), Is inequality harmful for growth? American Economic Review 84: 600-621.

[17] Rawls, J. (1971), A Theory of Justice. Harvard University Press. Cambridge, Massachusetts.

[18] Siegel, S., Castellan, N. J. (1988), Nonparametric Statistics for the Behavioral Sciences. McGraw-Hill. New York. 2nd edition.

[19] Sutter, M., Weck-Hannemann, H. (2001), An experimental test of the public-goods crowding-out hypothesis when taxation is endogenous – A comment on Andreoni (1993). University of Innsbruck, mimeo.

[20] van der Heijden, E., Nelissen, J., Potters, J., Verbon, H. (1998), Transfers and the e¤ect of monitoring in an overlapping generations experiment. European Economic Review 42: 1363-91.

[21] Warr, P. G. (1982), Pareto optimal redistribution and private charity. Journal of Public Economics 19: 131-38.

[22] Warr, P. G. (1983), The private provision of a public good is independent of the distribution of income. Economics Letters 13: 207-11.

Appendix - not necessarily for publication

Instructions (originally in German)

We provide the instructions for the UN-treatment. Those for the EQ-treatment are analogous and available upon request from the authors.

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 …xed 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 in‡uence 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 …xed. 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 …xes 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 a decision and indicate an expectation concerning the subsequent decision of your successor.

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

If you are active in a period, you receive an endowment. If you are passive or resting, you do not get an endowment. The size of your endowment (in points) in the active state depends upon your group number and whether you are in group A or group B. The following graph shows your endowment as well as the endowment of all other members in your group and your parallel group.

endowment	member 1	member 2	member 3
Group A	10	40	10
Group B	40	10	40

Decision and income

In the active state, you have to decide on a transfer (in points) to your predecessor. The di¤erence between your endowment and your transfer will be referred to as 'intermediate

amount' henceforth. If your endowment is 10 points, for instance, and you give 4 points to your predecessor, then your intermediate amount equals 6 points.

There will be an automatic deduction of 5% from your intermediate amount as well as from the intermediate amount of your parallel member. 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.

The amount remaining after the automatic deduction will be referred to as '…nal amount' in the following. In the above example, your intermediate amount was 6%. Then, the deduction would be 0.3 points and your …nal amount would be 5.7 points.

In the passive state, you have 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.

Second, you get points from the automatic deductions from your successor's and the parallel successor's intermediate amount.

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

Assume, for instance, that your successor has an endowment of 40 points and that he transfers 20 points to you. Your parallel successor with an endowment of 10 points might transfer 2 points to your parallel member. Then, the intermediate amount of your successor is 20 points, and the one of your parallel successor 8 points. 5% of both intermediate amounts will be deducted (i.e., in total 1.4 points), and will be equally distributed (i.e. 0.7 points) to you and your parallel member. Adding 0.7 points to the transfer of 20 points from your successor, your allocation is 20.7 points.

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

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

In the above example, your income would be 5.7 * 20.7 = 117.99 points.

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 points = 16 Austrian Schillings

In the …rst period of the experiment, member 1 has no predecessor. Hence, the transfer that will be given by member 1 in the …rst period will be given to member 3 in the …nal 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 endowment of your predecessor in your group,

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

- the …nal amount of your predecessor,

- the transfer expected from you by your predecessor.

If you have made you decision on your transfer to your predecessor, then you will face a new screen which give information on the following:

- your …nal amount,

- the endowment of your successor.

Then you are requested to indicate which transfer you expect from your successor. Your expectation will be shown on the screen of your successor before the successor decides on his transfer. Note that your expectation on the transfer has no direct in‡uence on your income or your successor's income.

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

- your …nal 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 in a given period will also be given to the other members of your group. You will also be informed about the income of the other members in your group. You will receive no information on the income of members in your parallel group.

After 12 periods, participants were informed that the automatic deduction would be raised to 25% (phase 2).

After another 12 periods, participants got the following information (about phase 3).

Change

From the next period on there will be a vote on whether the automatic deduction from the intermediate amount shall be 5% or 25%. All other rules remain unchanged.

The voting rules are as follows: There will be a vote every 3 periods (each time before members 1 become active). That means the outcome of the vote is valid for 3 periods.

Each member of your group and of your parallel group can participate in the vote. You have to vote either for the high or the low deduction. The alternative with more votes is the voting outcome which applies to your group and your parallel group. In case of a tie there will be a random draw on which deduction rate shall be applied in the next three periods. After each voting phase, you will be informed about the number of votes for the low, respectively the high deduction, and about the voting outcome. However, you won't receive any information on a single member's voting behavior.

After 9 periods with voting, participants got the following information (about phase 4).

From now on there will be a vote in every period. In each period, the active and passive members of the respective period can vote on the deduction (either high or low). Resting members are not allowed to vote. The alternative with more votes will be implemented in the respective period. In case of a tie (2 votes for the high deduction, 2 votes for the low deduction), there will be a random draw on the deduction rate.