Passing the Buck

Friedel Bolle

European University Viadrina Frankfurt (Oder)
Department of Business Administration and Economics
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Friedel Bolle[1]

Europa Universität Viadrina

Abstract:

Shifting the responsibility for a necessary but costly action to someone else is often called *Passing the Buck*. Examples of such behavior in politics are environmental and budget problems which are left to future generations. Small group examples are (not) washing the dishes or (not) dealing with a difficult customer. Under the assumption of altruistic preferences, rational behavior in this game is derived and confronted with experimental data. By comparison, the sequence of possible decision makers in the "normal" Passing the Buck game is substituted with an "expert" who alone is competent to fix the problem. It turned out that the marginal probabilities of shifting the responsibility are in good accordance with the theoretical model, although with completely different parameter distributions for experts and non-experts. The *structure* of the individual decisions, however, is best described by a random parameter model (Cox et al., 2007).

Keywords: Public Goods, Volunteer's Dilemma, responsibility

Europa-Universität Viadrina Frankfurt (Oder)
Lehrstuhl Volkswirtschaftslehre
insbesondere Wirtschaftstheorie (Mikroökonomie)
Postfach 1786
D - 15207 Frankfurt (Oder), Germany
Email: bolle@euv-frankfurt-o.de

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1. Introduction

In this paper, *Passing the Buck* is defined as shifting the responsibility for a necessary but costly action to someone else – who may try to Pass the Buck[2] back or to a third party. Passing the Buck is also used in the sense of "Shifting the Blame" for own mistakes or for actions which are morally questionable. There are countless examples of such behavior, most prominently in politics where environmental problems are passed to later generations (though it would mostly be cheaper to handle them today) and where necessary negotiations and concessions are postponed by making unacceptable take-it-or-leave-it offers to one's opponent (Israel and Palestine). Philip A. Wellons (1987) and Jasmine Farrier (2004) published books with the title "Passing the Buck" discussing international credit policy and US budget policies. The EU is accused of passing the problem of political refugees to Central and Eastern Europe (Lavenex, 1998). Blame shifting, for example in the wake of Hurricane Katrina, is described by Maestas et al. (2008).

Also business and social relations are believed to be plagued with Passing the Buck behavior. Lambert (2008) accuses firms of passing the problem of flexibility to labor. When customers complain about the product they bought, frontline managers often "react by 'Passing the Buck' back to the customer, to other members of the firm, or even to outside forces." (Hill et al., 1992, p. 673). For individuals, Passing the Buck is often an option in order to avoid the costs of decision making or to defend a political position (Green et al., 2000). Problems of postponing and leaving necessary work to others are also abundant in everyday life. Public goods as a clean kitchen in a students' apartment need service after every major usage and many conflicts arise from relying on the service of others. Cautious usage and individual small-scale repairs/re-equipment of commonly used property like bicycles, vacuum cleaners, lamps (changing bulbs), etc. also pose the temptation to leave these costs to others.

The moral requirement is to accept responsibility and bear the costs. President Harry S. Truman's office deck had a sign on it "The BUCK STOPS here", indicating that he was ready to decide and bear responsibility. This moral requirement and the many examples of Passing the Buck seem to create the widely held belief that such

[2] The expression probably stems from poker where a marker indicated the person whose turn it was to deal. The player can refuse to deal and pass the buck.

behavior is the rule and not the exception. But do we really have empirical knowledge about the frequency of Buck Passing?

Experiments have shown that people are endowed with social preferences. They give voluntarily and non-strategically part of their income to other people in the Dictator Game as well as in the last periods of Solidarity Games and Trust/Investment/Gift Exchange games. People (partly) cooperate in Prisoners' Dilemma, Public Goods, and some Oligopoly games though the equilibrium behavior of selfish people should be non-cooperation. Under the impression of these and other results we may ask how severe the problem is, at least as far as behavior in the private sphere is concerned.

As far as I know there is only a small number of investigations which are related to the Passing the Buck problem. Erev and Rapoport (1990) and Chen et al. (1996) investigate experimentally behavior in sequential step-level (threshold) Public Good games. Two of four or three of five players have to contribute to pass the threshold. Below the threshold no public good is produced, at and beyond the threshold one unit of the public good is produced. Insufficient or superfluous contributions are not refunded. Erev and Rapoport (1990) found that the sequential moves game leads to more efficient outcomes than the simultaneous moves game and that the information provided to the players in the sequential game matters. Chen et al. (1996) are especially interested in the impact of "criticality" of a player's choice on his propensity to cooperate. A choice is critical if it is necessary and possibly even sufficient for passing the threshold. When choices are critical subjects more often contribute to the public good than when choices are non-critical. Bartling and Fischbacher (forthcoming) investigate a Passing the Buck situation in their study about responsibility. They find that many players delegate a personally profitable but unfair decision to someone with an equally strong incentive to choose this unfair option (they shift the blame), in particular if the decision maker can be punished by a victim of the unfair decision.

Passing the Buck is related to the Volunteers Dilemma (Diekmann, 1985) which can be described as a step-level Public Good game where it is necessary to contribute one unit (= fixing the problem). In addition to the pure strategy equilibria where one of the n players provides one unit and all other players provide nothing, there is a symmetric mixed strategy equilibrium.[3] We could call Passing the Buck a Sequential Volunteers Dilemma which has to be distinguished from the Volunteers Dilemma with a timing dimension. The latter is related to War of Attrition games. Otsubo and Rapoport (2008) investigate a game where all players can decide in every of T periods to fix the problem. The game ends if one player fixes the problem or when T is reached without someone fixing it. Bilodeau and Slivinski (1996) and Weesie (1993, 1994) investigate this problem with continuous time.

There does not seem to exist a theoretical analysis or a game with the structure of Passing the Buck (= Sequential Volunteer's Dilemma). In the next section I will analyze Passing the Buck played by altruistic players under complete and under incomplete information about the altruism of others. The generically unique equilibria are characterized explicitly.

In Section 3, I will report about an experiment with a sequence of decision makers who could choose to fix the problem or not. In a variant of the game only one of the players in the sequence (the expert) had the ability to fix the problem. Marginal fixing probabilities are well explained by the theoretical model, although with completely different altruism parameter distributions of experts and non-experts. Most of the subjects were required to make decisions in more than one position in the sequence. The observed individual decision structures cannot be explained without the introduction of random influences. They are in accordance with a random parameter model (Cox et al., 2007) but cannot be explained by a random utility (McKelvey and Palfrey, 1998) extension of my linear altruism model.

2. Theory

Let us assume that a certain problem can be fixed in one of n>1 periods. The costs c_t of fixing it are non-decreasing, i.e. $c_t \leq c_{t+1}$, t = 1, …, n - 1. In every period one of the n players t (denominated by the period t in which she/he is active) decides either "1" = fixing the problem or "0" = not fixing it. If t has fixed the problem no s > t can fix it, i.e. t knows whether or not the problem has already been fixed. The pay-off if t has

[3] Also asymmetric Volunteer's Dilemma games are investigated (Diekmann, 1993) where no symmetric equilibria exist.

fixed the problem is P – c_t for t and P for the other players. If no one fixes the problem all pay-offs are 0. Let us call this game Γ_n. We will assume altruistic, egoistic, or spiteful preferences. A simplification of Game Γ_n is the game Γ_n^t where only t is capable of fixing the problem. In this case, t is called an *expert*.

Assumption 1: Preferences are described by

(1) $U_t(x_1, \ldots, x_n) = x_t + a_t \sum_{i \neq t} x_i$, $a_t \in (\underline{a}, \overline{a})$ where x_i = income of player i.

We assume that, in cases of indifference, players fix the problem.

Under this assumption the utility from no one fixing the problem is 0, if t fixes the problem his utility is P-c_t+(n-1)a_tP, and the utility of r≠t is P+a_r((n-1)P-c_t). Note that a player's utility is not affected by other players' altruism (as in Levine, 1998).

Lemma 1: In Γ_n^t player t will fix the problem if and only if

(2) $a_t \geq -\frac{P-C_t}{(n-1)P}$.

Proof: t's utility from fixing the problem is $P - C_t + a_t(n-1)P$ while not fixing it yields 0. □

The assumption of non-decreasing costs implies

Corollary 1: An expert individual who is the only one who could fix the problem, should fix it in periods 1, …, t_{max} (i.e. in games Γ_n^t , t≤ t_{max}) and not in periods t_{max} +1, …, n. t_{max} may be 0 or n.

Lemma 1 provides us also with the decision of player n in Γ_n if no previous player has fixed the problem.

2.1. Complete Information

Assumption 2: a_t and c_t, t = 1, …, n, are common knowledge.

Under Assumption 2, all players know whether player n will fix the problem. If she won't, player n - 1 is in the same situation as n, etc. Let t = s_k be the player with the largest t for whom (2) applies. Then player s_k - 1 knows that s_k will fix the problem and he has to compare his utility when he fixes the problem with the utility from Passing the Buck and letting s_k fix it. The same applies for players before s_k - 1.

Proposition1 (Subgame perfect equilibrium): There is a (possibly empty) subset S = {s_1, …, s_k}⊆{1, …, n} with $s_i < s_{i+1}$ of players who decide to fix the problem if no previous player has fixed it. For s_k, (2) applies. For all $s_i \in$ S – {s_k}

(3) $$a_{s_i} \geq c_{s_i}/c_{s_{i+1}}.$$

For all t with $s_{i-1} < t < s_i$ or $t < s_1$, we have

(4) $$a_t < c_t/c_{s_i} \ .$$

For t > s_k or, if $S = \emptyset$, for all t, (2) does not apply.

Proof: If (2) does not apply for any t then, by backward induction we can conclude that the problem will never be fixed, i.e. $S = \emptyset$. For $S \neq \emptyset$, (2) does not apply for t > s_k. The cases $s_{t-1} < t < s_t$ (or $t < s_1$ if k = 1) must be accompanied by (4) because otherwise t's utility of fixing the problem, $P - c_t + a_t(n-1)P$, would be at least as large as his/her utility from Passing the Buck to s_k which yields $P + a_t(n-1)P - a_t c_{s_k}$. For all s_i, however, the comparison of these two utilities requires (3) to hold. □

Along the equilibrium path players t < s_1 Pass the Buck and t = s_1 fixes the problem. Only if s_1 Passes the Buck by mistake will s_2 fix the problem. If all player are egoistic, (4) never applies, i.e. the largest t for which (2) holds, i.e. t with $\geq c_t$, would fix the problem (or no one if $P < c_t$ for all t).

If $a_t < 1$ for all t, i.e. if no one assumes another one's income to be more important than his own, (4) cannot apply for constant C_t. Therefore we get

Corollary 2: For

(i) egoistic or spiteful players or

(ii) $a_t < 1$ and $c_t = c$, t = 1, …, n,

S is empty or a singleton.

2.2. Incomplete Information

Complete information is a strong assumption. While costs may be common knowledge, the strength of others' altruism is unlikely to be known, in particular if the identity of successors in the game is not known. Then, (2) and (3) are fulfilled only with a certain probability. In the following, I will assume that others' a_t is regarded as a random variable.

Assumption 3: It is common knowledge that the altruism parameters a_t of players t are i.i.d. on $(\underline{a}, \bar{a})$ with the distribution function F(.).[4]

Assumption 4: All players are risk-neutral, i.e. they maximize the expected (social) utility (1).

In the following, q_t is the probability that t fixes the problem if no previous player had fixed it, Q_{t+1} is the probability that someone fixes the problem if it has not been fixed in period t and D_{t+1} are the expected costs of players s > t.

Proposition 2: Perfect Baysian Equilibrium behavior is described by a sequence of critical altruism parameters a_t^*. Player t's strategy is $\phi_t(a_t) = 1$ (fixing the problem) if $a_t \in (a_t^*, \overline{a})$ and $\phi_t(a_t) = 0$ (Passing the Buck) otherwise. a_t^*, the probabilities Q_t, q_t, and the expected costs D_t are determined recursively from the following system of equations.

(5) $$a_t^* = -[P(1 - Q_{t+1}) - c_t]/[(n-1)P(1 - Q_{t+1}) + D_{t+1}]$$
$$(= -[P - c_n]/(n-1)P \text{ for t } = \text{ n})$$

[4] We leave the question open whether the altruism parameters depend on the size of the group n.

(6) $q_t = 1 - F(a_t^*)$

(7) $Q_t = q_t + (1 - q_t)Q_{t+1},\ \ t = 1, \ldots, n-1;\ \ Q_{n+1} = 0$

(8) $D_t = q_t c_t + (1 - q_t)D_{t+1},\ \ t = 1, \ldots, n-1;\ \ D_{n+1} = 0$

Proof: Player n decides as in the previous section, i.e. (5) coincides with (2). As there are no subgames in this game, there may be Nash equilibria (c.f. threat equilibria) where player n need not move. But if he has to move, deciding according to (5) is optimal. Therefore any trembles of other players eliminate such Nash equilibria. Players t < n have to compare the expected value of fixing the problem,

(9) $EU(fixing) = P - C_t + a_t(n-1)P,$

with the expected value of Passing the Buck,

(10) $EU(passing) = Q_{t+1} \cdot [P + a_t(n-1)P] - a_t D_{t+1}.$

The comparison of the two expected utilities results in the "fixing condition" $a_t \geq a_t^*$ with a_t^* from (5). Alternative Nash equilibria where player t can differ from such behavior because he "need not decide" are again eliminated by trembles of previous players.□

Note that Q_t (= probability that r≥t fixes the problem) is a decreasing function of t by definition. Formally, this follows from (7) because Q_t is a weighted average of 1 and Q_{t+1}, i.e. Q_t is larger than Q_{t+1}. It is implied by Proposition 2 that, ceteris paribus, with larger a_t a player will be more prone to fix the problem.

More difficult is the question of how the position in the sequence influences a player's decision (keeping his altruism parameter constant). Increasing costs decrease his propensity to fix the problem but the decreasing probability Q_t that anyone else will fix the problem increases it. Thus a_t^* may be an increasing or a decreasing function of t. Figure 1 provides us with three examples. In all cases a_t is drawn from the uniform distribution on [-½, ½] and we have five periods with C_t = 2, 4, 6, 8, 10 for t = 1, 2, 3, 4, 5. Proposition 2 allows us to compute the equilibrium altruism parameters a_t^* for the three cases P = 4, 10, 150. In the case P = 4, costs are large compared with the benefit so that player 5 needs to be extremely altruistic in order to fix the problem. Player 4 can practically ignore the small probability that player 5 will fix the problem (under our distribution only 12.5%) and will be guided mainly by his own costs when deciding on fixing the problem. Because his costs are smaller, the critical a_4^* is smaller than a_5^*. We can proceed with this argument until t = 1. In case P = 150 we are in a contrary position. Only rather spiteful players 5 will reject fixing the problem (under our distribution only 27%). So previous players can rely very much on later players fixing the problem, player 3 even more than player 4, etc.. The case P = 10 is between the other two cases because there is a medium probability (50%) that player 5 will fix the problem. Player 4 relies on this probability if he is not "too altruistic". Moving backwards, for player 1 and 2 the reduction of costs is more important than the increase of probability that later players will fix the problem. Therefore we have increasing a_t^* from player/period 1 to 3.

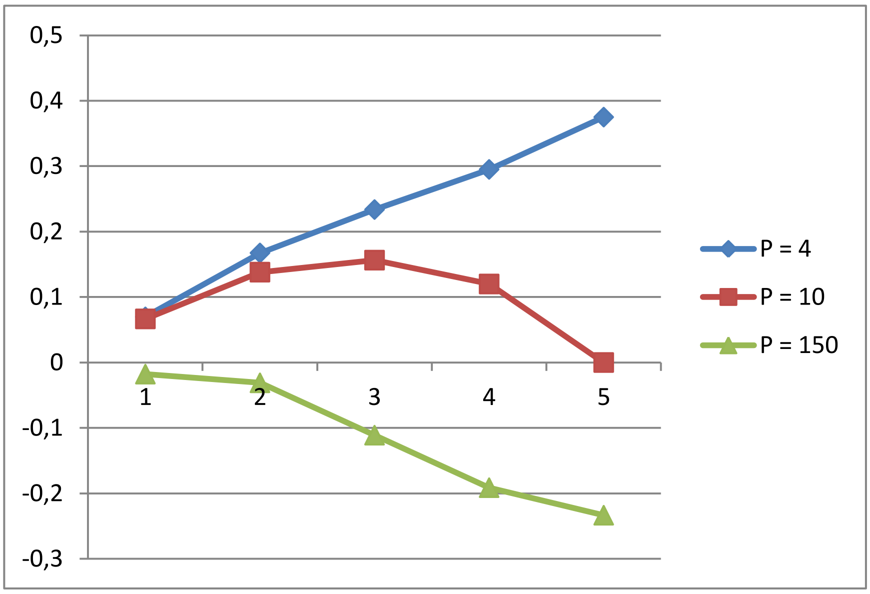


Figure 1: Equilibrium a_t^*, t = 1, …, 5, with $c_t = t \cdot 2$ and a_t uniformly distributed on [-½, ½].

The examples show that we cannot predict the curve a_t^* without strong assumptions on the distribution of altruism parameters and/or the cost curve c_t and benefits P. A benchmark case is provided by constant costs. In this case, the sequence of a_t^* is influenced only by the increasing probability 1 - Q_t that nobody will fix the problem. Thus a_t^* decreases, i.e.

Corollary 3: Assume that c_t = c and that F(.) is continuous at $\bar{a}$.

If $-\frac{[P-c]}{(n-1)P} < \bar{a}$, then $q_t < q_{t+1}$. Otherwise q_t =0 for all t.

Proof: $-\frac{[P-c]}{(n-1)P} \geq \bar{a}$ implies that, with probability 1, player n will Pass the Buck, player n-1 will do it, and so on, i.e. q_t =0 for all t. From $-\frac{[P-c]}{(n-1)P} < \bar{a} \leq 1$ follows $P > c$. c_t= c implies

(11) $D_t = cQ_t$.

After substituting D_t in (5) we get

(12) $$\frac{\partial a_t^*}{\partial Q_{t+1}} = \frac{c \cdot (nP-c)}{[(n-1)P(1-Q_{t+1})+cQ_{t+1}]^2} > 0\,.$$

As Q_t decreases with t, a_t^* decreases with t, and therefore q_t increases with t. □

Of course there are alternatives to the simple linear altruism model. Inequity aversion (Fehr and Schmidt, 1999; Bolton and Ockenfels, 2000) will not make a great difference but the consideration of reciprocity may be important. If it is player t's turn to decide she knows (except t = 1) that previous players have not fixed the problem though they had lower costs than she has, and she may dislike the idea to be these opportunists' fool. But if a player assumes an obligation for previous players to fix the problem then she must also accept her own obligation with respect to her successors. Therefore a reciprocative decision rule as "always fix the problem in period 1 but never in later periods" seems to be inconsistent.

Superior models may be inspired by the reciprocal altruism model of Levine (1998) or the dynamic altruism model of Bolle and Kritikos (2006). As a simplification of these ideas we could hypothesize that the altruism parameter for those who have Passed the Buck decreases to $b_t < a_t$, i.e. fixing the problem is evaluated by P - c_t + (t -1) b_tP +

(n - t)a_t P where b_t is a second individual parameter which is not known by the other players. This approach would yield a similar result as Proposition 2.

A variation of the model without the necessity to alter the theoretical investigation are cases where many people are affected by the problem but only some of them (say T) have the power or competence to fix it. Then we can simply restrict the analysis to periods n–T+1 through n without any change in the recursion formulas of Proposition 2. The case when there is only one expert who can fix the problem (i.e. game Γ_n^t, see above) delivers a useful comparison to the "normal" Passing the Buck game.

Corollary 4: In Γ_n^t the probability $\tilde{q}_t$ that t is altruistic enough to fix the problem is larger than that of player t in Γ_n, provided $c_t < P$ and t < n. In the case t = n both probabilities are equal.

Proof: In game Γ_n^t **,** $\tilde{q}_t = F(\tilde{a}_t)$ is computed as if t were the last period. Therefore $\tilde{q}_n = q_n$. For t < n, $\tilde{a}_t = \frac{C_t - P}{(n-1)P} < \frac{C_t - P(1-Q_{t+1})}{(n-1)P(1-Q_{t+1}) + D_t} = a_t^*$ is equivalent to $(c_t - P)D_t < c_t Q_{t+1}(n-1)P$ which is always fulfilled for $c_t < P$. □

At last, let us have a look at the Passing the Buck game under a random utility assumption (McFadden, 1974; McKelvey and Palfrey, 1995, 1998)[5]. We assume that a player's utilities $EU(fixing)$ from (9) and $EU(passing)$ from (10) are perceived by them only stochastically. Technically we assume additive random terms which are extreme value distributed. Then a player decides for fixing the problem with a probability

(13) $$q_t(a_t) = \varphi(EU(fixing), EU(passing) = \frac{g(EU(fixing))}{g(EU(fixing) + g(EU(passing))}$$

with g(z)=$e^{\lambda z}$, $\lambda \in \mathrm{IR}_+$.

In period n, we have x_n = EU(fixing) = P – C_n + a_n(n – 1) P and y_n = EU(passing) = 0. This implies an average fixing probability of

[5] For an overview and critical comments see Haile et al. (2008).

(14) $\tilde{q}_n = \int q_n(a_n)dF(a_n) = \int \varphi(P - c_n + a_n(n-1)P, 0)dF(a_n).$

In period t the expected utilities of player t are

(15) $x_t = EU(fixing) = P - c_t + a_t(n-1)P$ and

(16) $y_t = EU(passing) = \tilde{Q}_{t+1} \cdot (P + a_t(n-1)P) - a_t\tilde{D}_{t+1}$

where $\tilde{Q}_t$ and $\tilde{D}_t$ are determined by the recursion formulas (7) and (8) after substituting q_t by $\tilde{q}_t$ with

(17) $\tilde{q}_t = \int q_t(a_t)\, dF(a_t).$

Therefore there is a logit equilibrium of Passing the Buck which uniquely determines the stochastic behavior of all agents. Equilibrium behavior is described by (7), (8), (13), (15), (16), and (17).

II.3 Two policy questions

If we have the choice, should we rely more on large groups or on small ones if we want that help is provided with high probability? In general Public Good games (Isaak and Walker, 1988) as well as in the Volunteer's Dilemma game[6] (Diekmann, 1985, 1986, 1993; Franzen, 1995; Goeree et al., 2005) this question is discussed theoretically and investigated with experiments. The answer depends on whether the efficiency of the public good production is independent of n and, for a theoretical investigation, also on whether the social utility function is independent of n. In the Passing the Buck game, if we assume P and c_t to be given and the distribution of $a_t(n-1)$ to be independent of n[7], then the crucial comparison of (9) and (10) is independent of n, i.e. we carry out the same backward induction and arrive at the

[6] If players are egoistic and play the mixed strategy of the symmetric game then the probability that a volunteer is found should decrease with the number of players. This hypothesis is contradicted by the experiments of Franzen (1995) and Goeree et al. (2005).
[7] Such independence is assumed for the parameters of Fehr and Schmidt's (1999) inequality aversion.

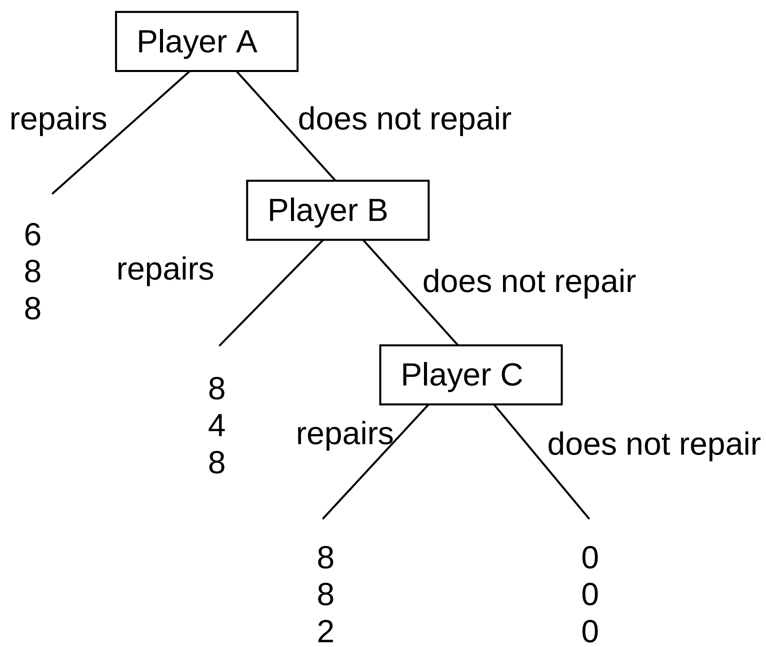
same last period q_n and Q_n for every n. As Q_t is decreasing in t, however, Q_1 is larger for larger n, i.e. the problem will be fixed with a higher probability if n is larger.

Another question is whether it might be a good policy to appoint an expert who is the only one who has the competence (and the duty) to fix the problem. If you know that it is personally advantageous for the expert to fix the problem then this is certainly a good policy because the problem will be fixed with probability 1. It is an empirical question whether a randomly determined expert has a higher average fixing probability than a sequence of non-experts.

3. An experimental investigation

3.1. The experiment

Passing the Buck is played with three players/periods and the game tree from Figure 2 (where utilities are equal to pay-offs), i.e. we have P = 8 and $c_1 = 2$, $c_2 = 4$, $c_3 = 6$. As it is easier for subjects to understand the implication of their and others' behavior when confronted with a concrete example of social relations[8] they were told a story of three individuals renting together a machine which is used sequentially by A, B, and C. Already on the first day a problem turns up which does not affect their gross profit P but which needs to be fixed before the machine is returned.



[8] That is the message of the Wason Four Card test when played with different frames (Wason, 1966; Cosmides and Tooby, 1992).

Figure 2: The game tree of the experimental Passing the Buck game.

The experiment was played as a classroom experiment in two sessions. The subjects were seated in a large lecture hall as in written examinations, i.e. with enough space between them to prevent communication. Every subject got a sealed envelope. After a verbal explanation of the task they were asked to open their envelopes where they found a written description of the situation (repeating the oral explanations) and three (in session 1) or four (in session 2) sheets of paper which were folded and clipped together. At the head of the description sheet they could read a subject number and they were required to choose a pseudonym. In the first session, subjects decided either in treatment 1a or in 1b or in 1g plus 2 (this order); in the second session either in Treatment 1b plus 2 (this order) or in 1d plus 2 (this order) or in 1e or in 1f.

After subjects had read the description of the game, they were asked to open the first clipped sheet of paper. There they were required to decide in a certain position (in Treatment 1a as player A) and put the sheet of paper back into the envelope. Then they were asked to open the next clipped sheet of paper where they found a questionnaire requiring information about sex, age, faculty, and country of origin (for Germans, which federal state). After they had put also this sheet of paper back into the envelope they opened the third clipped sheet of paper where they were asked to decide in another position (in treatment 1a as player B). In the second session there always was a fourth clipped sheet of paper. Under treatment 1c (1f), a last decision in the position of C (A) had to be made. If the first session started with treatment 1g or if the second session started with 1b or 1d the last decision was on treatment 2 where the player was told to be the only expert who could fix the problem (her fellow players couldn't) and she was required to decide in positions A, B, and C (this order).

Treatment	1a	1b	1c	1d	1e	1f	1g	2
Order of positions	A, B	B, C	C, B	B, A	A, B, C	C, B, A	B	A, B, C
Expert	*no*	*no*	*no*	*no*	*no*	*no*	*no*	*yes*
Session	1	2	1	2	2	2	1	1, 2
Number of	30	26	32	25	25	26	29	80

subjects

Table 1: Treatments.

In the instructions, the players were told that groups of three would be formed and that they would be appointed to a group and to a role by chance. Their pay-off would be determined by their own and by their fellow players' decisions. They were not described the exact matching procedure but were guaranteed that every decision had about the same probability to be decisive. For the practical matching we had to take care that players received a certain role only if they had made a decision in this role. In order to make also the expert decisions pay-off relevant, participants in the conditions "Treatments 1b/1d/1g plus Treatment 2" were either allocated to expert or non-expert groups. In the expert group only A or B or C was determined by chance to be the expert and only his decision in the respective role was made pay-off relevant. The subjects received their payment from a person not involved in the experiment after reporting their subject number and pseudonym.

Why so many treatments with different orders and numbers of decisions? I wanted subjects to make more than one decision because only then individual differences and random influences can be disentangled. With several decisions, however, also the influence of the order of decisions has to be investigated.

3.2. Aggregate results

The experiment lasted about 20 minutes and payments were €6.50 on average. The reason for presenting A, B, and C in many different orders is the possibility that decisions are not independent if they are required to be made together. It is important, however, that the subjects see themselves in only one position in the sequence of decision makers, develop expectations about the decisions of sub-sequent players and (under reciprocity aspects) evaluate the behavior of previous players who (except in the expert treatment) have Passed the Buck to her. The presentation of the non-expert decision requirements on different sheets of paper and the position of the questionnaire which separated the first and the second decision were expected to foster independent decisions.

Did the number and order of decisions play a role? Let us first have a look at the decisions in position B. There is no significant difference of repair decisions, whether B was the only non-expert decision (62%), the first decision (60%), or the second decision after deciding in position A (51%) or C (51%). Similarly, there is no significant difference between A and C decisions when these were first or second decisions. The third decision, however, which is required in treatments 1e and 1f, is less often a fixing decision. (See Table 2.) This may be an indication that decisions are not completely independent. Some subjects may have got the impression that they have done their duty after one or two fixing decisions. As Table 3 shows, however, these deviations are relatively small (a reduction of 18 to 29 percentage points), concerning one of three decisions of 51 of 192 subjects or of 30% of the decisions in role C and 32% of the decisions in role A. Below, we will discuss whether to neglect this effect or not.

	A	B	C
Tr. 1 (all variants)	68/106* 64%	104/192 55%	77/108*** 71%
Tr. 1 (first decision)	38/55^{+} 69%	48/80 60%	45/57**$^{+++}$ 78%
Tr 1 (second decision)	17/25 68%	57/112 51%	20/26$^{\$++}$ 77%
Tr 1 (third decision)	13/26 50%	-	12/25 48%
Tr. 2 (expert)	76/80§ 95%	72/80§ 90%	54/80 68%

Table 2: Frequencies of repair (not passing the buck)
*(**, ***) different from B in a χ^2-test[9] with p = 0.09 (0.02, 0.004)
+(++,+++) different from third question with p=0.09 (0.03, 0.006)
§ different from Treatment 1 (all variants) with $p < 10^{-6}$

The distribution of individual decision structures is given in Table 3. A structure **10.** indicates that the problem is fixed by the player in position A, that it is not fixed in

[9] A Fisher test is neither practical nor better because of the large numbers involved.

position B, and that the decision in position C is not elicited or disregarded. Neither are the frequencies under the orders of decisions ABC and CBA significantly different nor those under orders AB and BA or under BC and CB. From the aggregate decisions under ABC and CBA we can determine the marginal frequencies for AB and BA as well as for BC and CB. The former are significantly different from the observed frequencies under orders AB and BA, the latter are not.

Structure	**111**	**110**	**101**	**100**	**011**	**010**	**001**	**000**	**N**
Order ABC	7	5	1	4	0	2	4	2	25
Order CBA	5	3	4	1	2	2	8	1	26
Aggr. ABC/CBA	12	8	5	5	2	4	12	3	51
Marginal	**11.**	**10.**	**01.**	**00.**	**.11**	**.10**	**.01**	**.00**	
Distributions	20	10	6	15	14	12	17	8	51
Order AB	8	13	6	3					30
Order BA	11	6	5	3					25
Aggr. AB/BA*	19	19	11	6					55
Order BC					10	4	10	2	26
Order CB					14	3	12	2	31
Aggr. BC/CB					24	7	22	4	57
Only B	**.1.**	**.0.**							
	18	11							29

Table 3: Frequencies of individual decision structures.
* Significantly different from marginal distribution in a χ^2-test with p = 0.046.

Result 1: The number and order of Passing the Buck decisions have only a small influence. One systematic deviation is that third decisions are significantly less frequent (18 to 29 percentage points) “fixing” decisions than first and second decisions are.

In the following we say that decisions in Treatment 2 are made by experts and the decisions in Treatment 1 by non-experts. It made no significant difference whether the expert decisions were placed after Treatment 1b or 1d or 1g.

Result 2: Corollary 4 is supported. We find that the frequencies of fixing the problem in positions A and B are much higher in the case of experts, and that the frequency in position C is not significantly different (see Table 2).

Finally, we try to adapt the structure outlined in Lemma 1 (for experts) and Proposition 2 (for non-experts) to our data. For the altruism parameters we assume a normal distribution and that it is common knowledge. Do the aggregate results, i.e. the frequencies $(q_A,q_B,q_C)=(0.64, 0.55, 0.71)$ for non-experts and $(q_A,q_B,q_C)=(0.95, 0.90, 0.68)$ for experts differ significantly from the theoretical model? χ^2-tests are carried out after the parameters have been estimated by the χ^2 minimum method. For the minimization in this and all following cases the Nelder-Mead algorithm is used. In the case of experts, we get $\chi^2 = 0.956$ (df=1, p=0.328) at $\mu = -0.026$, $\sigma = 0.198$. For non-experts we find a minimum of $\chi^2 = 2.03$ (df=1, p=0.154) at $\mu = 0.328$, $\sigma = 0.760$. Thus experts' and non-experts' behavior can be explained by the theoretical model if we assume different distributions of the altruism parameters. A joint estimation of expert and non-expert frequencies with the same (μ,σ) is not successful. The minimum χ^2 score is 14.38 (df=4, p=0.006) and thus indicates a significant deviation between the empirical and the theoretical structure.

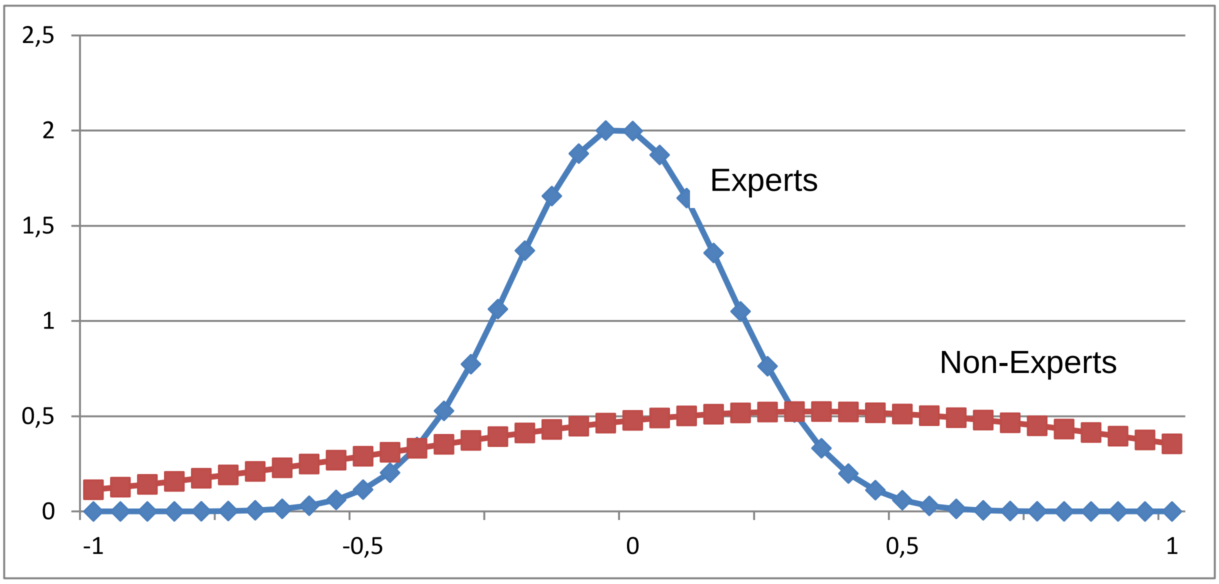


Figure 2: The estimated normal distributions of altruism parameters for experts ($\mu = -0.026$, $\sigma = 0.198$) and non-experts ($\mu = 0.328$, $\sigma = 0.760$)).

Result 3: The observed aggregate frequencies of fixing decisions of experts and non-experts are both individually compatible with the theoretical model. There is no normal distribution of altruism parameters, however, which explains both aggregate frequency structures.

The impossibility of describing the two frequency structures with the same model can be due to several reasons. First, the expert *role* may be different from the non-expert role and different roles result in different levels of altruism. According to the above estimation experts are neither very altruistic nor very spiteful. Their average altruism parameter is close to 0 and the variance is small. Non-experts are, on average, more altruistic, but they also differ much more than experts do. As a second explanation, *dynamic (reciprocal) preferences* might be assumed which can apply only in the case of non-experts. Both explanations, however, do not suit well to the fact that, in position C, experts and non-experts show almost the same frequencies (68% and 71%) of fixing the problem. Under the assumption of different roles and under reciprocal preferences this would happen only by chance. A last explanation is that random influences play a decisive role. We will discuss this explanation by taking into account the structure of individual decisions.

3.3. The structure of decisions

So far we were concerned mainly with the aggregate frequencies of fixing decisions in positions A, B, and C. Now we have a look at the structure of decisions by the same subject (Table 3). All data points are all from different individuals and thus independent.

According to Corollary 1, experts should show $a^*_A > a^*_B > a^*_C$ and thus only structures **111** or **110** or **100** or **000** should be observed. From the estimated distribution of altruism parameters we can predict the frequencies of the different structures. **111** results if a subject has an altruism parameter larger than a_A^* and it should be observed with frequency q_A. **110** should occur with frequency $q_B - q_A$, **100** with frequency $q_C - q_B$ and **000** with $1 - q_C$. (See Figure 3). We see in Table 4 that the experts' observed frequencies suit relatively well to the predicted frequencies of the q_i computed from the estimated (μ,σ).

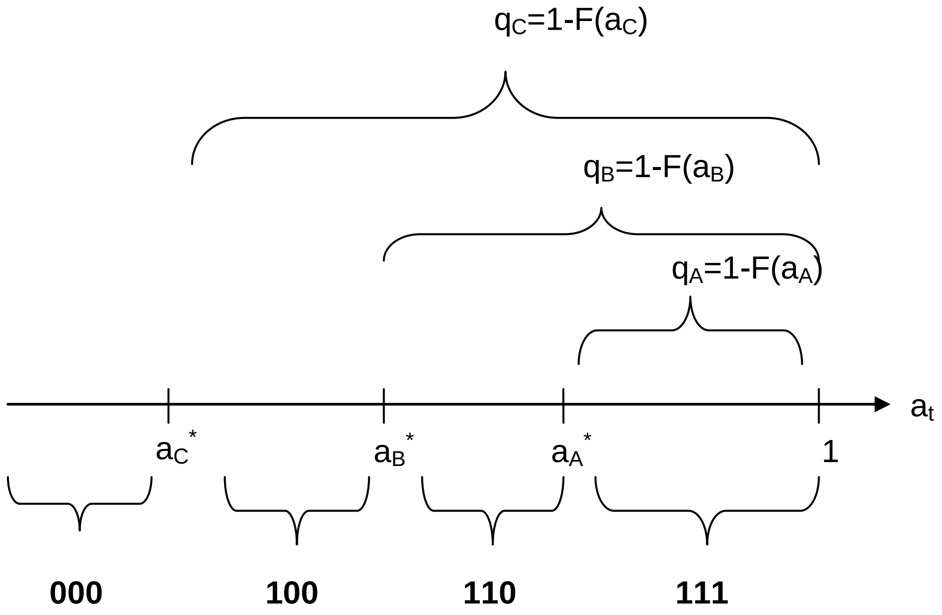


Figure 3: The prediction of the frequencies of structures in the case of experts.

	111	**110**	**100**	**000**	**(other)**	**sum**
Predicted	69.1%	18.0%	9.0%	3.9%	0%	100%
Observed	49/80 61%	22/80 28%	2/80 2%	2/80 2%	5/80 8%	 101%

Table 4: Structure of expert decisions, predicted from the estimation of the altruism parameter distribution with μ =-0.03, σ = 0.19 and observed.

	111	**101**	**001**	**000**	**other**	**sum**
Forecasted	56.2%	0.019%	14.6%	27.3%	0%	100%
observed	12/51 24%	5/51 10%	12/51 24%	3/51 6%	19/51 36%	 100%

Table 5: Structure of non-expert decisions in Treatments 1e and 1f, forecasted from the estimation of the altruism parameters' distribution with μ=0.328, σ=0.760 and observed.

In the case of non-experts, the order of the a_i may be different; in the experiment, we observed q_B<q_C<q_A which corresponds to $a_B^* > a_C^* > a_A^*$. The predicted and the observed frequencies of structures in Treatments 1e and 1f are reported in Table 5. The non-experts' decision structure shows major deviations from the forecasts, in particular the large difference in the "others" category casts doubt on the explanation of the non-experts' behavior by "rational altruism".

As the "others" category has a theoretical probability of 0, no direct χ^2–test is possible. In the following the rationality model will be qualified by assuming that subject's decisions have a random component, either in the form of *quantal response equilibrium* (McKelvey and Palfrey, 1995, 1998) or in the form of a *random parameter* approach (Cox et.al., 2007). The fit of the quantal response equilibrium (derived in Section 2) is endogenously tested by the resulting chi-square scores which will suggest the rejection of the model "logit equilibrium with normally distributed linear altruism". As an alternative, random "emotional states" (Cox et.al., 2007, p.18) are assumed, that are altruism parameters which change for every decision to be made.

For the logit equilibrium, the individual fixing probabilities $q_t(a_t)$ are determined by (13) together with (7), (8), (15), (16), and (17). The theoretical probability with which a subject with the altruism parameter a is ready to fix the problem in all three periods (category **111**) is $q_1(a)q_2(a)q_3(a)$, i.e. category 3 should be assumed with a relative frequency of

$$(18) \quad h_{RU}(\mathbf{111}) = \int \mathrm{q}_1(\mathrm{a})\mathrm{q}_2(\mathrm{a})\mathrm{q}_3(\mathrm{a})\, dF(a).$$

The other relative frequencies are determined correspondingly. Now I try to adapt the frequencies Aggr.1, Aggr.2, Aggr.3, and Only B from Table 3 to the predictions of the theoretical model where F is a normal distribution as above and the random influences are measured by λ from (13). Altogether there are 18 frequencies from four distributions. Because three parameters are estimated the χ^2 statistic with these frequencies has 18-4-3=11 degrees of freedom. For all the following parameter estimations (of Quantal Response equilibria as well as of the Random Parameter equilibria) again the minimum χ^2 method is used and the minimum is computed with the Nelder-Meads algorithm. The minimum χ^2 is 34.01 (df=11, p= 0.0003), which indicates an insufficient fit between model and data.

For the optimal parameter choice the number of theoretical frequencies smaller or equal to 5 is three (=1/6 of all frequencies). According to a rule of thumb which requires 20% of the theoretical frequencies in a χ^2 –test to be larger than 5 this is sufficient. Possibly the mismatch is caused by the fact that third decisions are different (see above). If we disregard third decisions (i.e. C in the order of decisions ABC and A in the order CBA) we can aggregate the resulting structures with Aggr. AB/BA and Aggr. BC/CB in Table 3. A new estimation of (μ,σ,λ) for the categories **ik.**, **.ik**, and **.k.** (= "Only B" in Table 3) with i,k=0,1 results in χ^2 = 22.36 (df=10-3-3=4, p= 0.0002), which constitutes no improvement.

In the random parameter model, the distribution function F has a different meaning. It is the distribution of the random "emotional state" of a subject (measured by his altruism parameter) and we assume that this state is realized by independent random draws of the parameter a according to the distribution F(a). Thus we get

$$(19) \quad h_{RP}(\mathbf{111}) = q_1 * q_2 * q_3$$

With q_i from (6). The other relative frequencies are determined correspondingly. The estimation of the parameters of the normal distribution (with the categories including the third decisions) results in μ=0.219, σ=0.652 and χ^2 = 22.62 (df=12, p= 0.031). If we disregard the third decisions then we get μ=0.280, σ=0.655 and χ^2 = 8.63 (df=5, p= 0.125).

Result 5: The *logit equilibrium* with a linear altruistic utility function and a normal distribution of the altruism parameter cannot explain the structure of decisions in the Passing the Buck game with non-experts (p≤0.0003). A *random parameter* model with the same utility function shows a far better fit with the non-expert decisions (p=0.031), in particular if we disregard the third decisions of subjects (p=0.125).

Let us briefly come back to the expert decisions. A problem for the adaptation of the two alternative models are the low frequencies of six of the eight categories (see Table 4). According to the marginal distributions (q_A,q_B,q_C)=(0.95, 0.90, 0.68) of the experts decisions the catagories **011**, **010**, **001**, **000** are expected to assume the lowest theoretical frequencies and therefore aggregated. The *random utility* model predicts again frequencies which are significantly different from the data (χ^2 = 7.62, df=1, p=0.006) and the *random parameter* approach fits also the expert data better (χ^2 = 4.9, df=2, p=0.086) than the *random utility* model. The estimated distribution of altruism parameters for the *random parameter* model is practically the same, namely μ=-0.002, σ=0.218, as that which was estimated from the marginal frequencies.

Result 6: The expert decisions are in (weak) accordance with *random parameter* altruism (p=0.086), *random utility* in a model of normally distributed linear altruism is rejected (p=0.006).

4. Conclusion

Passing the Buck need not be such a big problem as many people assume, at least not in our three-periods experimental game. 61% of the decisions were “fixing the problem”. In the last period even 71% of our subjects were ready to fix it though the cost of €6 were relatively high compared with the personal benefit of €8. (See the non-experts’ behavior in Table 2). It happened only in about 5% of the cases that a group of three did not fix the problem. (The appointment of an expert resulted in a worse average fixing probability of 84%.) This overall success is qualified, however, by the fact that, in the non-expert game, in only about two third of the cases (64%) the problem was fixed efficiently, i.e. by the first player.

The explanation of behavior by the theoretical model in Section 2 is partly successful. The aggregate fixing probabilities in positions A, B, and C can be explained, although with different altruism parameter distributions of experts and non-experts. The structure of individual decisions can be explained by a *random parameter* model (Loomes and Sugden, 1995; Cox et al., 2007), but not by a *random utility* model (MacKelvey and Palfray, 1995, 1998).

Under the above analysis the sole-responsibility condition under which experts decide seems to influence their altruism or the distribution from which their altruism parameter is drawn. We may object that, as a second difference, the decision problem of the experts is simpler. This does not prevent, however, the common explanation of experts and non-expert behavior by *random altruism*.

Further insight into the decision structure should be gained from further experiments. Variations of the number of players and costs and benefits may help, but especially new experimental designs (as for example, the elicitation of beliefs about others' behavior) will be required. With this proposal I Pass the Buck to other researchers.

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Appendix: The English translation of the instructions and decision requirements

Page 1

Number: ……………..
(Filled in by the experimenters)
Pseudonym: …………………
(Filled in by the subject)

Instructions

Three individuals A, B, C have jointly rented a machine which is used by each of them for one day. The order is A, B, C. Each of them earns €8 from using the machine.

Already on the first day a problem emerges for which the renters are in change. The problem can be fixed

- by A on the first day or
- by B on the second day or
- by C on the third day or
- not at all.

Costs for fixing are

- €2 on the first day
  Consequence: A earns €6, B and C earn €8 each
- €4 on the second day
  Consequence: A earns €8, B earns €4 (earns €8)
- €6 on the third day.
  Consequence: A and B earn €8 each, (earns €2)
- If the problem is not fixed at all, all three pay a fix of €8 and earn nothing

Payoff: Random Groups of 3 will be formed. You will be randomly selected as A, B or C. Your payoff is according to the decision in your group.

Page 2

Decisions (Treatment 1a)

If you are individual A, how would you decide?

- ☐ I fix the problem
  (*Consequence:* €6 for you, €8 each of the others)

- ☐ I do not fix the problem
  (*Consequence:* €8 for you or nothing for you depending on the decisions of B and C)

Page 3

Personal Questionnaire

Gender:	☐ female	☐ male
Field of studies:	☐ Business	☐ International Business
	☐ Economics	☐ Cultural Science
	☐ Law	☐ others

I completed my university-entrance diploma [Abitur] in the following state (for Germans) or in the following country (for foreigners):

……………………………………………………….

For Germans: In the last federal election I have voted for

☐ CDU	☐ SPD
☐ Linke	☐ Grüne
☐ FDP	☐ others/not voted

Page 4

Decision (Treatment 1a)

If A has not fixed the problem and if you are individual B, how would you decide?

- ☐ I fix the problem
  (*Consequence:* €4 for you, €8 each of the others)
- ☐ I do not fix the problem
  (*Consequence:* €8 for you or nothing for you depending on the decisions of C)

[In other treatments the order of decisions was changed (see Table 1). In treatments 1e and 1f a third decision is required (page 5). In Treatment 2 (after Treatments 1b, 1d, 1g) “experts” are asked to decide:]

Pages 4’ (substitutes of Page 4/5 in the case of experts)

Decisions

You are the only one who can fix the problem because the others are not competent enough.

If you are individual <u>A</u>, how would you decide?

- ☐ I fix the problem
  (*Consequence:* €6 for you, €8 for B and C)
- ☐ I do not fix the problem
  (*Consequence:* zero income for all)

If you are individual <u>B</u>, how would you decide?

- ☐ I fix the problem
  (*Consequence:* €4 for you, €8 for A and B)
- ☐ I do not fix the problem
  (*Consequence:* zero income for all)

If you are individual <u>C</u>, how would you decide?

- ☐ I fix the problem
  (*Consequence:* €2 for you, €8 for A and BC)
- ☐ I do not fix the problem
  (*Consequence:* zero income for all)