The Value of Authority

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Abstract

While the incentive effects of authority within organizations have been studied extensively in economics, researchers from other social sciences have suggested that authority has not only instrumental value, but might be intrinsically valuable. We develop a theoretical and experimental framework which incorporates the possibility that authority has intrinsic value and enables us to identify this value empirically. Our data show that humans intrinsically value authority, i.e., it is a direct source of utility. The intrinsic utility component of authority has important consequences for organizations, such as a tendency for empire building, inefficient delegation of authority, and it can be an obstacle to mergers and acquisitions.

Keywords: Organizational Behavior, Authority, Power and Experiments.
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1 Introduction

This paper tests the hypothesis that authority is intrinsically valuable. Authority is associated with having the right to take decisions that have consequences for oneself and other parties. In organizations, the distribution of authority establishes a hierarchy, which has important consequences for incentives and for organizational efficiency (see, for example, Aghion and Tirole (1997), Dessein (2002), Alonso, Dessein and Matouschek (2008), Athey and Roberts (2001), and Baker, Gibbons and Murphy (1999)). It is therefore important to understand the motives of individuals to acquire and hold on to authority. So far, economists focussed on the incentive effects of authority and regarded authority as an instrument that can be valuable because it allows to extract rents, choose favorable actions or to adjust risk and uncertainty according to one's preference.

Authority as we define it in this paper gives an individual influence over others, since actions taken in organizations usually affect the outcomes of other individuals. Therefore, our notion of authority neatly fits into standard political science definitions of power.[1] It may be important to consider the power aspect of authority because psychologists have long argued that there might be more to power than the extrinsic benefits that result from its exercise. For example, the concept of power motivation (McClelland (1975)) postulates that "Humans have a 'need for power' where power connotes an internal urge to influence and control other people," and self-determination and self-efficacy, which are both concepts that are closely related to authority, have long been considered as potential intrinsic sources of utility (see Deci (1981) and Bandura (1997)).

However, the psychological literature often does not clearly distinguish between intrinsic and extrinsic factors that may affect utility. The economic literature on the other hand has so far ignored potential intrinsic utility aspects of authority. It therefore remains an open question whether authority is simply a tool that allows individuals to achieve higher utility by using it to influence processes to their own advantage, or whether it additionally has an intrinsic utility component. With field data, it is difficult to precisely measure a potential intrinsic utility component, because the costs and benefits associated with having or not having authority are private information of the individual. Extrinsic and intrinsic components of utility are therefore not perfectly separable. Moreover, the utility function of the individual is unobservable and usually only one position within the authority relationship

[1] See, for example Giddens (1985): "Power in its highly generalized sense means 'transformative capacity', the capability to intervene in a given set of events so as in some way to alter them." (The Nation-State and Violence). Another definition is given by Bachrach and Baratz (1970): "Of course power is exercised when A participates in the making of decisions that affect B." Further definitions of power can be found in Polsby (1963) or Lukes (2005).

is observed (either an individual has authority or is a subordinate), so nothing can be learned about the counterfactual case. Given these limitations of field data, experimental evidence is useful to shed light on this question.

This paper develops a theoretical framework which incorporates the possibility that authority has intrinsic value for individuals, and we use experimental methods to test whether individuals indeed behave as if they assign intrinsic value to authority. A laboratory experiment is ideally suited to study this question because it gives us control over the benefits and costs and allows us to study both, the situation in which an individual has authority and the situation in which it is the subordinate, such that we can draw conclusions with regard to the utility received in the realized as well as in the counterfactual case.

In our experiment, a principal and an agent can implement a project. The project can be implemented in two different variants and there is a conflict of interest with regard to which variant should be chosen. One variant is favoured by the principal, the other by the agent. The party with authority can choose the variant. The party with authority can also choose the effort, which determines the probability of successful implementation. Effort is costly and the party with authority has to bear this cost.[2]

Initially, authority is given to the principal. The principal can keep authority or choose to delegate authority to the agent. Our experiment is concerned with the principal's willingness to delegate authority to the agent. Intuitively, the principal should delegate authority if his utility in case of delegation is at least as large as his utility if he keeps authority. However, the outcomes in case of delegation will depend on actions taken by the agent and therefore expected utility in case of delegation depends on beliefs as well as risk and ambiguity preferences. In order to control for the principal's preferences and beliefs, we use an approach that elicits the conditions that make the principal indifferent between keeping and delegating authority. The principal can choose a minimal effort requirement for the agent, conditionally on which authority is delegated. Only if the agent chooses an effort which is at or above the stated requirement, authority is delegated. Otherwise, the principal keeps authority. At the same time, the principal chooses his own effort for the case that the agent does not fulfill the requirement. While this is an unusual setting when thinking about delegation of authority in organizations, it enables us to observe the principal's utility maximizing behavior when he keeps authority, as well as an effort requirement for the agent that, if exactly chosen, makes the principal exactly indifferent between keeping and delegating authority. If the

[2] We purposefully introduced a conflict of interest with regard to the variant choice. Some political scientists view conflict between parties as essential for authority to be meaningful. For example, Ball (1976) writes: "when we say that someone has power or is powerful we are assigning responsibility to a human agent or agency for bringing (or failing to bring) about certain outcomes that impinge upon the interests of other human beings."

agent chooses an effort level above the minimal requirement, the principal strictly prefers to delegate authority, because project success becomes more likely. Once the effort and variant decisions are made, payoffs in the authority game are solely determined based on the probability of successful project implementation and the associated payoffs and costs. Hence, there is an implied lottery that determines the ultimate outcomes for the principal and the agent. Therefore, we label the case of kept authority and choosing the individually optimal effort level as "the authority lottery," and the case of delegated authority when the agent exactly chooses the minimal effort requirement as "the subordinate lottery."

We use the revealed indifference between the authority lottery and the subordinate lottery to test the null hypothesis that authority has no intrinsic effect on utility. In a second part of the experiment, we elicit certainty equivalents of lotteries that are identical in any aspect to the authority lottery and the subordinate lottery as they were determined in the authority game. However, these lotteries are presented to the principals as pure lotteries, i. e. completely outside the context of the authority game. Therefore, preferences for authority cannot play a role in the evaluation of these lotteries because they do not arise in the context of a delegation decision. The principals are simply confronted with lotteries that happen to be identical to the lotteries that they demselves determined by fixing their effort choice for the case of kept authority and by fixing a minimum effort requirement for the agent. If authority indeed has no intrinsic effect on utility, we should observe no systematic differences in the certainty equivalents of these lotteries. If, however, authority is intrinsically valuable to individuals, we should find differences in the certainty equivalents of these lotteries. If authority is intrinsically valuable, there is an additional utility component that positively affects utility in the authority lottery. Hence, the principal needs to value the pure lottery that is monetarily identical to the subordinate lottery higher than the pure lottery that is monetarily identical to the authority lottery, because he demands a compensation for the loss of the intrinsic value of authority when he delegates.

Our main finding is that principals have an intrinsic value of authority, which cannot be explained by the monetary consequences of the authority allocation. Principals assign significantly *larger* certainty equivalents to the pure lottery that is identical to the subordinate lottery compared to the pure lottery that is identical to the authority lottery. On average, this difference amounts to 14.2% of the overall value of the lottery. Given that the principal revealed to be indifferent between the two lotteries in the authority game, the observed difference in certainty equivalents must be due to an intrinsic value component that is not represented in the pure lotteries. The intrinsic value component must be such that it positively affects the authority lottery in order to restore the initial indifference.

While our main result establishes the existence of an intrinsic value of authority, it is important to check the robustness of this result on an individual level. If intrinsic value of authority is indeed a stable component of individual preferences, it should affect individuals consistently across different situations that involve an authority relationship. In our experiment, principals had to make decisions on the delegation of authority in 12 games that differed with regard to the game parameters. Estimating Cronbach alpha, a concept that allows to assess the extend to which our different games measure the same latent variable, reveals that the intrinsic value of authority is measured very consistently across games ($\alpha = 0.81$), which lends support to the hypothesis that the intrinsic value of authority is based on a stable individual preference for authority.

Additional evidence that authority is intrinsically valuable may be obtained by considering individual loss aversion, i.e. the tendency of losses to loom larger than equally sized gains. There is evidence that the valuation of owned goods is affected by loss aversion (Knetsch (1995)), because more loss averse individuals demand a larger compensation for the loss of a good than less loss averse individuals. If authority is intrinsically valuable, we might also observe such an effect in our data. In our experiment, the subjects were randomly assigned the role of the principal, i.e., they were randomly endowed with authority. Thus, if there is intrinsic value of authority, then subjects whose preferences exhibit more loss aversion should demand a larger compensation for the delegation of authority. In a separate experiment we measure subject's loss aversion and we indeed find a positive correlation between a subject's loss aversion and the intrinsic value assigned to authority. Subjects with a degree of loss aversion above the median on average have a 37 percent larger intrinsic value of authority than subjects with a degree of loss aversion below the median.

Our paper contributes to the understanding of the motivational consequences of authority. We provide evidence that individuals have an intrinsic value of authority, an insight that has so far been neglected in economics and that has, to our knowledge, not been shown empirically in other social science literatures. These insights have important consequences for the analysis of authority relationships within organizations. Individual incentives to efficiently delegate authority within organizations might be severely reduced, which implies a rationale for empire building (see Niskanen (1971)). It creates a distortion in the efficient delegation of authority to subordinates. Indeed, Fehr, Herz and Wilkening (2010) find evidence that principals delegate too little which results in considerable monetary losses for the organization in an experimental setting.[3] Considering that authority assignment can have severe monetary consequences for the organization as a whole (see Aghion and Tirole (1997)), it can be harmful if the authority allocation is distorted due to individual intrinsic

[3]Dominguez-Martinez, Sloof and von Siemens (2010) also find suggestive evidence that principals have a preference for control in a principal-agent monitoring task.

benefits from keeping authority. Hence, overall efficiency can be significantly reduced due to underdelegation of authority.[4] It is therefore important to think about mechanisms that bring about the optimal allocation of authority within organizations and account for potential distortions that stem from the fact that directly involved parties make the delegation decision.

Intrinsic value of authority can also have effects on organizational growth and transformation. There is evidence in corporate finance that is consistent with CEO's trading power for premium in merger negotiations (see Wulf (2004) and Hartzell, Ofek and Yermack (2004)) and there is suggestive evidence that mergers can fail because of dispute over the authority allocation in the merged company. For example, in 1998 a planned merger between Glaxo-Wellcome and SmithKline Beecham, which would have been the largest merger ever at that time, failed because the top executives of the merging firms were unable to agree on the division of authority between them in the merged entity.[5] The merger failed despite consensus that synergies between the two firms would have been large.[6] The notion that social factors - like the intrinsic value of authority - may be important determinants of merger success and failure is indeed discussed widely by practitioners and observers of mergers and acquisitions (see Lipin (1996)). Intrinsic value of authority is thus one aspect that helps understanding how exactly social factors affect organizational change, and which role they may play in the evolution and restructuring of organizations.

Another application of the intrinsic value of authority is worker empowerment. Managerial scientists regard empowerment as an important tool of employee motivation. Thomas and Velthouse (1990) identify four cognitions which are the basis of worker empowerment: Sense of impact, competence, meaningfulness, and choice. Clearly, these cognitions do not only refer to instrumental aspects of power, but also to intrinsic aspects. The empowerment literature postulates that delegation of authority serves the purpose to raise an agent's utility, independent of the consequences of authority. This implies that the delegation of authority can help relaxing participation constraints. Suggestive evidence in favour of this hypothesis has previously been found in studies of individuals who follow career paths that give them more authority in what they do. Hamilton (2000) shows that entrepreneurs ef-

[4] Given that we argue that authority is intrinsically valuable, this value should obviously be included in an analysis of efficiency of the organization. However, authority was randomly assigned in our experiment, hence it is reasonable to assume that agents and principals intrinsically value authority equally. This implies that a transfer of authority has in expectation no effect on the average intrinsic value of authority. We can therefore ignore this aspect when analyzing organizational efficiency.

[5] Hartzell et al. (2004) provide further evidence of this kind, for example how the proposed acquisition of Texaco Inc. by Chevron Corp. initially fell through because Chevron's CEO "was not willing to share power with" his Texaco counterpart.

[6] This particular case of merger failure has become known as the "clash of the egos." The firms finally merged two years later, after the SmithKline CEO retired in 1999.

fectively forego earnings for their self-employment, which also holds true for scientists (see Stern (2004)). Our results suggest that intrinsic value of authority is a potential explanation for these differences and they provide a rationale why worker empowerment affects workers beyond the pecuniary incentive effects of authority.

Finally, the clear distinction between intrinsic and extrinsic impact factors on individual utility in our paper lends credibility to theories in social psychology that power itself, as well as elements of power like increased self-determination and increased self-efficacy, are intrinsically valuable. Even in the field of economic philosophy the notion that attributes of power may be intrinsically valuable is discussed, for example in the capabilities approach developed by Amartya Sen and Martha Nussbaum (see for example Sen and Nussbaum (1993) and Nussbaum (2000)).[7] Given the prevalence of interest in the effects of power and authority, the empirical evidence provided in this paper should be taken into account not only in organizational economics, but in other social science disciplines as well.

The remainder of the paper is structured as follows. Section 2 details our experimental design. In Section 3, we present theoretical predictions and a theoretical framework that incorporates the possibility that authority has intrinsic value. Section 4 reports the results of our experiment, and Section 5 concludes.

2 Experimental Design

Our experiment is designed to measure an individual's intrinsic value of authority, i.e. the willingness to pay for authority that is independent of the monetary consequences of the authority relationship. A clean measurement of this value requires a design that involves two separate experiments. The first experiment is an authority game and the second is a lottery experiment. Subjects participated in both experiments in a single session. The authority game was always played first. Subjects read instructions and had to answer control questions to guarantee that the instructions were understood. Instructions for the lottery experiment were only handed out after the authority game was finished, and subjects did not know the content of the second experiment beforehand. Again, subjects had to complete control questions to make sure that the instructions for the lottery experiment were understood. Section 2.1 explains the authority game and Section 2.2 explains the lottery experiment in detail. Procedural details are given in Section 2.3.

[7] Martha Nussbaum writes: "The central capabilities are not just instrumental for further pursuits: they are held to have value in themselves, in making the life that includes them fully human" (Nussbaum (2000)).

2.1 The Authority Game

The basis of our experimental design is a principal-agent game, in which a principal (she) and an agent (he) are organized in a hierarchical structure and must decide to implement a project.

The project can be implemented in one of two variants: variant A or variant B. Each variant generates a private benefit of P_A or P_B for the principal and of A_A or A_B for the agent if the project is implemented successfully. If the project implementation is unsuccessful, the principal and the agent receive a known outside value of P_0 and A_0 respectively. The principal always prefers variant A over variant B ($P_A > P_B > P_0$), and the agent always prefers variant B over variant A ($A_B > A_A > A_0$), and independent of the variant, a successful implementation is always preferred to the outside option. One party is given authority, which is equivalent to the right to choose a project variant and the right to choose an effort level to successfully implement the project. This party can select the effort in increments of 1 from $\{0, 1, \ldots, 99, 100\}$. This effort corresponds to the probability that the project is implemented successfully. Effort choices are made in private and effort has an associated cost generated via a quadratic cost function. The cost is borne by the party who chooses the effort. Costs are identical for the principal and the agent. Project payoffs and cost functions are common knowledge. The cost functions are given by: $C_P(E) = \frac{E^2}{100}$ and $C_A(e) = \frac{e^2}{100}$, where E is the principal's effort choice and e is the agent's effort choice.[8]

The game is played in 5 stages, which are illustrated in Figure 1. In the first stage of the game, the principal has authority but can choose to delegate it to the agent. In case of no delegation, the principal gets to choose the variant and the implementation effort. In case of delegation, the agent gets to choose the variant and the implementation effort. The delegation decision is not implemented as a binary choice, but as a conditional choice. The principal can condition the delegation of authority on the agent's effort in case the agent receives authority. Precisely, the principal can choose a minimal agent effort (MAE) requirement, conditionally on which the delegation of authority is implemented. If the agent chooses an effort level equal to or above the requirement, authority is delegated to him. Otherwise, the principal keeps authority.[9] If, for example, the principal determined an MAE of 60, and the agent chose an effort of 40, authority was not delegated and the principal kept authority.[10]

[8]The cost of effort is presented to subjects in a table where each possible effort and its associated cost are displayed. In addition, the instructions contained a graph displaying the cost function (see appendix 5 for further details).

[9]The MAE could not be made conditional on the variant choice of the agent. The agent was always free to choose the variant he preferred. In 98.1% of the cases, this was variant B.

[10]Only the party who eventually has authority has to bear the cost of his own effort. If, for example, the

The second and the third stage are implemented using the strategy method. Both parties determine their variant and effort choice in case they have authority. Finally, in stage 4 and 5, given the minimal effort requirement and the actual agent effort, the delegation decision is determined, and according to the choices made in stage 2 and 3 the project variant is implemented. A random process determined the success or failure of the project implementation, and payoffs are made accordingly.

This experimental procedure allows us to elicit five different variables: the principal's effort and variant choice, the minimal agent effort requirement of the principal conditional on which he delegates authority and the agent's effort and variant choice.

The authority game was repeated for 12 rounds. Subjects remained in the role of the principal or the agent throughout the experiment. The twelve rounds differed with regard to the payoffs that could be achieved at variant A and variant B of the project. The cost functions were constant across rounds. Therefore, in every round a different authority game was played. We chose different parameterizations in order to test the robustness of a potential result across different games. Table 1 gives an overview of the payoffs in each game.

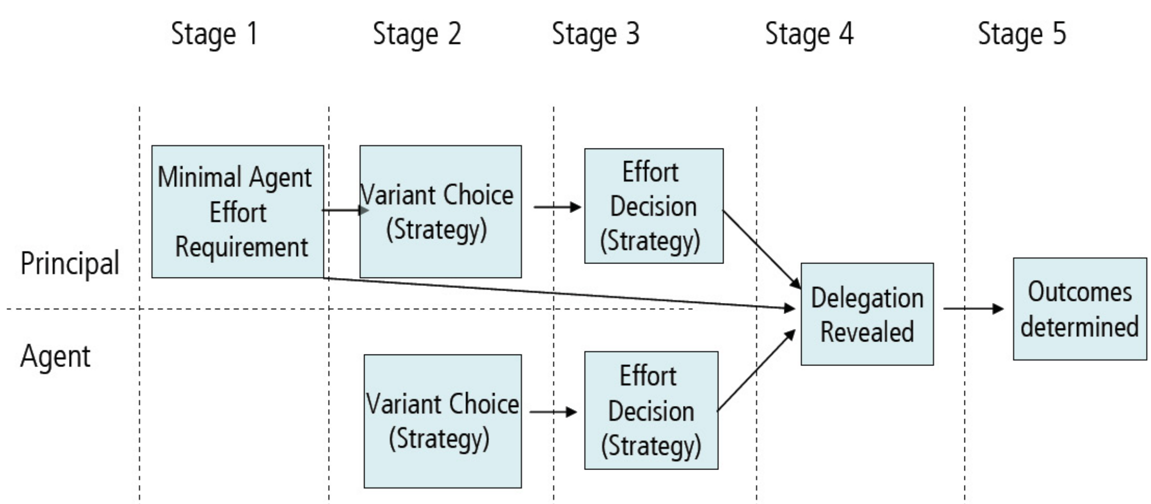


Figure 1: The Stage Game

Subjects were informed that in a new round they would be matched with another randomly chosen partner. No feedback was given to the subjects after each round. Only at the very end of a session (after the lottery experiment), outcomes and payoffs were determined. The order of game 1 to 12 was randomized across sessions.

principal decides not to delegate authority to the agent, the agent does not have to bear the cost associated with his choice of e, since the agent never gets to actually implement the project.

	Implementation successful				Implementation unsuccessful	
	Variant A		Variant B		both variants	
	Principal	Agent	Principal	Agent	Principal	Agent
Game 1	200	130	130	250	100	100
Game 2	200	150	150	250	100	100
Game 3	200	175	175	250	100	100
Game 4	200	130	130	200	100	100
Game 5	200	150	150	200	100	100
Game 6	200	175	175	200	100	100
Game 7	180	130	130	180	100	100
Game 8	180	150	150	180	100	100
Game 9	180	175	175	180	100	100
Game 10	180	130	130	200	100	100
Game 11	180	150	150	200	100	100
Game 12	180	175	175	200	100	100

Table 1: Project Payoffs in each game

2.2 Lotteries

After the authority game was played, all subjects participated in a second experiment. In the second experiment, principals were presented 24 pure lotteries and were asked to state certainty equivalents for these lotteries. Each principal received a different set of lotteries, determined by the principal's own choices in the authority game. 12 lotteries were designed such that they were exactly identical to the 12 authority lotteries, one for each round. The payoffs for these lotteries were determined based on the principal's own choices of E and the project variant if she kept authority in the authority game. The other 12 lotteries were designed such that they were exactly identical to the 12 subordinate lotteries, one for each round. Again, the payoffs for these lotteries were determined based on the principal's own choice of MAE and project variant B, in case of delegation of authority to the agent. The principals were offered each of these 24 lotteries in a randomized order.[11]

For example, assume that a principal chose an own effort of $E = 50$ (with an associated effort cost of 25) and variant A, and chose a minimum required effort for the agent of $MAE = 40$ (with an associated effort cost of 16) in game 1 of the authority game (see Table 1). This implies that the principal implicitly faces two lotteries with the following payoffs in the authority game:

[11]The agents were also offered lotteries which match the consequences of choices made by principals in the authority game. Since we are mainly interested in the principal's assessment of these lotteries, we restrict further discussion to the principals.

- Authority-Lottery:
  - The principals earns $200-25 = 175$ points with 50% probability and $100-25 = 75$ points with 50% probability.
  - The agent earns 130 points with 50% probability and 100 points with 50% probability.
- Subordinate Lottery:
  - The principals earns 130 points with 40% probability and 100 points with 60% probability.
  - The agent earns $250 - 16 = 234$ points with 40% probability and $100 - 16 = 84$ points with 60% probability.

In the lottery experiment, the principal is confronted with exactly these lotteries, but they are presented outside of a delegation and effort choice framework. The principal is simply referred to as "you", and the agent is a "random other participant", whom participants were randomly matched with and who received the specified payoff.

To elicit the certainty equivalents, we used an incentive compatible mechanism first introduced by Becker, DeGroot and Marschak (1963). Subjects had to choose how much in terms of certain payoffs they demand in order to be willing to accept the certain payment instead of playing the presented lottery. In case the certain payment was accepted, the random other participant received 100 points. A random mechanism then determined the certain payment that was actually offered to the principal. In case the actually offered certain payment was at or above the stated certainty equivalent, the principal received the actual certain payment and the other party received 100 points. The lottery was not played in this case. In case the actual certain payment was below the stated certainty equivalent, the lottery was played.

2.3 Procedures

We conducted two sessions with a total of 72 subjects. Our subject pool consisted primarily of students at Zurich University and the Swiss Federal Institute of Technology in Zurich.[12] The experiments took place in April and May 2010. Experiments were computerized using the software z-tree (Fischbacher (2007)). Payment was given for one randomly drawn round of the authority game and for four randomly drawn lotteries.[13] On average, an experimental

[12]Subjects were drawn from a database of volunteers using ORSEE (Greiner (2004)).

[13]Each subject chose certainty equivalents in 24 lotteries. 2 of these lotteries were paid. This guarantees that the expected value (in Swiss Francs) of one point in the lottery experiment is equal to the expected

session lasted 2.5 hours with an average payment of 45.8 CHF ($52.00 at the time of the experiment), including a 10 CHF show-up fee. A translation of the instructions is in appendix B.

3 Theory

We first analyze the authority game in detail. As a benchmark, we initially assume risk-neutral and selfish preferences. Later, we relax assumptions, because our experiment is designed such that subjects directly reveal their preferences. Therefore we need to impose very little structure on individual utility functions to test our main hypothesis.

3.1 Theoretical analysis under the assumption of individual material payoff maximization

If the principal keeps authority, she has an incentive to implement her preferred variant and she chooses effort such that expected material payoff is maximized:

$$\max_{E} E \cdot P_A + (1 - E) \cdot P_0 - C_P(E) \tag{1}$$

Hence, effort is chosen such that marginal costs equal marginal revenue:

$$P_A - P_0 = C'_P(E) \tag{2}$$

Similarly, if the principal delegates authority, the agent has an incentive to choose his preferred variant and chooses e to maximize his expected material payoff from the project:

$$\max_{e} e \cdot A_B + (1 - e) \cdot A_0 - C_A(e) \tag{3}$$

Again, expected material payoff is maximized when marginal costs equal marginal revenue:

$$A_B - A_0 = C'_A(e) \tag{4}$$

Let E^* and e^* denote the solutions to the maximization problems of the principal and the agent, respectively. When making the delegation decision, the principal has to contrast his

value (in Swiss Francs) of one point in the authority game. In addition, each subject also took the role of the "other party" in the lottery treatment. For every lottery, the subject is randomly assigned to another subject. Two of the 24 lotteries were chosen and paid out according to the choices of that other subject.

expected material payoff when keeping authority and choosing E^* to his expected material payoff when delegating authority and having the agent choose e^*. Hence, delegation is optimal if

$$E^* \cdot P_A + (1 - E^*) \cdot P_0 - C_P(E^*) \leq e^* \cdot P_B + (1 - e^*) \cdot P_0 \tag{5}$$

The optimality of delegation will therefore depend on the values attached to variant A and variant B, as well as the agent's optimal effort choice. In our experiment, however, the principal could choose a minimal agent effort requirement (MAE), such that he is only delegating authority if $e \geq MAE$.[14] The principal should therefore choose MAE such that

$$E^* \cdot P_A + (1 - E^*) \cdot P_0 - C_P(E^*) = MAE \cdot P_B + (1 - MAE) \cdot P_0 \tag{6}$$

It follows that

$$MAE^* = \frac{E^* \cdot (P_A - P_0) - C_P(E^*)}{P_B - P_0} \tag{7}$$

The twelve games are designed such that the predictions with regard to optimal principal effort, optimal agent effort and the required minimal agent effort differed. The games also lead to different equilibrium predictions with regard to delegation. Table 1 displays the payoffs at each variant in each game. Table 2 summarizes the predictions for e, E and MAE in each game based on the analysis in this subsection. It also gives the equilibrium prediction with respect to delegation.

3.2 Generalization of the theoretical analysis

What happens if we relax the assumptions imposed on the utility function of the principal? Obviously, the optimal effort level and the required minimal agent effort depend on the preferences of the individual, which we are unable to observe directly. Risk-attitudes may affect expected utility and therefore the principal's optimal choice of E and MAE, since the authority game is a risky decision situation. Moreover, ambiguity aversion may affect the utility received after delegation, because the agent's exact effort choice is unknown. Given that two parties are affected, social preferences could also be a determinant of the effort and the delegation decision. These factors are very likely to cause deviations from the risk-neutral, selfish predictions presented in Section 3.1. In our theoretical framework, which is laid out in detail below, we therefore allow that risk, ambiguity and social preferences affect

[14] Notice that the expected material payoff of the principal in case of delegation is strictly increasing in e.

	E^*	e^*	MAE^*	Delegation
Game 1	50	75	85	No
Game 2	50	75	50	Yes
Game 3	50	75	35	Yes
Game 4	50	50	85	No
Game 5	50	50	50	Indifferent
Game 6	50	50	35	Yes
Game 7	40	40	50	No
Game 8	40	40	35	Yes
Game 9	40	40	25	Yes
Game 10	40	50	50	Indifferent
Game 11	40	50	35	Yes
Game 12	40	50	25	Yes

Table 2: Predicted effort levels and equilibrium delegation under the assumption of individual expected material payoff maximization

utility. Most importantly, we also extend the utility framework by allowing that utility is intrinsically affected by authority, which introduces our main hypothesis.

Let the utility function of a subject over sure amounts of money be written as $u(x, y, A)$, where x denotes own payoff, y denotes the payoff of another party, and A denotes the position of the individual within the authority relationship. $A = 1$ implies that an individual has authority, $A = 0$ denotes the case in which the individual is the subordinate, and the case of authority neutrality is denoted as $A = \varnothing$. This refers to the case in which outcomes are not the result of someone's action, but simply given to the individual.[15]

In our experiment, there is uncertainty with regard to outcomes. We assume that principals are expected utility maximizers and the von Neumann-Morgenstern expected utility function is denoted by $U(L, A)$, where L denotes the lottery that reflects the potential outcomes of all parties involved as well as the outcome probabilities.

The goal of the theoretical analysis is to analyze the optimal delegation decision and the development of an individual measure of the intrinsic value of authority. Principals derive utility from a lottery over monetary outcomes, and potentially from their position in the authority relationship. In our experiment, the lotteries over monetary outcomes result from the effort and minimal effort requirement choices of the principal. The key feature of our experimental design is that we can directly control for individual preferences, because the choice of E and MAE reveals the principal's point of indifference between keeping authority and delegating authority.

[15]The authority neutral case applies in our lottery treatment. Each subject evaluates a lottery that is given to him. It is not the consequence of another parties actions. Therefore, we call it authority-neutral.

Let $x = \begin{pmatrix} P_A - C_P(E) \\ P_0 - C_P(E) \end{pmatrix}$ denote the vector of monetary outcomes for the principal and $y = \begin{pmatrix} A_A \\ A_0 \end{pmatrix}$ denotes a vector of monetary outcomes for the agent in the authority lottery.[16] $x' = \begin{pmatrix} P_B \\ P_0 \end{pmatrix}$ denotes the vector of monetary outcomes for the principal and $y' = \begin{pmatrix} A_B - C_A(MAE) \\ A_0 - C_A(MAE) \end{pmatrix}$ denotes a vector of monetary outcomes for the agent in the subordinate lottery.[17] E and MAE denote the probability of success in the respective situations.

Remember that the agent is not restricted to the choice of MAE. Authority is delegated to the agent whenever he chooses $e \geq MAE$. Therefore, in order for our analysis to hold, we need to impose some structure on the underlying utility function. We assume that $\frac{\partial U(x',y',MAE|A=0)}{\partial MAE} \geq 0$. This implies that it does not hurt the principal if the agent voluntarily invests an effort that is higher than the minimal requirement. We regard this assumption as weak and very reasonable, because the project success becomes more likely. Social preferences do not reverse this effect since the agent reveals that he is maximizing his own utility at some other effort level, making the principal monetarily better off at the same time. This implies that $U(x', y', MAE|A = 0)$ is the minimal utility that will be realized in all potential realizations of the authority game in case of delegation. The ambiguity that still exists with regard to the agent's actions can therefore not hurt the principal. If anything, he will be better off than in the subordinate lottery in which MAE is chosen by the agent. Hence, even extreme forms of ambiguity aversion imply that the overall utility after delegation is at least as large as $U(x', y', MAE|A = 0)$. Therefore, it is an additional important feature of our design that differences in certainty equivalents cannot be attributed to ambiguity aversion. Given the monotonicity of principal utility in e, it is therefore optimal for the principal to choose MAE such that the utility after delegation is at least equal to the utility when the principal keeps authority and implements the project herself. Therefore, the following condition holds:

$$U(x, y, E|A = 1) = U(x', y', MAE|A = 0) \tag{8}$$

[16]We assumed here that the principal chose his preferred variant (variant A). In case the principal chose variant B, x and y would be $x = \begin{pmatrix} P_B - C_P(E) \\ P_0 - C_P(E) \end{pmatrix}$ and $y = \begin{pmatrix} A_B \\ A_0 \end{pmatrix}$.

[17]Here, we always assume that the agent chooses his preferred variant B. Of course, the agent was also free to chose variant A. Again, we assume that this will never hurt the principal, because it makes herself monetarily better of and it is the utility maximizing choice of the agent at the same time.

We are interested in testing the null hypothesis that authority has no impact on individual utility. If this is the case, the utility function is independent of A, and we can write:

$$U(x,y,E|A=1) = U(x,y,E|A=0) = U(x,y,E|A=\varnothing) = U(x,y,E) \tag{9}$$

For all 24 lotteries, there exist certainty equivalents which yield the same utility as the lottery. We can therefore write:

$$\begin{aligned} U(x,y,E) &= u(CE(x,y,E)) && (10)\\ U(x',y',MAE) &= u(CE(x',y',MAE)) && (11) \end{aligned}$$

Hence, if authority has no impact on individual utility, the following condition follows from equation 8:

$$\begin{aligned} u(CE(x,y,E)) &= u(CE(x',y',MAE)) && (12)\\ CE(x,y,E) &= CE(x',y',MAE) && (13) \end{aligned}$$

Thus, if the authority relationship has no intrinsic effect on utility, the principal should be indifferent between the pure lottery that is exactly identical to the authority-lottery and pure lottery that is exactly identical to the subordinate-lottery. In other words, in each of the 12 games, the pairs of certainty equivalents relating to these two lotteries have to be identical. If we find significant differences in these certainty equivalents, authority has an intrinsic impact on utility in the authority game. If, for example, the certainty equivalents of the pure lotteries that are identical to the subordinate lotteries are significantly larger than the certainty equivalents of the pure lotteries that are identical to the authority lotteries, there must have been some other component that positively affected utility in the authority lottery, such that the principal was initially indifferent between the authority lottery and the subordinate lottery.

Hypothesis 1 *There is no difference in certainty equivalents of the two pure lotteries that are identical in terms of payoffs to the authority lottery and the subordinate lottery from the authority game. Therefore, authority has no intrinsic impact on utility.*

3.3 Introducing a monetary measure of the intrinsic value of authority

To analyze the potential intrinsic impact of authority on utility further, we define a measure of the individual intrinsic utility derived from authority. Intuitively, the measure captures how much an individual demands in form of certain payoffs in order to be compensated for the loss of the intrinsic value of authority.

The expected utility associated with the authority lottery is given by $U(x, y, E|A = 1)$. The certainty equivalent that yields the same utility when the principal has authority is given by $CE(x, y, E|A = 1)$. It follows that

$$U(x, y, E|A = 1) = u\Big[CE(x, y, E|A = 1)|A = 1\Big]. \tag{14}$$

We now define the monetary value $MV_{A=1}$. This value captures the intrinsic effect on utility derived from having authority, relative to the authority-neutral benchmark. $CE(x, y, E|A = \oslash)$ denotes the certainty equivalent of the pure lottery that is exactly identical to the authority lottery, but not the consequence of an authority delegation game. This is precisely the certainty equivalent that we measure in the lottery experiment. This certainty equivalent differs in an important aspect from $CE(x, y, E|A = 1)$, since it abstracts from the potential intrinsic impact of authority on utility. To account for this potential difference, we introduce the value $MV_{A=1}$. This value captures the compensation in terms of certain income which is required to keep utility constant when moving from the authority lottery, that involves having authority, to the pure lottery that exactly mirrors the authority lottery, but is presented in an authority-neutral environment. Or, in other words, $MV_{A=1}$ is the difference in value between the certainty equivalent that we actually measure, and the certainty equivalent that reflects the utility in the authority game when the authority lottery has been chosen. it therefore follows that

$$u\Big[CE(x, y, E|A = 1)|A = 1\Big] = u\Big[CE(x, y, E|A = \varnothing) + MV_{A=1}|A = \varnothing\Big]. \tag{15}$$

We can repeat this exercise for the expected utility of the principal in the subordinate lottery. There, utility can be written as

$$\begin{aligned} U(x', y', MAE|A = 0) &= u\Big[CE(x', y', MAE|A = 0)|A = 0\Big] \\ &= u\Big[CE(x', y', MAE|A = \varnothing) + MV_{A=0}|A = \varnothing\Big] \end{aligned} \tag{16}$$

In equation 16, $MV_{A=0}$ is therefore defined as the compensation in terms of certain income which is required to keep utility constant when moving from the subordinate lottery that involves not having authority to the pure lottery that is identical to the subordinate lottery, but not the consequence of an authority delegation game.

What is the overall intrinsic value of authority? The principal's choice is between having authority and not having authority. The relevant measure for the intrinsic value of authority is therefore the difference between $MV_{A=1}$ and $MV_{A=0}$. We know by revealed preference that

$$U(x, y, E|A = 1) = U(x', y', MAE|A = 0) \tag{17}$$

Given the transformations made in equations 15 and 16, this implies that

$$\begin{aligned} u\Big[CE(x, y, E|A = \varnothing) + MV_{A=1}|A = \varnothing\Big] = \\ u\Big[CE(x', y', MAE|A = \varnothing) + MV_{A=0}|A = \varnothing\Big] \end{aligned} \tag{18}$$

From equation 18 follows that

$$CE(x, y, E|A = \varnothing) + MV_{A=1} = CE(x', y', MAE|A = \varnothing) + MV_{A=0} \tag{19}$$

$$MV_{A=1} - MV_{A=0} = CE(x', y', MAE|A = \varnothing) - CE(x, y, E|A = \varnothing) \tag{20}$$

Hence, we can use the difference in certainty equivalents of the pure lottery that is identical to the subordinate lottery and pure lottery that is identical to the authority lottery as an individual measure of the utility compensation required for the loss of the intrinsic value of authority. Therefore, we are able to directly observe a measure of the intrinsic value of authority from our data. We will refer to the term $MV_{A=1} - MV_{A=0}$ as the "monetary value of authority."

3.4 Measurement of loss aversion

In the experiment described in Section 2, the principals are endowed with the right to choose the project. There is evidence that the valuation of owned goods is affected by an individual's loss aversion (see Knetsch (1989), Kahneman, Knetsch and Thaler (1990)). Thus, if principals intrinsically value authority, loss aversion can play a role here because more loss averse principals may be more reluctant to give up authority than principals who are less loss averse. In order to better understand the potential individual heterogeneity in the intrinsic value of authority, we therefore measured subjects loss aversion with a lottery choice task. Each subject was presented with the opportunity to participate in six different lotteries, each having the following form:[18]

> Win CHF 6 with probability $\frac{1}{2}$, lose CHF X with probability $\frac{1}{2}$. If subjects reject the lottery they receive CHF 0.

[18] This experiment to elicit individual loss aversion is adopted from Fehr and Goette (2007).

The six lotteries varied in the amount X that could be lost, where X took on the values $X \in \{2, 3, 4, 5, 6, 7\}$. One of the six gambles was randomly selected and paid. These lotteries enable us to construct individual measures of loss aversion. The amount X at which a subject starts rejecting the lottery is an indicator of a subjects' loss aversion.[19] For example, a subject that rejects all lotteries with a potential loss of $X > 3$ is classified as more loss averse than a subject that only rejects all lotteries with a potential loss of $X > 5$.[20]

Eliciting a measure of a principal's loss aversion enables us to analyze whether the existing empirical evidence that loss aversion can affect the valuation of owned goods can possibly be extended to less tangible domains like the intrinsic value of authority. If we indeed find a correlation between the intrinsic value of authority and loss aversion, this is further evidence that authority actually has an intrinsic value. It also points out one important aspect of preferences that is of particular importance for efficiency in organizations, since it would imply that a more loss averse principal is more likely to cause inefficiencies due to his delegation decisions. We therefore test the following hypothesis:

Hypothesis 2 *More loss averse principals demand a larger compensation in terms of certain income for the loss of the intrinsic value of authority.*

4 Results

4.1 Is there an intrinsic value of authority?

Our theoretical framework generates predictions with regard to the intrinsic impact of authority on utility. If authority has no intrinsic influence on utility, we should observe that principals value the lottery that is identical to the authority lottery and the lottery that is identical to the subordinate lottery equally. Empirically, we do not find that this is the case in our experiment:

Result 1 *Principals intrinsically value authority. The principals value the pure lotteries that are in all monetary aspects identical to the subordinate lotteries significantly higher*

[19] One might think that rejection of these lotteries may also be compatible with risk aversion. However, Rabin (2000) shows that a theory of risk averse behavior based on the assumption of diminishing marginal utility of lifetime income implies that people essentially must be risk neutral for low-stake gambles like these lotteries. Intuitively, this follows from the fact that risk-averse behavior for low-stake gambles implies ridiculously high levels of risk aversion for slightly higher, but still moderate, stake levels. Such unreasonably high levels of risk aversion can be safely ruled out. For example, we show in appendix A that if one assumes that the rejection of the lottery with $X = 4$ is driven by diminishing marginal utility of lifetime income, then the subject will also reject a lottery where one can lose \$30 with probability $\frac{1}{2}$ and win any price with probability $\frac{1}{2}$. Thus, there is no finite prize that induces this subject to accept a 50-percent chance of losing \$30.

[20] 68 out of 72 subjects who participated in the lottery task have a unique switching point.

than the pure lotteries that are in all monetary aspects identical to the authority lotteries. On average, the difference in certainty equivalents is 14.2%. Hence, the intrinsic value of authority accounts for 14.2% of the totally generated value in the authority game.

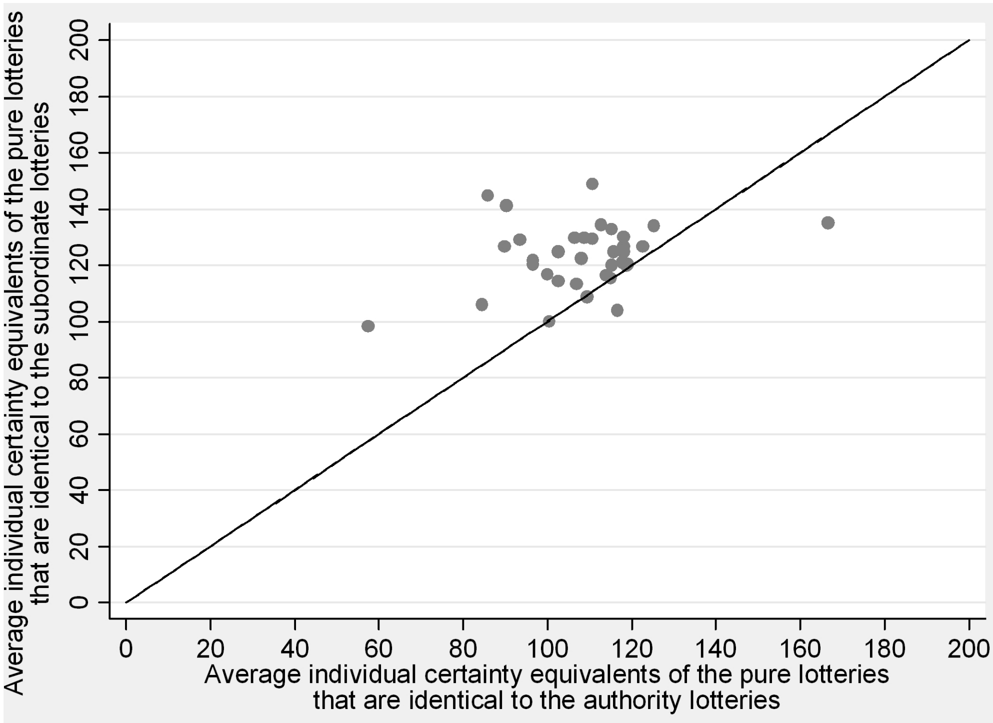


Figure 2: Average individual certainty equivalents of the pure lotteries that are identical to the authority lotteries and identical to the subordinate lotteries (in points).

Figure 2 shows the average certainty equivalents principals assigned to the pure lotteries that are identical to the authority lotteries ($CE(x, y, E|A = \varnothing)$) on the horizontal axis and the average certainty equivalents assigned to the pure lotteries that are identical to the subordinate lotteries ($CE(x', y', MAE|A = \varnothing)$) on the vertical axis. If principals derive no intrinsic utility from authority ($MV_{A=1} - MV_{A=0} = 0$), the average certainty equivalents of these lotteries should be equal. However, it can immediately be seen that the vast majority of observations lie above the 45° line. The average individual certainty equivalent of the pure lotteries that are identical to the subordinate lotteries is 123.3 points, and the average individual certainty equivalent for the pure lotteries that are identical to the authority lotteries is 108.6 points. The hypothesis that the average individual certainty equivalents are equal can be rejected ($p = 0.00$, Wilcoxon signed-rank test). On average, principals assign higher certainty equivalents to the pure lotteries that are identical to the subordinate lotteries, which in turn implies that principals derive a higher utility from the monetary consequences of the subordinate lotteries than the authority lotteries. Remember from the theory and design section that the principal revealed being indifferent between delegating authority if the agent chooses MAE, and choosing E when he keeps authority herself. In the authority game, decisions were embedded in an authority-relationship, which is not the case in the lottery treatment. The difference in certainty equivalents assigned to the lotteries implies that the authority relationship indeed affects utility. Given that the certainty equivalents of the lotteries that are identical to the subordinate lotteries are significantly higher than the certainty equivalents of the lotteries that are identical to the authority lotteries, principals have an intrinsic value of authority.

4.2 Heterogeneity across different authority games

Remember that the experiment consisted of 12 different games which varied with regard to the payoffs of the principal and the agent at variant A and variant B. We can use these different games to test the robustness of our result with regard to the game parameters.

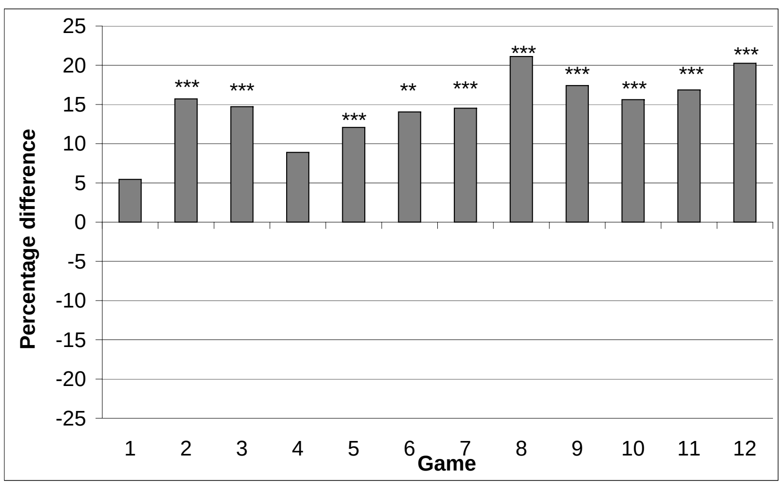


Figure 3: Average percentage difference between the certainty equivalent of pure lotteries that are identical to the subordinate lotteries and the certainty equivalent of the pure lotteries that are identical to the authority lotteries, sorted by authority game. Significance levels calculated using Wilcoxon signed-rank tests: * p<0.1, ** p<0.05, *** p<0.01.

Figure 3 displays the average percentage difference in certainty equivalents in all 12 authority games. The pure lotteries that are identical to the subordinate lotteries are consistently valued higher than the pure lotteries that are identical to the authority lotteries across the different games. The intrinsic value of authority is positive in all 12 games, and significantly different from 0 in 10 out of 12.

The fact that authority is intrinsically valued in all 12 games demonstrates the robustness of our result. Nonetheless we observe differences in the intrinsic value assigned to authority across the 12 games. Therefore, before we turn to an analysis of the individual determinants of the intrinsic value of authority, it is useful to analyze potential determinants of these differences. Remember that the principal reveals his preference through her choice of E and MAE. It therefore may be informative to analyze the determinants of these choices. Table 3 reports regressions of the principal's effort choices (E) and of the principal's minimal effort requirements for the agent (MAE) on parameters of the game. Observations are only included if the principal chose variant A, since incentives are very different if variant B is chosen.[21] As a benchmark, we include choice predictions from Section 3.1 in the regression analysis.

Table 3: Determinants of Effort Choices

	(1) E	(2) MAE	(3) E	(4) MAE
E^*	0.780**			
	(0.373)			
MAE^*		0.624***		
		(0.076)		
Principal's payoff at var. A (P_A)			0.371*	0.543***
			(0.195)	(0.135)
Agent's payoff at var. B (A_B)			0.011	0.092*
			(0.026)	(0.047)
P_B				–0.604***
				(0.075)
A_A			–0.167***	
			(0.038)	
Constant	20.739	18.441***	8.301	16.860
	(17.064)	(4.837)	(36.561)	(21.029)
Adj. R^2	0.037	0.173	0.056	0.204
Observations	400	400	400	400

Significance levels: * p<0.1, ** p<0.05, *** p<0.01

Robust standard errors in parentheses, clustered by the individual.

P_B denotes the principal's payoff at variant B.

A_A denotes the agent's payoff at variant A.

E^* denotes the optimal principal effort choice reported in Table 2.

MAE^* denotes the optimal minimal effort requirement reported in Table 2.

Only principals who chose variant A are included in the regression.

[21] Variant B was chosen in 6.8% of the cases.

Column (1) of Table 3 reports a regression of the principal's effort choice (E) on the optimal effort choice calculated under the assumption of individual expected material payoff maximization (E^*). If principals are risk-neutral and perfectly respond to monetary incentives in the game, neglecting the payoff of the other party, the constant in regression (1) should be zero and the coefficient on E^* should equal 1. It can be seen that the constant is greater than zero, but not significantly so. Moreover, the coefficient on E^* is 0.78, which is smaller than 1, but again not significantly so (p=0.56). Taking the expected individual material payoff maximizer from Section 3.1 as the benchmark , we can conclude that principals react to monetary incentives very much like it is predicted in our baseline model. Column (2) reports an identical regression of the minimal agent effort requirement (MAE) on the optimal choice of MAE. Again, MAE^* takes on the optimal value of MAE in case the principal is risk neutral and does not take into account the other party's payoff (except for the incentive effect on the agent's effort).[22] If the principals in our sample had such preferences, the constant should be 0 and the coefficient on MAE^* should be 1. We can observe that the constant significantly deviates from 0 and takes on a positive value. The coefficient on MAE^* is 0.63, which is significantly smaller than 1 (p=0.00). Hence, from our baseline model viewpoint, principals demand too much from the agent when the optimal requirement should be small, and they demand not enough when the requirement should be high.

Columns (3) and (4) analyze how the payoffs of the principal and the agent at variant A and variant B affect effort choices. It can be seen that P_A significantly and positively affects the principal's effort choice, which confirms the observation from column (1). While A_B is largely irrelevant, as it should be, interestingly A_A also seems to matter as a determinant of effort. An increase in the agent's payoff causes the principal to decrease his own effort. Evidently, payoff comparisons between the parties seem to matter for effort choice. Column (4) reports the effect of payoff on the minimal agent requirement. An increase in P_A leads to a significant increase in the minimal agent requirement, which confirms that principals require a larger compensation the more they give up when delegating authority. At the same time, the required compensation is lowered if P_B increases. Table 3 therefore shows that principal's reactions to changes in incentives are directionally consistent with standard economic theory, and that the delegation trade-off was well understood.

[22] MAE^* is calculated according to equation 7 in Section 3.

4.3 Heterogeneity in the intrinsic value of authority across individuals

In this subsection, we analyze how consistent our measure of intrinsic value of authority is across games, and whether we can identify individual determinants of the intrinsic value of authority. In Section 3, we introduced an individual measure for the intrinsic value of authority. Figure 4 shows a histogram which depicts the mean intrinsic value of authority, averaged by the individual.

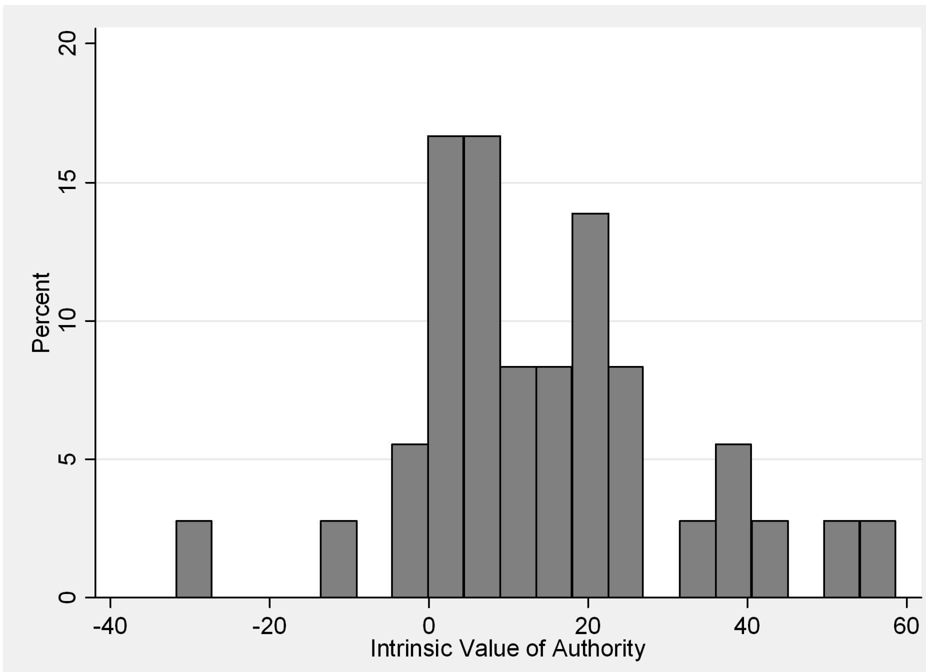


Figure 4: Histogram of the mean intrinsic value of authority ($MV_{A=1} - MV_{A=0}$), averaged by the individual.

It can be seen that authority is intrinsically valued fairly heterogeneous across individuals. In fact, while the vast majority values authority positively, a small minority of principals prefers to be in the subordinate role. Given that we observe the intrinsic value of authority of every principal in 12 different games, we can test the robustness of our results at the individual level. If intrinsic value of authority is the consequence of a stable individual preference for authority, within subject variance in the monetary value of authority across our 12 games should be low and we should observe consistency and correlation across the 12 games with regard to who values authority how much. One way to assess the internal validity of our different authority games is to compute Cronbach's alpha, a concept frequently used in psychology and the social sciences as a measure of the internal consistency or reliability of a psychometric test score. Cronbach alpha measures to what extend different items in questionnaires, or for our purposes economic games, measure the same latent variable. In order for our experimental method to have internal validity, the results with respect to the measured intrinsic value of authority across the games should be correlated. We could therefore measure the across participant correlation of the average monetary value of authority in the first 6 games and the last 6 games. Since the split in the middle is arbitrary, Cronbach alpha is the mean of all split-half correlations among games. The corresponding formula is $\alpha = \frac{M}{M-1}\left(1 - \frac{\sum_{j=1}^{M} var(x_j)}{var \sum_{j=1}^{M} x_j}\right)$ where M is the number of games, $var(x_j)$ is the variance in the monetary value of authority in the j-th game, and $var \sum_{j=1}^{M} x_j$ is the variance of the sum of the intrinsic value of authority in the M games. Intuitively, α measures the correlation between the games, and varies between zero and unity. If the measured intrinsic value of authority across the games is independent, $\alpha = 0$, and if it is perfectly correlated Cronbach's alpha is equal to unity. In our data, the Cronbach alpha coefficient of our different measures of the intrinsic value of authority is 0.81. This implies that our different measures of the intrinsic value of authority are positively correlated, and that the intrinsic value of authority affects the delegation trade-off very consistently across the different games.

Given that our games are reliably measuring an intrinsic value of authority that is heterogeneous across participants, it is interesting to study the origins of this preference for authority. What determines the extent to which individuals intrinsically value having authority? In our experiment, we controlled for one important individual preference characteristic, which we considered as a potential correlate of the preference for authority: loss aversion. Empirically, we find that:

Result 2 *Loss aversion (non significantly) affects the principals' propensity to delegate authority. The more loss averse a principal is, the higher she intrinsically values authority.*[23]

Column (1) and (2) of Table 4 show regressions of the average monetary value of authority on the principal's loss aversion. For each additional gamble rejected in the lottery treatment, the compensation demanded for the loss of the intrinsic value of authority increases by 2.7 points. Including data from a pilot (column (3)), the coefficient on loss aversion becomes significant.

In column (4) of Table 4, we also include the payoff parameters of the different authority games into the regression equation. We have seen in figure 3 that the measured average intrinsic value of authority varies to some extend across our different authority games. In

[23]Including observations from a pilot session, the effect is significant. In this subsection, we also report results when observations from the main sessions and the pilot are pooled. We did not include pilot data in the rest of the analysis, since there were small differences in the procedures between the pilot and the main sessions. More sessions are planned to substantiate the evidence in this section.

Table 4: Monetary Value of Authority

	(1) MVA	(2) avg. MVA	(3) MVA	(4) MVA	(5) avg. MVA
Loss Aversion	2.743	2.743	4.811**	4.890*	4.811**
	(2.422)	(2.446)	(2.246)	(2.589)	(2.116)
P_A				–0.277*	
				(0.147)	
A_B				0.047	
				(0.070)	
P_B				0.167**	
				(0.079)	
Constant	8.248	8.248	5.634	23.117	5.634
	(5.766)	(6.460)	(4.616)	(18.156)	(5.549)
Adj. R^2	0.009	0.007	0.031	0.038	0.081
Observations	432	36	576	537	48

Standard errors are in parentheses. Significance levels: * p<0.1, ** p<0.05, *** p<0.01

Regressions (1), (3) and (4) use robust standard errors, clustered by the individual.

Regressions (3), (4) and (5) use additional data from a pilot session.

P_B denotes the principal's payoff at variant B.

Regression (4) only includes observations in which variant A was chosen.

Regression (2) and (5) use the average individual MVA as the dependent variable.

Exclusion of principals who were inconsistent in the lottery task does not change any results.

column (2) of table 4, it can be seen that the monetary value of authority marginally decreases in P_A, and that it increases in P_B. Hence, the more profitable delegation becomes in monetary terms (and the lower MAE should therefore be), the higher is the measured intrinsic value of authority. We saw before that, relative to the benchmark analysis in Section 3.1, actual choices of MAE tend to be relatively high when MAE^* is low, and relatively low when MAE^* is high. It is plausible to assume that principals make decision errors in our experiment that create variance in E and MAE. We may therefore observe some bias in aggregate data towards the mean when optimal values are close to the boundary of the action space. This implies that our measure might exaggerate the monetary value of authority when MAE^* is low, and underestimate the monetary value of authority when MAE^* is high. This observation could explain why we observe that project payoffs matter in a systematic way with respect to the monetary value of authority. However, an important insight from column (4) is that the game parameters do not eliminate or dampen the effect of loss aversion on the intrinsic value of authority.

Figure 5 further illustrates the effect of loss aversion on the intrinsic value of authority. If the sample of principals is split in a high and a low loss aversion group (at median loss aversion), it can be seen that the measured monetary value of authority of the high loss

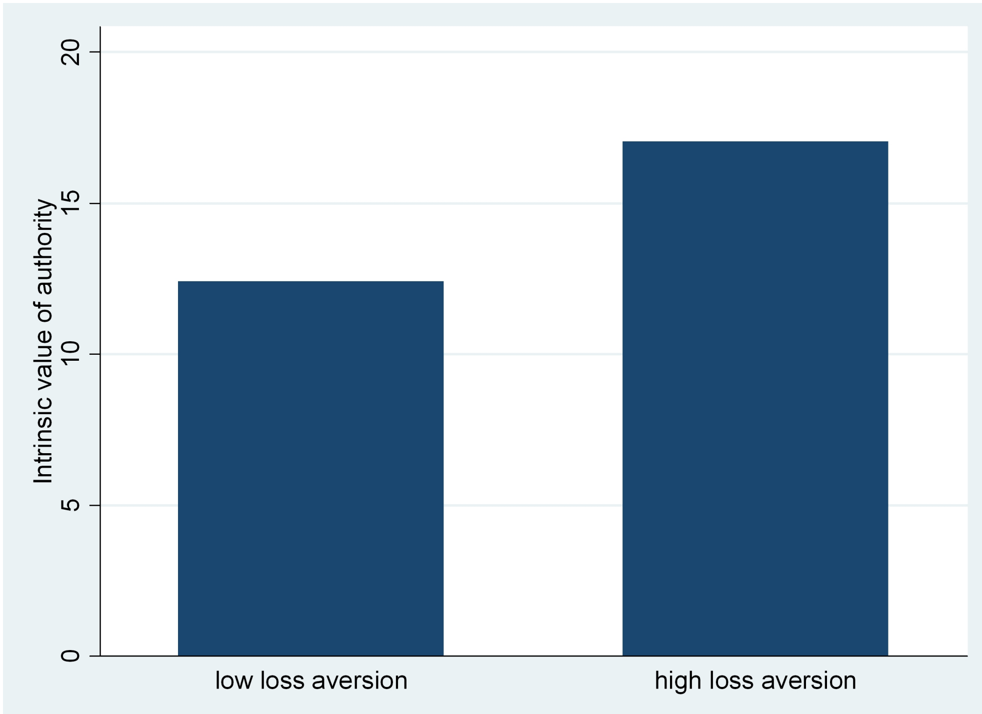


Figure 5: The monetary value assigned to authority (in points) after splitting the sample in a high and a low loss aversion group (split made at the median).

aversion group is about 37% higher than that of the low loss aversion group. The effect is, however, statisitcally not significant using a Mann-Whitney test. Including data from the pilot, the effect becomes significant ($p = 0.04$).

Our conjecture from the correlation between loss aversion and the intrinsic value of authority is that authority may indeed be treated like a good by the principals. People are known to demand more for a good they possess than they are willing to pay for the good they do not possess (Knetsch (1989), Kahneman et al. (1990)). Theoretically it is well known that there is a positive relationship between an individual's loss aversion in risky choice and the individual's proneness to the endowment effect (Kahneman and Tversky (1991)). This fact seems to be reflected in our data. In our experiment, the difference in certainty equivalents reflects the willingness to accept the loss of authority. The positive correlation between loss aversion and the monetary value of authority therefore suggests that authority is treated in similar ways as ordinary goods. However, more data is needed before conclusive evidence with respect to the correlation between loss aversion and the intrinsic value of authority can be drawn.

5 Conclusion

The incentive and efficiency effects of authority have long been recognized in the economics literature. Potential intrinsic effects of authority on utility have been suggested by psychologists, philosophers and political scientists, but have been widely ignored in economics. The experimental revealed preference approach used in this paper controls for preferences over outcomes by experimental design and therefore allows to separate between the intrinsic value of authority and extrinsic utility components relating to pecuniary aspects of authority. This clean distinction provides novel insights for economists as well as the psychology and political science literature. According to our data, prinicpals indeed value authority intrinsically. On average, 14.2% of the overall generated value for an individual with authority can be attributed to intrinsic factors. The existence of an intrinsic value of authority is further endorsed by the finding that a principal's degree of loss aversion is correlated with the intrinsic value of authority. Moreover, within subject variation across different authority games is small, lending further support to the hypothesis that individuals have a stable preference for authority.

Given the importance of authority for the functioning as well as the development and transition of economic and political organizations, we believe that the intrinsic value of authority revealed by our data needs to receive more attention. Organizational design should account for the fact that parties who are directly involved in the decision making process may be biased to keeping authority. Alternative mechanisms which solve the authority assignment problem may be desirable. Intrinsic value of authority is also likely to be a social factor that prevents otherwise favourable mergers, like the examples of Glaxo Wellcome, SmithCline Beecham and others suggest. Our results imply that a better theoretical and empirical understanding of the role of intrinsic value of authority for organizational processes and efficiency is needed. This also directly applies to governance considerations in the political sciences because the reluctance to delegate can cause considerable welfare losses for organizations and, perhaps, even society. Further empirical studies of the determinants and consequences of authority may thus yield important insights. We believe that our empirical approach may prove useful in this respect.

In order to get a better understanding of the intrinsic value of authority, it may also be desirable to disentangle the determinants of the intrinsic value of authority. While the aim of this paper was to establish its existence, an immediate question that arises is what exactly causes authority to be valuable. Several aspects of authority are suggested in the political science and psychology literature as potential determinants of its value, such as conflict of interest, variety of choice and the degree of influence over other parties' outcomes.

Our experimental design is suitable to analyze the impact of these factors on the monetary value of authority and future research is needed to shed light on these questions.

References

Aghion, Philippe and Jean Tirole, "Formal and Real Authority in Organizations," *Journal of Political Economy*, 1997, *105* (1), 1–29.

Alonso, R., W. Dessein, and N Matouschek, "When Does Coordination Require Centralization," 2008.

Athey, Susan and Donald J. Roberts, "Organizational Design: Decision Rights and Incentive Contracts," *The American Economic Review*, 2001, *91* (2), 200–205.

Bachrach, Peter and Morton S. Baratz, *Power and poverty: Theory and practice*, New York: Oxford University Press, 1970.

Baker, George, Robert Gibbons, and Kevin J. Murphy, "Informal Authority in Organizations," *Journal of Law, Economics, and Organization*, 1999, *15* (1), 56–73.

Ball, T., "Review of S. Lukes, Power: A Radical View and Nagel 1975," *Political Theory*, 1976, *4*, 246–249.

Bandura, Albert, *Self-Efficacy: The exercise of control*, New York: W.H. Freeman, 1997.

Becker, Gordon M., Morris H. DeGroot, and Jacob Marschak, "Measuring utility by a single-response sequential method," *Behavioral Science*, 1963, *9*, 226–232.

Deci, Edward L., *The Psychology of Self-Determination*, Lexington, MA.: Health, 1981.

Dessein, Wouter, "Authority and Communication in Organizations," *Review of Economic Studies*, 2002, *69* (1), 811–838.

Dominguez-Martinez, Silvia, Randolph Sloof, and Ferdinand von Siemens, "Monitoring Your Friends, Not Your Foes: Strategic Ignorance And The Delgation Of Real Authority," Mimeo 2010.

Fehr, Ernst and Lorenz Goette, "Do Workers Work More if Wages Are High? Evidence from a Randomized Field Experiment," *American Economic Review*, March 2007, *97* (1), 298–317.

——, **Holger Herz, and Tom Wilkening**, "The Lure of Authority: Motivation and Incentive Effects of Power," Mimeo 2010.

Fischbacher, Urs, "z-Tree: Zurich Toolbox for Ready-made Economic Experiments," *Experimental Economics*, 2007, *10* (2), 171–178.

Giddens, Anthony, *The Nation-State and Violence*, Cambridge: Polity Press, 1985.

Greiner, Ben, "The Online Recruitment System ORSEE 2.0 - A Guide for the Organization of Experiments in Economics," Working Paper Series in Economics 10, University of Cologne, Department of Economics June 2004.

Hamilton, Barton H., "Does Entrepreneurship Pay? An Empirical Analysis of the Returns to Self-Employment," *Journal of Political Economy*, June 2000, *108* (3), 604–631.

Hartzell, Jay C., Eli Ofek, and David Yermack, "What's in It for Me? CEOs Whose Firms Are Acquired," *The Review of Financial Studies*, 2004, *17* (1), pp. 37–61.

Kahneman, Daniel and Amos Tversky, "Loss Aversion in Riskless Choice: A Reference-Dependent Model.," *The Quarterly Journal of Economics*, 1991, *106* (4), 1039–1061.

——, **Jack L Knetsch, and Richard H Thaler**, "Experimental Tests of the Endowment Effect and the Coase Theorem," *Journal of Political Economy*, December 1990, *98* (6), 1325–48.

Knetsch, Jack L., "The Endowment Effect and Evidence of Nonreversible Indifference Curves," *American Economic Review*, 1989, *79* (5), 1277–84.

——, "Asymmetric Valuation of Gains and Losses and Preference Order Assumptions," *Economic Inquiry*, 1995, *33* (1), 134–141.

Lipin, S., "In Many Merger Deals, Ego and Pride Play Big Roles in Which Way Talks Go," *The Wall Street Journal*, 1996.

Lukes, Steven, *Power: A Radical View, Second Edition*, Basingstoke, Hamphire: Palgrave MacMillan, 2005.

McClelland, David C., *Power: The Inner Experience*, Irvington, New York: Halsted Press, 1975.

Niskanen, William A., *Bureaucracy and Representative Government*, Chicago: Aldine-Atherton, 1971.

Nussbaum, Martha C., *Women and Human Development: The Capabilities Approach*, Cambridge: Cambridge University Press, 2000.

Polsby, Nelson W., *Comunity Power and Political Theory*, New Haven: Yale University Press, 1963.

Rabin, Matthew, "Risk Aversion and Expected-Utility Theory: A Calibration Theorem," *Econometrica*, 2000, *68* (5), 1281–92.

Sen, Amartya and Martha C. Nussbaum, *The Quality of Life*, Cambridge: Oxford University Press, 1993.

Stern, Scott, "Do Scientists Pay to be Scientists," *Management Science*, June 2004, *50* (5), 835–853.

Thomas, Kenneth W. and Betty A. Velthouse, "Cognitive Elements of Empowerment: An "Interpretive" Model of Intrinsic Task Motivation," *The Academy of Management Review*, 1990, *15* (4), pp. 666–681.

Wulf, Julie, "Do CEOs in Mergers Trade Power for Premium? Evidence from Mergers of Equals," *Journal of Law, Economics and Organization*, April 2004, *20* (1), 60–101.

Appendix A: Measuring Loss Aversion

In the main text of the paper, we interpret decisions made in the lottery task as being a result of loss aversion rather than risk aversion. This interpretation is based on Rabin's Calibration Theorem (Rabin (2000)) which shows that strictly concave utility of wealth is an implausible explanation for risk averse behavior over modest stakes. In this appendix we apply Rabin's calibration theorem to our lottery game. We show that if individuals have a globally concave utility function over wealth $w \in [0, \infty]$ and rejects gamble three of our lottery game — a coin flip in which the individual can either win CHF 6 or lose CHF 4 — then he or she will reject *any* coin flip in which she could lose CHF 30 no matter how large the positive prize that is associated with the coin flip. This is an implausibly high level of risk aversion while a reference dependent utility function that incorporates loss aversion can easily capture this behavior. We proceed in four steps:

1. We adopt the convention that, if indifferent, the individual rejects the coin flip. Re-

jecting the coin flip implies

$$
\begin{aligned}
0.5u(w+6) + 0.5u(w-4) &\leq u(w) \\
u(w+6) - u(w) &\leq u(w) - u(w-4)
\end{aligned}
$$

It follows from concavity that $6[u(w+6) - u(w+5)] \leq u(w+6) - u(w)$ and $u(w) - u(w-4) \leq 4[u(w-3) - u(w-4)]$. Define $MU(x) = u(x) - u(x-1)$ as the marginal utility of the xth dollar. Putting the last three inequalities together, it follows that

$$MU(w+6) \leq \frac{2}{3} MU(w-4)$$

and, by concavity, that $MU(x+10) \leq \frac{2}{3} MU(x)$ for all $x > w-4$.

2. We now derive an upper bound on $u(\infty)$. The concavity of $u()$ implies

$$u(w+10) \leq u(w) + 10MU(w)$$

Using the same logic,

$$
\begin{aligned}
u(w+20) &\leq u(w) + 10MU(w) + 10MU(w+10) \\
&\leq u(w) + 10MU(w)[1 + \frac{2}{3}] \\
u(w+30) &\leq u(w) + 10MU(w)[1 + \frac{2}{3} + \frac{2}{3}^2]
\end{aligned}
$$

and so on. Thus, we can develop a geometric series starting from w. Taking the limit, we obtain

$$u(\infty) \leq u(w) + 30MU(w)$$

3. Concavity implies $u(w-30) \leq u(w) - 30MU(w)$.

4. Using the results from step (ii) and (iii), we get an upper bound on the value of a coin flip where the individual would either lose CHF 30 or win an infinite amount:

$$0.5u(w-30) + 0.5u(\infty) \leq u(w)$$

This implies that the individual would reject the gamble. This concludes the proof.

Appendix B: Instructions

Instructions for participant A

Welcome to this economic study.

You are now participating in a scientific study, which has been funded by diverse research funds. Please read these instructions carefully. Everything you need to know for participation in the study is explained bellow. If you do not understand something, please contact us. We will answer your question at your cubicle.

At the beginning of the study, you receive a show-up fee of 10 Swiss Francs. During the study you can earn an additional amount of money by collecting points. The number of points you get will depend on your decisions and decisions of other participants.

All the points you earn during the study will be converted to Swiss Francs at the end. The conversion rate is

15 points = 1 Swiss Franc

At the end of the study you will receive the amount of money that you earned during the study as well as the 10 Swiss Francs show-up fee in cash.

Please note that communication is strictly prohibited during the study. Additionally, you are only allowed to use those functions of your computer that are needed for the study. Communication or playing around with the computer will lead to the exclusion of the study. If you have any questions, don't hesitate to contact us.

This study consists of three parts.

1. The first part runs over 12 periods. In each period you are matched with a different participant B. In each period either you or the matched participant B can implement a project. The detailed instructions for the first part of the study follow below.
2. In the second part of the study, 24 different decisions between a fixed income and a lottery are presented to you. You will receive detailed instructions for the second part of the study once the first part is finished.
3. The third part is very short and you will receive instructions for it on your computer screen.

Short overview over the first part of the study

In this study, there are two types of participants: participants A and participants B. You are a participant A.

In each of the 12 rounds of this study you are matched with another participant B. In each round, a project can be implemented. Successful implementation of the project leads to positive payments to both participants.

In each round, either you or participant B has the decision right. The participant with decision right can decide, whether variant A or variant B of the project is implemented. In addition, the participant with the decision right can decide on the probability, with which the project will be successful.

The participant with decision right can, therefore, make two decisions:

1. **Which variant - A or B - is going to be implemented? At variant A participant A received the larger share of the project payoff, at variant B participant B receives the larger share.**
2. **What is the probability of project success? This is decided upon by determining a success probability. The determination of the probability is combined with costs for the participant with decision right. The higher the success probability, the higher are the costs.**

The payoffs, which result after a successful implementation of the project, vary from round to round. At the beginning of each round you are informed about the payoffs.

If the implementation is not successful, both participants receive 100 point (from an alternative project), independent of whether you or participant B had the decision right. This amount is the same in each round.

You can see an example in the following table:

Example: Payoffs in one round

		Your payment	Payment participant B
Implementation Successful	**Variant A**	200	150
	Variant B	150	200
Implementation unsuccessful		100	100

Detailed Course of Action

1. **Step: Who holds the decision right?**

The participant with decision right can choose the project variant and the probability with which the implementation will be successful. At the beginning, you have the decision right. You can

- keep the decision right or
- delegate the decision right to participant B.

2. **Step: Choosing the project variant**

If you keep the decision right, you can determine in step 2, whether variant A or variant B should be implemented.

3. **Step: Choosing the success probability**

Hereupon, you can, if you kept the decision right, choose the probability with which the chosen project variant is successful.

How is the success probability determined in step 3?

The participant with the decision right chooses a success probability. He can choose a number between 0 and 100.

0 ≤ success probability ≤ 100

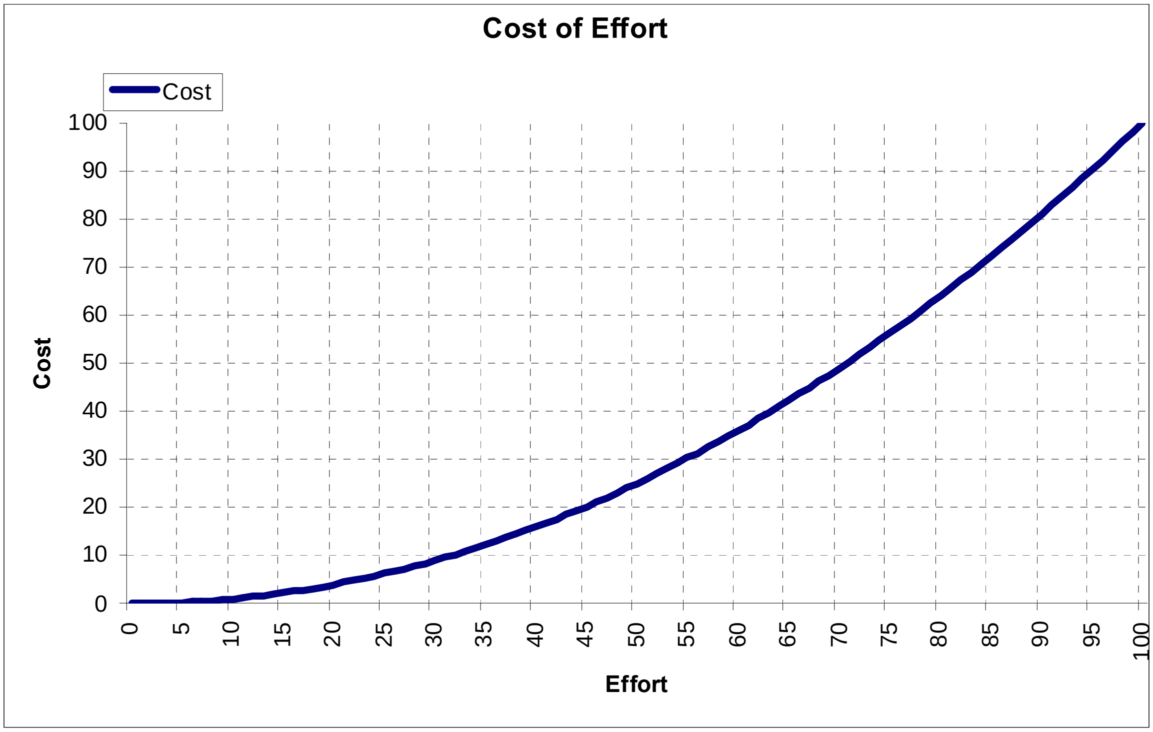
A success probability of 0 means, that the project will never be successful. A success probability of 100 means, that the project will always be successful. For all intermediate values, it can happen that the project is successful or not.

If the project is successful, participant A and participant B will be paid according to the chosen variant. If the project is not successful, both participants receive 100 points (from an alternative project).

If you delegated the decision right to participant B in step 1, then participant B chooses the project variant in step 2 and the success probability in step 3.

The costs of choosing the success probability

The higher the success probability, that the participant with decision right chooses, the higher are his costs. The following graph shows the costs associated with every possible success probability. Only integers (0,1, 2,…, 99, 100) can be chosen.



You can find an extra sheet on your table. On this extra sheet you can see a table, which reports the costs associated with every selectable success probability. Please adhere to this table when you choose your success probability. You can also choose to display the costs on the computer screen when you choose your success probability.

The following rule always applies: The higher you choose the success probability, the more probable it gets that the project is successful, and the higher will be your costs.

Whether the project is successful or not will be determined by rolling dice.

The participant with decision right is going to throw a red and a white 10-sided die (with numbers from 0-9). The red die determines the first digit, the white die the second digit. This determines a number between 1 and 100 (two nulls count as 100). Each number is equally probable. If the rolled number is smaller or equal to the chosen success probability, the project is successful. If the rolled number is greater, the project is unsuccessful.

The larger the chosen success probability, the more likely it gets, that the rolled number is smaller than the chosen probability, i. e. that the project is successful.

Examples:

1. You choose a success probability of 15, implying a success probability of 15 percent:

If a smaller or equal number results from rolling the red and the white die, i.e. a number between 1 and 15 (= 15 from 100 possibilities), then the project is successful. If the number is greater than 14 (=16 to 100, i.e. 85 possibilities), then the project is unsuccessful.

2. You choose a success probability of 85, implying a success probability of 85 percent:

If a smaller or equal number results from rolling the red and the white die, i.e. a number between 1 and 85 (=85 from 100 possibilities), then the project is successful. If the number is greater than 84 (=86 to 100, i.e. 15 possibilities), then the project is unsuccessful.

Imagine you roll a 9 with the red die and a 3 with the white die. This implies a number of 93. In this case, the project would be unsuccessful in both cases.

Imagine you roll a 5 with the red die and a 4 with the white die. This implies a number of 54. In this case, the project would be unsuccessful in the first case, but successful in the second case.

Imagine you roll a 0 with the red die and a 3 with the white die. This implies a number of 3. In this case, the project would be successful in both cases.

The Income

The income of participant A and participant B is determined by two pieces:

- Payment at the chosen project variant in case of success. If the project implementation is unsuccessful, both participants receive a payment of 100 points from an alternative project.
- The costs associated with the chosen success probability are subtracted from the payoff of the party with decision right.

For you, the following 4 possibilities can occur:

1. You keep the decision right and the project implementation is successful:

Income: Payment at the chosen project variant minus the costs of the chosen success probability.

2. You keep the decision right and the project implementation is unsuccessful:

Income: 100 minus the costs of the chosen success probability.

3. You delegate the decision right and the project implementation is successful:

Income: Payment at the project variant chosen by participant B.

4. You delegate the decision right and the project implementation is successful:

Income: 100

Summary of the course of action in one round

Initially you, as participant A, have the decision right.

1. You can keep the decision right or delegate it to participant B.

2. The participant with the decision right chooses a project variant.

3. The participant with decision right chooses a success probability.

There are 12 rounds in total. In each round, you are matched with a different participant B. Also, the payments at project variant A and variant B vary from round to round. At the end of the study, one of the 12 rounds is randomly determined.

For the randomly determined round, the success of the project variant chosen by the participant with the decision right is determined by rolling a die, given the chosen success probability of the participant with the decision right.

Given that you do not know which of the twelve periods is going to be randomly selected, think carefully about all decisions you take in all 12 rounds. The resulting payoffs then determine your payment for the first part of this study.

Procedure at the computer

1. **Who holds the decision right?**

Initially, you hold the decision right in every round. In every round, you can decide whether you want to delegate the decision right to participant B, or whether you rather want to keep it.

You are not going to make this decision directly, but by choosing a minimal requirement:

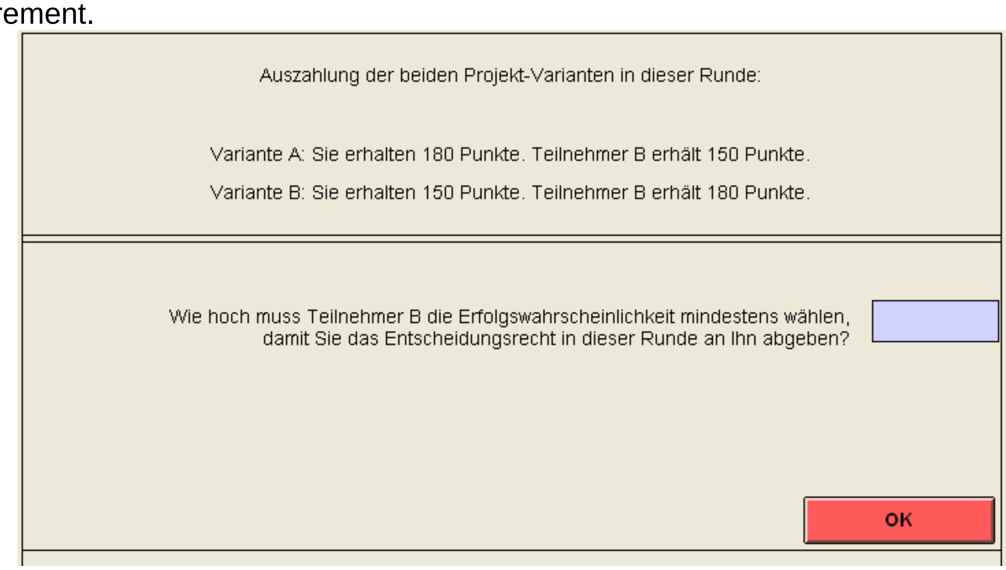
In every period you can decide how high participant B has to choose the success probability, so that you are willing to delegate the decision right to him.

In every period participant B always chooses a success probability for the case that you delegate the decision right to him. When participant B chooses his success probability, he is not informed about your minimal requirement, and is, therefore, choosing his success probability independently of your minimal requirement.

If the success probability of participant B is above your minimal requirement, then the decision right is delegated. If the success probability is below your minimal requirement, you keep the decision right.

You can enter your decision for the minimal requirement on the screen displayed below:

In the upper part of the screen you can always see the payments of both project variants in the given round. In the lower part of the screen you can enter your minimal requirement.

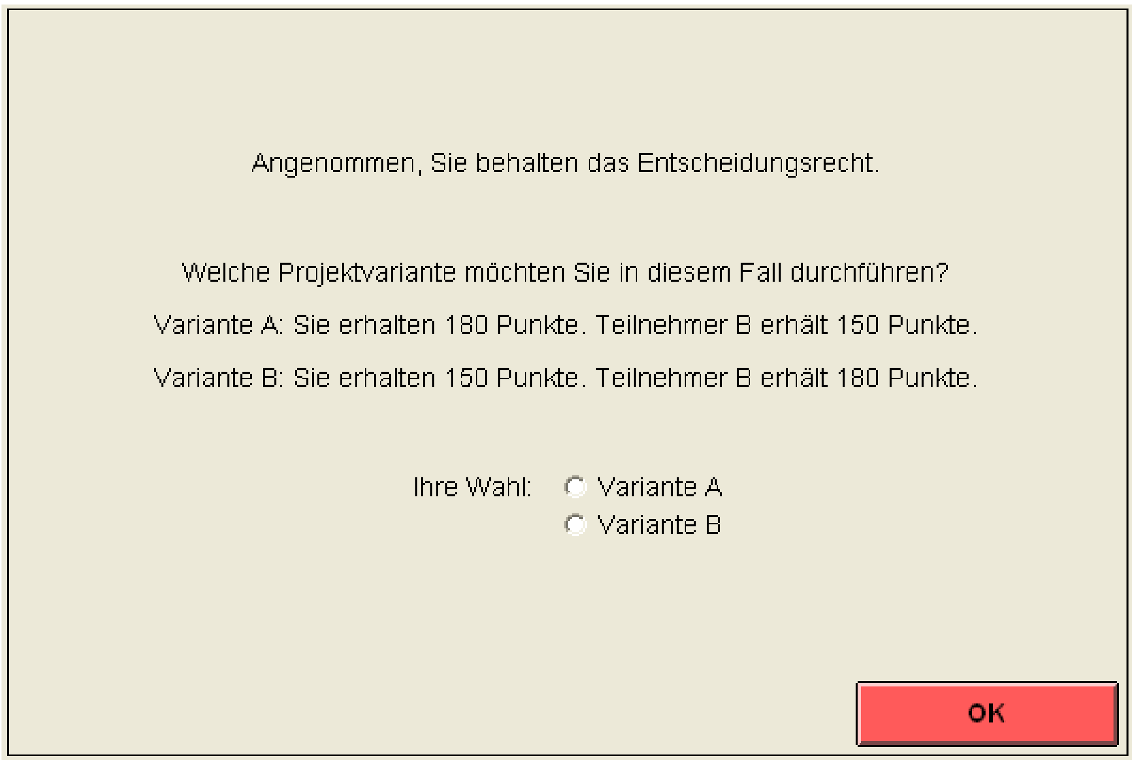


After entering your minimal requirement, click on the OK-button to proceed to the next step.

2. Choosing the project variant

When you choose the project variant you don't know whether participant B's success probability has met your minimal requirement or not. Therefore, you have to choose the project variant that you want to implement for the case that you keep the decision right. The project variant choice is made on the screen displayed below:

In the upper part of the screen you are always informed about the payments of both project variants in the current round. At the bottom of the screen you can choose the project variant.



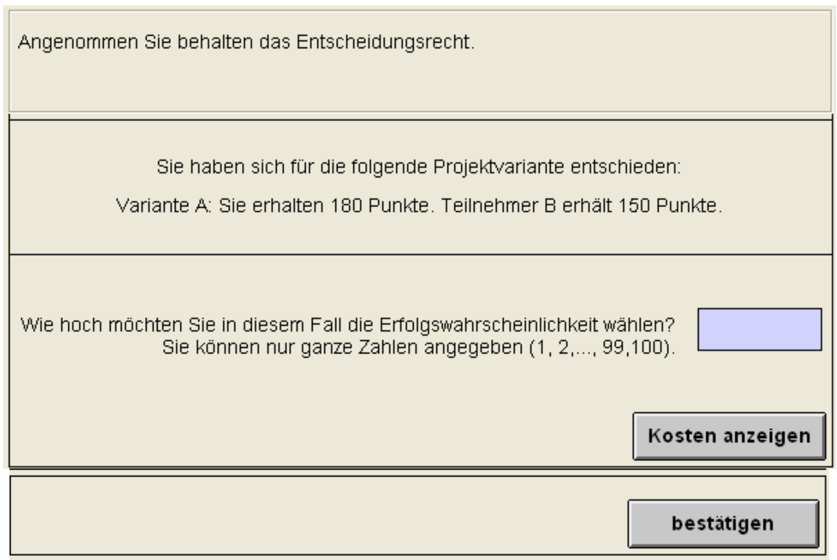
After choosing your project variant, click on OK.

3. Step: Choosing the success probability

At the time of choosing the success probability you are still not informed, whether participant B has met your minimal requirement or not. Therefore you have to decide on a success probability in case you keep the decision right. The costs of the success probability only count in case you indeed keep the decision right.

You make the success probability decision on the following screen:

In the upper part of the screen you are still informed about the payoffs of both project variant in the current round. At the bottom of the screen you can enter the success probability you want to choose.



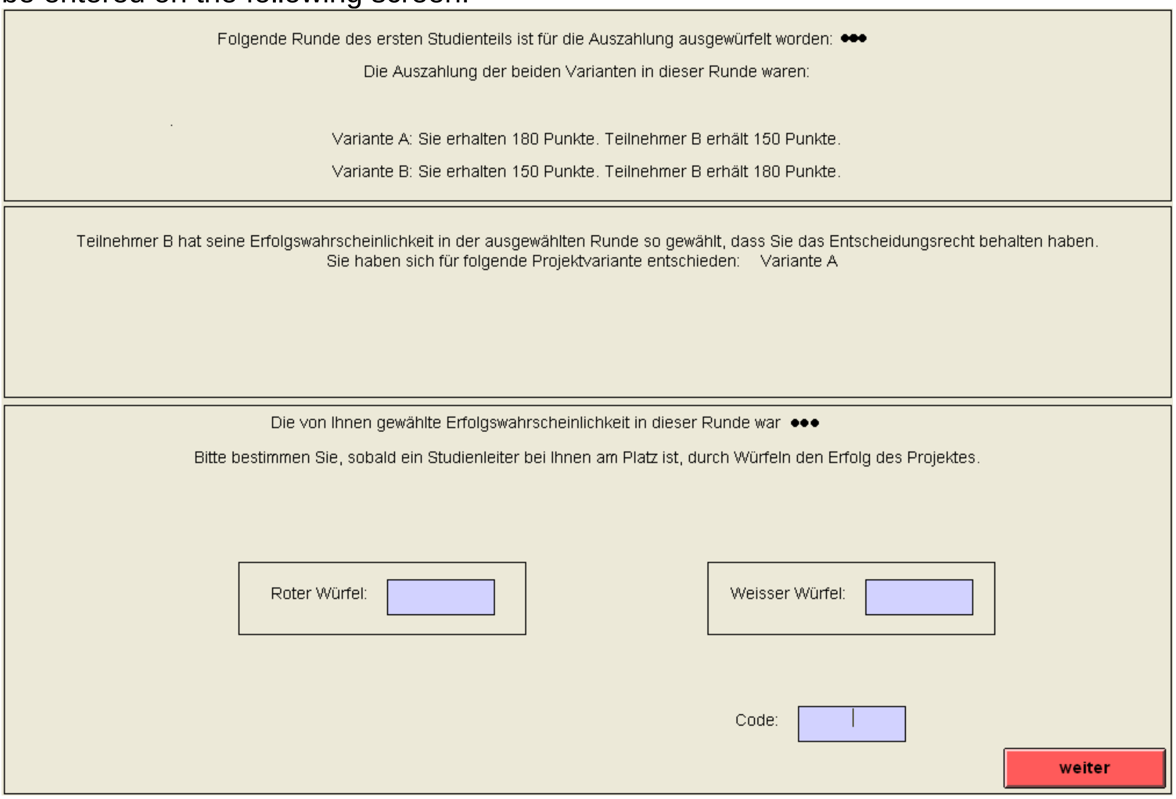
After you chose a success probability, click on the button "show costs". Thereafter, the exact costs associated with the success probability chosen by you are displayed. You can change your success probability, if you wish to. By clicking on "confirm", your decision becomes final.

4. Step: Determination of project success

At the very end of the study, after parts 2 and 3, one of the 12 rounds will be randomly determined by rolling a die, and your payments will be determined depending on your choices and the choices of the randomly matched participant B in the chosen round.

1. At first, one round is randomly picked by rolling a 12-sided die.
2. Then, it is checked whether the participant B who was matched with you in the chosen round has chosen a success probability, which is at least as large as your minimal requirement.
    - If the minimal requirement is fulfilled, you delegate the decision right.
    - If the minimal requirement is not fulfilled, you keep the decision right.

If you kept the decision right, you determine the project success yourself. This is decided by rolling dice at your place under supervision of an instructor. The result will be entered on the following screen:


Folgende Runde des ersten Studienteils ist für die Auszahlung ausgewürfelt worden: ●●●

Die Auszahlung der beiden Varianten in dieser Runde waren:

Variante A: Sie erhalten 180 Punkte. Teilnehmer B erhält 150 Punkte.

Variante B: Sie erhalten 150 Punkte. Teilnehmer B erhält 180 Punkte.

Teilnehmer B hat seine Erfolgswahrscheinlichkeit in der ausgewählten Runde so gewählt, dass Sie das Entscheidungsrecht behalten haben.
Sie haben sich für folgende Projektvariante entschieden: Variante A

Die von Ihnen gewählte Erfolgswahrscheinlichkeit in dieser Runde war ●●●

Bitte bestimmen Sie, sobald ein Studienleiter bei Ihnen am Platz ist, durch Würfeln den Erfolg des Projektes.

Roter Würfel:

Weisser Würfel:

Code:

weiter

You can roll the dice yourself, but the numbers and the code is entered by the instructor.

Do you have any questions regarding the study? Please contact us, and we will answer your questions at your cubicle.

Control Questions

Please answer the following control questions. If you have questions, please contact an instructor.

1. Imagine that you have chosen a minimal requirement of 51 and participant B has chosen a success probability of 43.
   a) Who has the decision right in this round? ....

You have kept the decision right and chosen a success probability of 54. After that, you roll an 8 with the red die and a 2 with the white die.

b) How high are your costs?
c) Was the project implementation successful?

The payments associated with the project were as follows:

		Your payment	Payment participant B
Implementation successful	**Variant A**	200	150
	Variant B	150	200
Implementation unsuccessful		100	100

Assume you have chosen project variant A.

d) How high is your income?
e) How high is the income of participant B?

Assume that you have chosen a success probability of 24 and that you rolled a 1 with the red die and a 5 with the white die. You have again chosen project variant A.

f) How high would be your costs?
g) Was the project implementation successful?
h) How high is your income?
i) How high is the income of participant B?

1. Imagine that you have chosen a minimal requirement of 39 and participant B has chosen a success probability of 53.

    a) Who has the decision right in this round?\........

    Now assume that you have chosen a minimal requirement of 65 and participant B has chosen a success probability of 54.

    b) Who has the decision right in this round?........

The payments associated with the project were as follows:

		Your payment	Payment participant B
Implementation successful	**Variant A**	180	150
	Variant B	150	200
Implementation unsuccessful		100	180

Assume you have delegated the decision right. Participant B has chosen variant B and a success probability of 43, and the project implementation is successful.

c) How high is your income?
d) How high is the income of participant B?

Assume you have delegated the decision right. Participant B has chosen variant B and a success probability of 48, and the project implementation is unsuccessful.

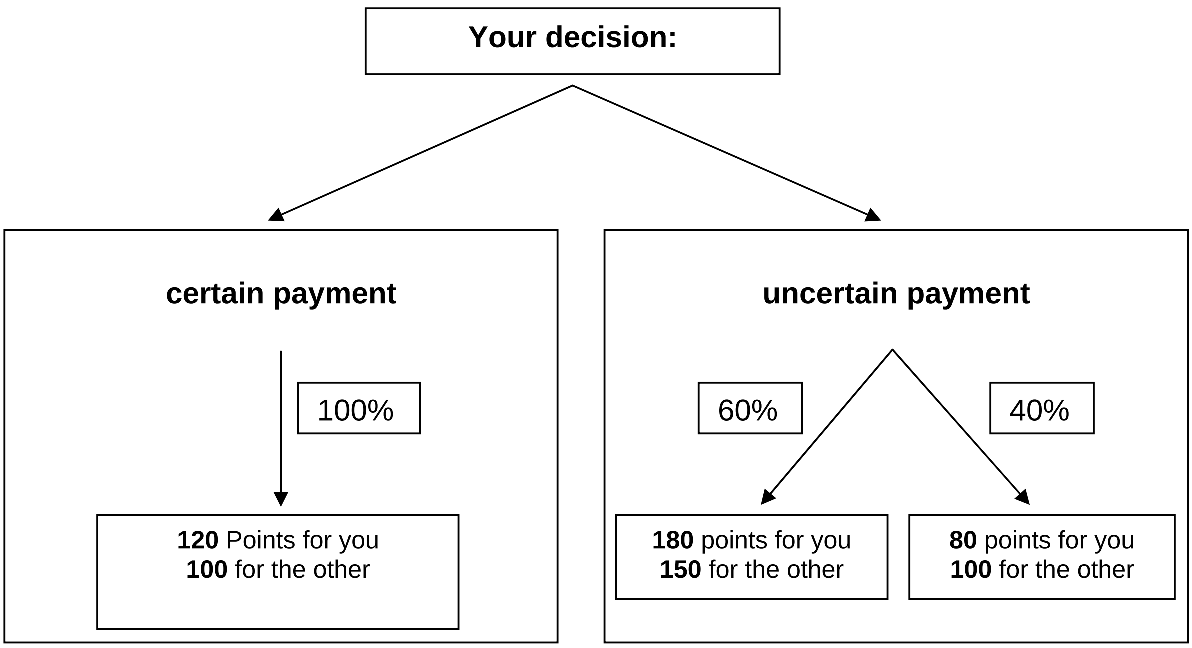
e) How high is your income?
f) How high is the income of participant B?

Second Part of today's study

There are 24 rounds in this part of the study. In each round you are randomly matched with another participant. The following rule still applies: 15 points=1 Swiss Franc.

In each round, you have to decide between a certain payment and an uncertain payment. Your decision also determines the payment for the other, randomly matched participant.

An Example:



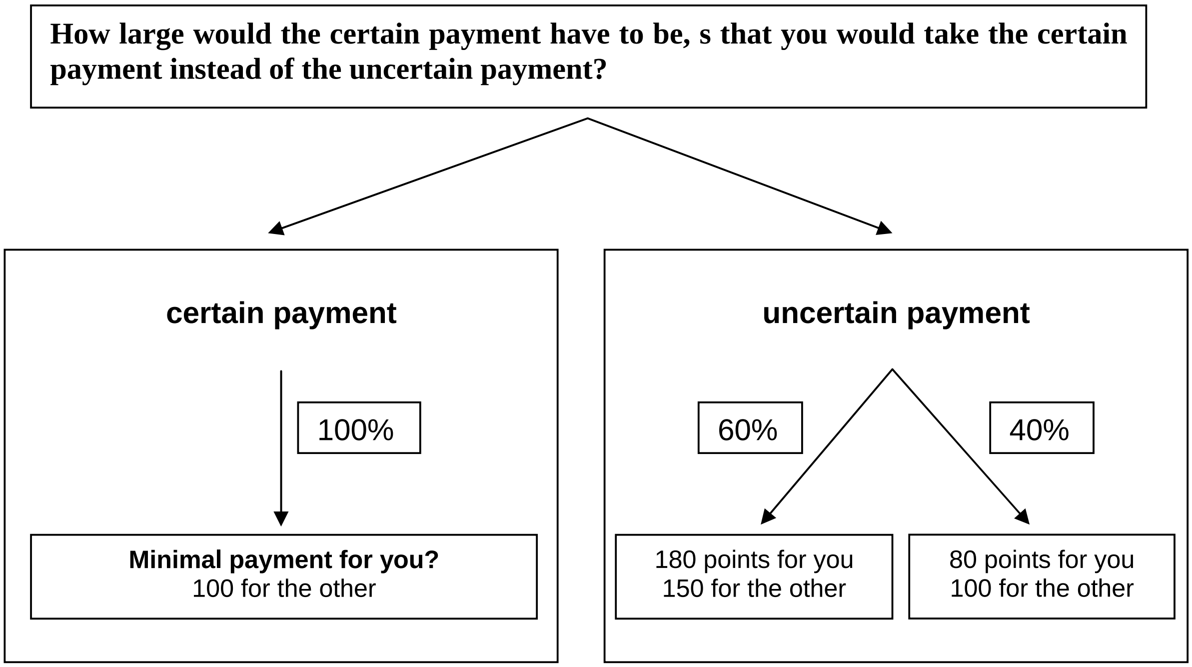
If you choose the **certain payment** in the example above, you receive 120 points and the other randomly matched participant receives 100 points.

If you choose the uncertain payment with 60% probability you receive 180 points and the other participant 150 points. With 40% probability you receive 80 points and the other participant 100 points.

In each of the 24 rounds you have to make a decision between a certain and an uncertain payment. Payments and probabilities will vary from round to round.

How do you make your decision between the certain and the uncertain payment?

When you make your decision between the certain and the uncertain payment in a given round, you do not yet know the exact size of the certain payment. Therefore, you cannot directly choose between a certain and an uncertain payment, but you have to decide how high the certain payment would have to be, so that you would take the certain payment instead of the uncertain payment.



The certain payment for the other participant is always 100 points. In every round, you are informed about the uncertain payments for you and the other participant as well as the probabilities of these payments.

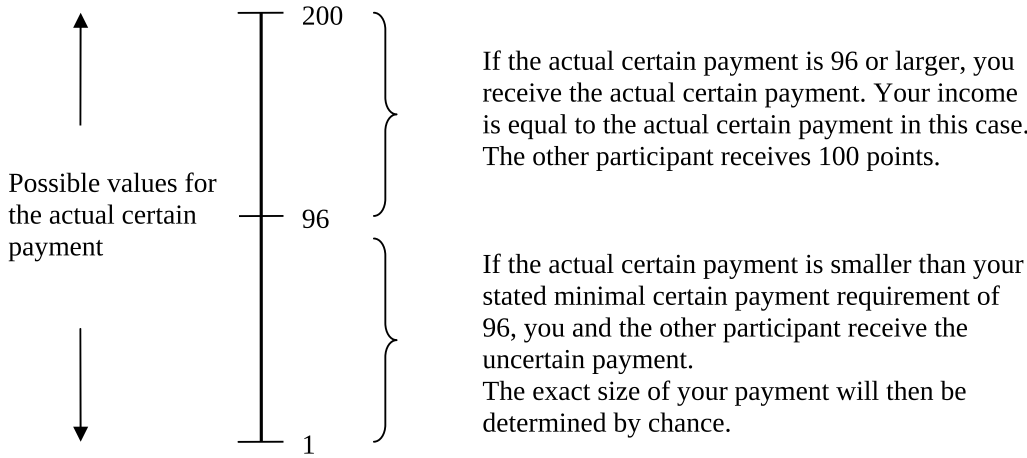
Only after having decided on the **minimal certain payment required** that you would choose the certain payment, you are informed about the **actual certain payment**. Your decision between the certain and the uncertain payment is then implemented as follows:

- If the actual certain payment is smaller than your stated minimal certain payment requirement, your income and the income of the other participant is determined by the uncertain payment.
- If the actual certain payment is larger than your stated minimal certain payment requirement, you receive the actual certain payment and the other participant receives 100 points.

The possible values of the actual certain payments lie between 0 and 200. Every integer value (0,1,2,3,…,200) is equally probable. Your stated minimal certain payment requirement can also be any value between 0 and 200.

The following graph again illustrates the relationship between your stated minimal certain payment requirement, the size of the actual certain payment and your decision between the certain and the uncertain payment

If, for example, you state a minimal certain payment requirement of 96, this implies that every actual certain payment between 96 and 200 is preferred by you to the uncertain payment.
You are only informed about the exact size of the actual certain payment after you have entered your minimal certain payment requirement.



When deciding on your minimal certain payment requirement, you should ask yourself the following questions:

- Would you prefer a certain payment of 200 points over the uncertain payment? If yes, you should ask yourself:
- Would you prefer a certain payment of 199 points over the uncertain payment? If yes, you should ask yourself:
- Would you prefer a certain payment of 198 points over the uncertain payment? And so on.

Until you reach a certain payment amount, at which you only just prefer the certain payment. In the example above, this amount is 96. This implies, that you only just prefer a certain amount of 96 to the uncertain payment, but if the certain payment would be 95 or less, you would prefer the uncertain payment.

The Income

If your actual certain payment is at least as high as the minimal certain payment requirement that you entered:

You receive the actual certain payment.
The other participant receives 100 points.

If your actual certain payment is smaller than the minimal certain payment requirement that you entered:

Given the probabilities of the given uncertain payments, your payoff and the payoff of the other participant is randomly determined.

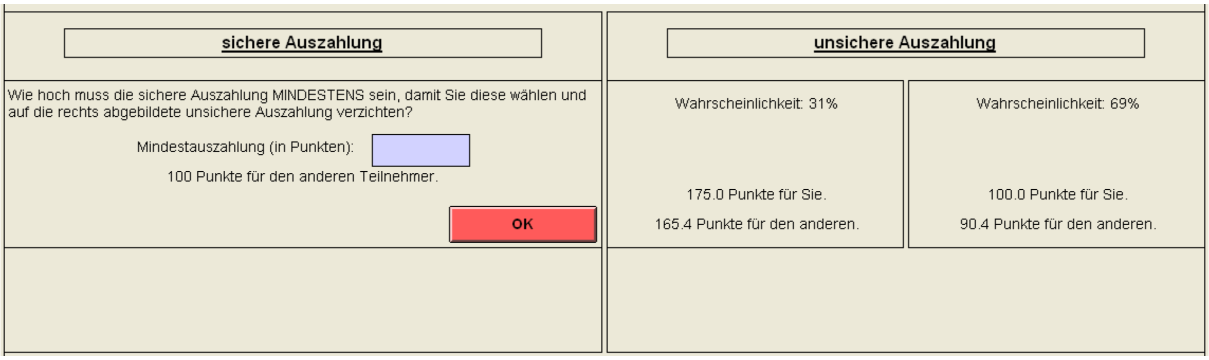
At the end of the study, 2 of the 24 rounds will be randomly chosen by rolling dice.

For the two chosen rounds, the actual certain payment will be compared to your minimal certain payment requirement and – if the actual certain payment is below your minimal requirement – it is determined by rolling dice, which of the two uncertain payments you and the other participant receive.

Since you do not know which of the 24 rounds will be randomly chosen, you should carefully think about your decisions in each of the 24 rounds!

Procedures on the Computer

1. Your decision about your **minimal certain payment required that you would prefer the certain payment over the uncertain paymen**t is entered in each round on the following screen:



On the right side of the screen, you can see the uncertain payments for you and the other, randomly matched participant. You also see the probabilities, with which the potential payment occur. This information will differ from round to round.

On the left side, you can enter your minimal certain payment requirement. Your minimal certain payment requirement determines which certain payment you have to receive at least, so that you would prefer the certain payment over the uncertain payment. After making your decision, please click the OK-button. As long as you have not clicked on the button, you can change your entry.

2. If in one of the two randomly chosen rounds your minimal certain payment requirement is below the actual certain payment, it will be decided by rolling dice which of the two uncertain amounts you and the other participant receive. Rolling dice works the same way as in part 1 of the study. The numbers you rolled will be entered by an instructor on the screen below:


Erste ausgewählte Runde:

Bei den Zahlen 0-15 (15.00% Wahrscheinlichkeit) erhalten Sie 175.0 Punkte und der andere Teilnehmer 247.8 Punkte.
Und bei den Zahlen 16-100 (85.00% Wahrscheinlichkeit) gewinnen Sie 100.0 Punkte und der andere Teilnehmer 97.8 Punkte.

Von Ihnen festgelegte Mindestauszahlung: •••
Ihre tatsächliche sichere Auszahlung: •••

Sie haben Ihre tatsächliche sichere Auszahlung gewählt. Folglich erhält der andere Teilnehmer 100 Punkte und Sie erhalten folgende Punktzahl: •••

Zweite ausgewählte Runde:

Bei den Zahlen 0-24 (24.00% Wahrscheinlichkeit) gewinnen Sie 194.2 Punkte und Teilnehmer B 150.0 Punkte.
Bei den Zahlen 25-100 (76.00% Wahrscheinlichkeit) gewinnen Sie 94.2 Punkte und und Teilnehmer B 100.0 Punkte.

Von Ihnen festgelegte Mindestauszahlung: •••
Ihre tatsächliche sichere Auszahlung: •••

Sie haben sich für die unsichere Auszahlung entschieden.
Bitte warten Sie, bis ein Studienleiter an Ihren Platz kommt. Daraufhin werfen Sie bitte einmalig den roten und den weissen Würfel.

Roter Würfel:

Weisser Würfel:

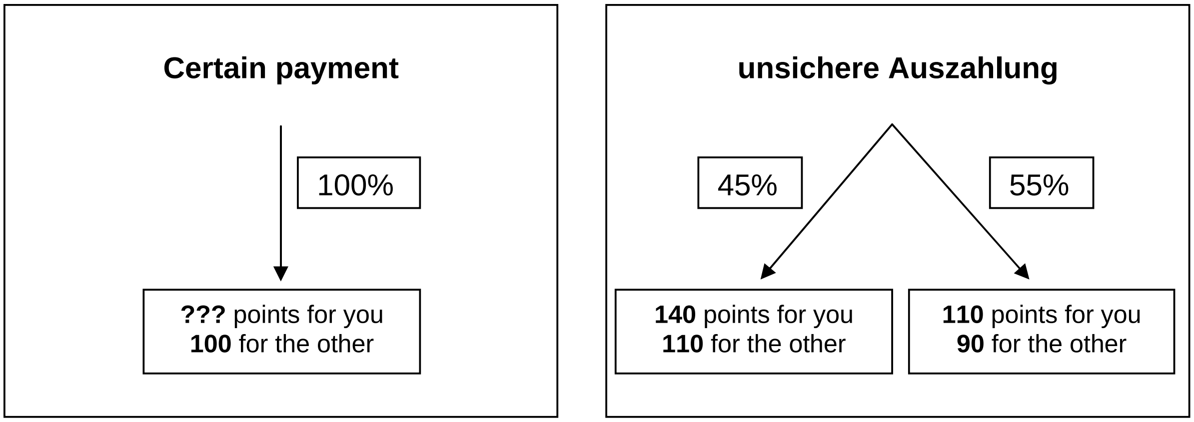
bestätigen

Do you have any questions regarding this study? Please contact an instructor; we will answer your question at your cubicle.

On the next page, you will find a few control questions.

Control Questions

Assume that the following amounts and probabilities were given for the certain and the uncertain payments in a round.



1. **Assume that you entered a minimal certain payment requirement of 77.**

   a) Assume, that the actual certain payment is 113.
   What is your payment in this round? ……….
   What is the payment of the other participant in this round? ……….

   b) Assume, that the actual certain payment is 61.
   What is your payment in this round? ……….
   What is the payment of the other participant in this round? ……….

2. **Assume that you entered a minimal certain payment requirement of 142.**

   a) Assume, that the actual certain payment is 113.
   What is your payment in this round? ……….
   What is the payment of the other participant in this round? ……….

   b) Assume, that the actual certain payment is 61.
   What is your payment in this round? ……….
   What is the payment of the other participant in this round? ……….

3. **Assume that you entered a minimal certain payment requirement of 19.**

   a) Assume, that the actual certain payment is 113.
   What is your payment in this round? ……….
   What is the payment of the other participant in this round? ……….

   b) Assume, that the actual certain payment is 61.
   What is your payment in this round? ……….
   What is the payment of the other participant in this round? ……….