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Drouvelis, Michalis; Sonnemans, Joep

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The Endowment Effect in Games*

Michalis Drouvelis[a] and Joep Sonnemans[b,c]

[a] University of Birmingham
[b] CREED, University of Amsterdam
[c] Tinbergen Institute

Abstract

In a laboratory experiment we study whether the endowment effect exists in a social and strategic context. We employ a within-subjects design whereby participants are asked for their Willingness-to-Accept (WTA) or Willingness-to-Pay (WTP) to play a series of 2x2 games. In the second part of the experiment, we study the endowment effect in lotteries with the same payoffs as the games in the first part. Our findings provide robust evidence for the endowment effect both in games and in lotteries, with the size of the effect actually being larger in games than in lotteries. We also find that the endowment effect can partly be attributed to optimism.

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1. Introduction

We report on an experimental test of whether the so-called 'endowment effect' exists when decisions are made in a strategic context. The endowment effect is observed when individuals place a higher value on a good when they are endowed with it, compared to when they are not. A large body of experimental studies has documented considerable evidence that provides support for the existence of the endowment effect in relation to individual decision-making (for a recent overview see Ericson and Fuster 2014). Most of these studies show that the entitlement affects the value of goods: average willingness-to-accept (WTA) values are greater than willingness-to-pay (WTP) values[1]. Endowment effect studies typically focus on situations where individuals are asked to trade consumption goods such as mugs, chocolate bars and pens (e.g., Knetsch, 1989; Kahneman et al., 1990; Shogren et al. 2001; Loewenstein and Issacharoff, 1994); less common consumption goods such as premium chocolate candies and tasting bitter liquids (e.g., Coursey et al., 1987; Bateman et al., 1997); or lottery tickets (Knetsch and Sinden, 1984; Harless, 1989; Eisenberger and Weber, 1995; Kachelmeier and Shehata, 1992; Singh, 1991). We extend this literature by exploring whether the endowment effect survives in strategic and social contexts. In the experiment participants have either the right to play a game and are asked for their WTA, or they do not have the right to play and are asked for their WTP[2]. The decision-making contexts in our experiment allow us to elicit information (such as individuals' expectations about others' actions) that may help explain the presence of the endowment effect in a strategic context.

From an economic perspective, the endowment effect is interesting because it can undermine the idea of a competitive equilibrium where all potential gains from exchange will be exhausted. The practical relevance of the endowment effect in social and strategic environments is also potentially large. The endowment effect is closely related to the status quo effect: the tendency to prefer the current state to alternatives. Such preference for the current state can bias the decision maker against both buying and selling (Kahneman et al. 1991, page 194) and in that sense the endowment effect can be considered a special case of the status quo bias. A status quo bias may lead to reluctance to give up existing political institutions for other institutions that would perform better. In a dynamic context Kloosterman and Schotter (2016) show how existing social institutions can influence the occurrence of new institutions. Institutions that have arisen for solving specific problems in the past may place constraints on the possible solutions of today's problems. An implicit but essential assumption in their model is that the existing institutions are hard to change and thus are hard constraints. Possible reasons for the permanence of social institutions are coordination problems and the status quo bias. For example, it is unlikely that a newly formed state nowadays would adopt constitutional monarchy as a political system, but there are still 10 hereditary

[1] For meta-analyses on the WTA-WTP disparity, see Horowitz and McConnell (2002), Sayman and Onculer (2005) and Tunçel and Hammit (2013).

[2] There is a substantial experimental literature about how auctioning the right to play influences beliefs and behaviour, see for example Offerman and Potters (2006) and Shachat and Swarthout (2013). Typically, in these experiments behaviour in a treatment where the right to play is purchased is compared with behaviour in a treatment where no market for playing rights exists. In a treatment with a market for playing rights, a player is more likely to play against a participant with a high valuation than with a low valuation. This may influence the beliefs about the play of others and thus the own choice of action. But this effect would be the same in the WTA and WTP games, so we cannot expect an influence of this on the WTA-WTP gap, which is the main topic of the paper.

monarchies in Europe[3]. In our study, we do not focus on institutional changes directly, but for practical reasons we examine the WTA-WTP gap for the right to play a game.[4]

In general it is far from obvious that regularities in individual decision-making will also be observed in a strategic context. According to Simon (1955) bounded rationality is characterized by the use of heuristics, and what heuristics are used depends very much on the context. As the attention of the decision maker may focus on different aspects in a more complex and strategic situation, it is not clear that observed behaviour in individual decision-making generalizes to such a setting. In our experiment we employ several different games. Coordination games can be considered to be in character close to a lottery (at least in theory), and because the endowment effect seems to be very robust for lotteries, we may expect to find evidence of the endowment effect also in these games. We also use other games, like the chicken game and the prisoners' dilemma. In these games social preferences and beliefs about the actions of others may play an important role, which makes the situation more complex and less similar to a lottery.

There are also possible reasons why the endowment effect will be observed in games and could be even larger in games than in lotteries. To evaluate the attractiveness of a trade, the decision maker may compare the price with some reference price (Thaler 1985, Putler 1992). Buying (selling) for a higher (lower) price than the reference price is a "bad deal". Isoni (2011) shows theoretically that bad deal aversion can be an explanation for the decreasing WTA-WTP gap in repeated markets, assuming that decision makers adapt their reference price based upon earlier actual market outcomes. Weaver and Frederick (2012) experimentally manipulate the reference prices and are able to change the size of the endowment effect. Note that the reference price will be typically not a precise amount, and because of this fuzziness it can be influenced by observed market prices (Isoni 2011) or information provided by the experimenter (Weaver and Frederick 2012). There may be an "imprecision interval" (Butler and Loomes 2007) around the reference price (see also Bayrak et al. 2016) [5]. To avoid bad deals the reported WTA and WTP values will be "on the safe side": high in the interval for a WTA and low for a WTP. The WTA-WTP gap will thus depend on the size of the

[3] There are some experimental studies on voting for institutions, specifically sanctioning institutions in public good games (e.g. Markussen et al 2014, Kamei et al 2015). Some results are suggestive that the status quo bias may play a role. For example, in Markussen et al. (2014) all groups start with playing 4 periods under the no-sanction institution and vote for no-sanction or informal sanction and 79% of the groups vote to continue under the no-sanction regime. Later in the experiment groups have to vote again between these two institutions but now they have been for the last 4 periods in a formal or informal sanction institution. 65% of the groups who are in the informal sanction institution now decide to stay there. Unfortunately they don't have a treatment in which the order of play is changed, so we cannot know whether these decisions are caused by a status quo effect, or by positive experiences with this informal institution.

[4] Directly studying the status quo effect for social institutions would mean a design in which participants would first have to experience a certain institution for quite some time (e.g. punishing rules in a public good game), before we would give them the option to change that institution. The practical problem is that groups will have different experiences (good or bad), which may have a large effect on their willingness to change institutions. Whether a group will judge their experience as being good or bad will depend on their reference point (probably expectations), which cannot be controlled by the experimenter. This lack of control and probably considerable noise would cause a low statistical power.

[5] Recent findings in neuroscience suggest that when a decision maker estimates subjective value, confidence is automatically coded in the same region of the brain, see Lebreton et al. (2015). This confidence can be regarded as a judgment on the correctness of the valuation. A low confidence is analogous to a large imprecision interval.

imprecision interval. Okada (2010) shows that the WTA-WTP gap indeed increases with reference price uncertainty.

One reason for analysing the possibility of the endowment effect in games is the high level of uncertainty or ambiguity in strategic situations. The uncertainty in a lottery is an explicit risk. In games the task is more complex as there is strategic uncertainty, which would make it even harder for subjects to establish a subjective utility or a reference price, and the imprecision interval may be larger than in lotteries.

Another reason can be optimism and relates to how the decision maker has to form beliefs about the actions of others. Optimism is very common and it is even considered in the Western culture to be an appealing personality trait (see Ehrenreich 2009 for a review). In the case of optimism (or pessimism) subjective beliefs about the occurrence of an event are positively (negatively) dependent on the consequences of the event for the decision maker. An optimist who owns a lottery ticket will think it is more likely that his ticket will win than a ticket not owned by him, which leads to a higher subjective expected value of a lottery ticket that is owned. Such distorted beliefs would lead to a difference in WTA and WTP values. Note that this hypothesis is hard to test in an experiment using lotteries, because it does not make much sense to ask an experimental participant for a subjective belief after providing the objective probability (as the objective probability would be an obvious "right answer"). However, in games there is strategic uncertainty and no objective probability. It may be easier to maintain self-deceptive beliefs like optimism in games and thus optimism may be more important. If optimism were an explanation for the WPA-WTP gap, we would expect a higher subjective expected value of a game that is owned than of a game that is not owned. Due to beliefs in the games being elicited, we can test whether the endowment effect can be attributed to optimism by comparing the subjective expected value of the WTA and WTP games.

Our experiment consists of two parts. In the first part, we study the presence of the endowment effect in games, whereas, in the second part of the experiment we study the endowment effect in lotteries. This is done for two reasons. First, if it so happens that we do not observe an endowment effect in games, this might have been caused by specific circumstances, like the subject pool, instructions, etc. In that case a null result would be more meaningful if we could show that the same participants show an endowment effect in lotteries. Second, since we elicit the subjective beliefs about the play of others, there is a direct relation between games and lotteries. For example, when a player expects that other players select "A" with a probability of 40% while they themselves play "B", the value of the game should be equal to the value of the lottery where with 40% probability the payoff is equal to the payoff in the game with a (B, A) outcome and with 60% the payoff is equal to the game payoff for the (B,B) outcome (abstracting from social preferences). In the second part of the experiment participants face lotteries that are based upon the games of the first part, using either the mixed Nash equilibrium (which we refer to as "fixed lotteries", see the design section) or the individual subjective beliefs measured in the first part (which we refer to as "subjective lotteries") as the corresponding probabilities.

We did not find any other experimental studies about the endowment effect in games. One study is indirectly relevant; in an experiment by Collins et al. (2015) the right to divide a sum of money between oneself and a passive recipient is traded in a double auction market[6]. Note that a dictator game is not a strategic situation (there is no strategic uncertainty) and a double auction differs from the Becker-DeGroot-Marchak procedure we employ, but it is interesting that their data shows an endowment effect in this specific social context.[7]

The next section will discuss the experimental design in detail, in section 3 the results will be presented and section 4 concludes.

2. Experimental design

The experiment consists of two parts. In the first part WTA and WTP values for the right to play the games were elicited. In addition, we ask for a choice in each game and we elicit expectations about the behaviour of others. In the second part WTA and WTP values for lotteries were elicited. We will first explain how the WTA and WTP values are elicited, then we will discuss the games employed in the experiment, how the lotteries of part two are constructed and we end the design section with the procedures. All the on-screen instructions, the paper handouts and relevant screenshots are included in the appendix.

2.1 The implementation of the Becker-DeGroot-Marchak (BDM) procedure

We use the BDM procedure (Becker, DeGroot & Marschak 1964) to elicit WTA and WTP values. The BDM procedure is a standard elicitation mechanism in the endowment effect literature. Plott and Zeiler (2005) are critical about the use of this mechanism and they argue that the endowment effect is caused by decision makers misunderstanding the mechanism. However, a recent study by Brebner and Sonnemans (2016) compares the size of the endowment effect using the BDM and the multiple price list (MPL) mechanisms, with lotteries as goods. An MPL is easier to understand but more time consuming. A robust endowment effect was found using both elicitation mechanisms. The MPL elicitation mechanism appears to result in a slightly larger endowment effect compared with the BDM mechanism, refuting claims that misconceptions of the BDM mechanism cause the endowment effect (see also Bartling et al. 2015 and Fehr et al. 2015). In brief, participants are asked to report their WTA or WTP values (in periods when they have or do not have the right to play, respectively), which they are told should be between 0 and 8 Euros. Whether they then actually play the game is determined by comparing their WTA and WTP value to a random draw on the interval [0, 8] Euros. For WTP periods, participants will take part in the game as long as the randomly drawn number does not exceed their stated WTP. Similarly, for WTA periods participants will take part in the game as long as the randomly drawn number is lower than their stated WTA.

Since this is not a straightforward procedure for participants to understand, we started each session with detailed instructions explaining this elicitation mechanism. We provided numerical examples in order for participants to understand why it is optimal for them to report a WTA and WTP value that is equal to their own true value. Our instructions follow closely the examples as described in Isoni et al. (2011). Just before the start of the session, we put the exact amount of the random bids in a

[6] We thank a referee for pointing our attention to this paper. Collins et al. (2015) does not focus on the endowment effect, but on the effect of market interaction on social behaviour.
[7] The rights to be a dictator were allocated randomly, and under the assumption of a continuous distribution of private valuations, one would expect that about half of the rights would be traded. However, only 129 of the possible 320 trades took place (40.3%), which is statistically significant less than 50% (sign-test, p=0.0006).

sealed envelope (together with the random draws of the payoff relevant periods), which is placed on a whiteboard in the laboratory. This information is revealed to participants at the very end of the experiment and determines whether participants have bought or sold their right to play the randomly selected game for payment.

2.2 Part 1: Games

The first part has 20 periods. In the odd periods, participants get “the right to play” and report their WTA value. In the even periods, they do not have the right to play and report their WTP value. [8] In all periods they make a choice in case that period is paid out and they did buy or did not sell the game, and report their expectations about the play of others. To make it easier for participants to distinguish between WTA and WTP periods, the differences between these periods are highlighted in green and purple colours, respectively (see figure 1).

Figure 1: Screenshots of odd and even periods in part 1

[8] A similar design choice of alternating between (blocks of) WTA and WTP value elicitations is used by Plott and Zeiler (2005).

Table 1: Game parameters

Game						
Game 1 Coord.	**WTA [50-50]**			**WTP [50-50]**		
		A	B		A	B
	A	2, 2	4, 6	A	3, 3	5, 7
	B	6, 4	0, 0	B	7, 5	1, 1
Game 2 Chicken	**WTA [50-50]**			**WTP [50-50]**		
		A	B		A	B
	A	4, 4	2, 5	A	3, 3	1, 4
	B	5, 2	1, 1	B	4, 1	0, 0
Game 3 Stag Hunt	**WTA [60-40]**			**WTP [60-40]**		
		A	B		A	B
	A	5, 5	1, 3	A	4, 4	0, 2
	B	3, 1	4, 4	B	2, 0	3, 3
Game 4 Coord.	**WTA [50-50]**			**WTP [50-50]**		
		A	B		A	B
	A	0, 0	7, 7	A	1, 1	8, 8
	B	7, 7	0, 0	B	8, 8	1, 1
Game 5 PD	**WTA**			**WTP**		
		A	B		A	B
	A	6, 6	0, 7	A	7, 7	1, 8
	B	7, 0	3, 3	B	8, 1	4, 4
Game 6 Coord.	**WTA [50-50]**			**WTP [50-50]**		
		A	B		A	B
	A	2, 2	6, 10	A	1, 1	5, 9
	B	10, 6	-2, -2	B	9, 5	-3, -3
Game 7 Chicken	**WTA [30-70]**			**WTP [30-70]**		
		A	B		A	B
	A	6, 6	3, 13	A	5, 5	2, 12
	B	13, 3	0, 0	B	12, 2	-1, -1
Game 8 Stag Hunt	**WTA [60-40]**			**WTP [60-40]**		
		A	B		A	B
	A	4, 4	-4, 0	A	5, 5	-3, 1
	B	0, -4	2, 2	B	1, -3	3, 3
Game 9 Coord.	**WTA [30-70]**			**WTP [30-70]**		
		A	B		A	B
	A	0, 0	3, 7	A	1, 1	4, 8
	B	7, 3	0, 0	B	8, 4	1, 1
Game 10 PD	**WTA**			**WTP**		
		A	B		A	B
	A	7, 7	-3, 9	A	6, 6	-4, 8
	B	9, -3	3, 3	B	8, -4	2, 2

Note: The payoffs of the above table correspond to Euros. Mixed strategy probabilities are given in square brackets (the first number corresponds to action A and the second one to action B). The order of play was the same for all participants and alternates WTA and WTP: 1WTA, 2WTP, 3WTA, 4WTP, 5WTA, 6WTP, 7WTA, 8WTP, 9WTA, 10WTP, 2WTA, 3WTP, 4WTA, 5WTP, 6WTA, 7WTP, 8WTA, 9WTP, 10WTA, 1WTP.

In total, we elicited WTA or WTP values for ten games (20 periods), which are outlined in Table 1. Our games differ in three respects. First, we have included four different types of games. These are Coordination games (1, 4, 6 and 9), Stag hunt games (3 and 8), Chicken games (2 and 7), and Prisoner's dilemma games (5 and 10). Second, the mixed equilibrium percentages can be 30%-70% (Games 7 and 9), 50%-50% (Games 1, 2, 4 and 6), 60%-40% (Games 3 and 8) or no mixed strategy equilibrium (the Prisoners' Dilemma Games 5 and 10). Third, we vary the presence of negative payoffs depending on the action chosen. Games 1, 2, 3, 4, 5 and 9 only have positive payoffs, whereas, Games 6, 7, 8 and 10 include negative payoffs as well.[9]

Notice that half of the games for which WTP is elicited are obtained by adding 1 euro to the corresponding WTA game and for the other half of the games for which WTP is elicited are obtained by subtracting 1 euro from corresponding WTA game. For example, in Game 1, the WTP game is obtained by adding 1 euro to the WTA variant of the game. This feature of the design is particularly well suited for making within-subject comparisons of WTP and WTA as it avoids having subjects value the same game twice, and is inspired by the manipulation of lotteries in Plott and Zeiler (2005)

[9] We note that only a very small proportion of bids correspond to the extreme values of 0 and 8 euros. In particular, for the games, 1.84% (21/1139) of the bids were equal to 0 euros and 8.08% (92/1139) of the bids were equal to 8 euros. For the lotteries, 7.68% (236/3074) of the bids were equal to 0 euros and 4.26% (131/3074) of the bids were equal to 8 euros.

and Isoni et al. (2011)[10]. In addition, another characteristic of our games is that row and column players are symmetric. This is done for practical reasons to avoid introducing different roles of row and column players. Note that participants did not receive feedback about the play of others during the experiment, which eliminates the possibility of learning[11]. The order of the games was the same for all participants.

An interesting element of strategic interaction (as opposed to individual decision making) is that a particular choice of an action may depend on a participant's beliefs about the opponent's actions. Clearly, the beliefs of participants are likely to influence their stated values. For example, in the Prisoner's dilemma Game 5 (see table 1), if a participant believes that his/her opponent will choose B with certainty, his/her willingness to pay for this game will not be more than 4 money units. It was therefore important to elicit participants' beliefs about what fraction of the participants in a session will choose a specific action (A or B). The elicitation of beliefs was incentivised; at the end of the experiment the expectations in one randomly determined period are compared with actual choices of 10 other participants in that session and paid out.[12] The use of participants' beliefs becomes particularly important for the second part of the experiment, which is described below.

2.3 Part 2: Lotteries

After the first part of the experiment is completed, we also elicited information about participants' valuations in 27 WTA lotteries and 27 WTP lotteries (54 periods). The lottery parameters that we used in our experiment are transformations of the parameters we used in each of the games outlined in Table 1[13]. For example, from the WTA version of Game 1, we obtained the following two lotteries: A = (€2, 0.5; €4, 0.5) and B = (€6, 0.5; €0, 0.5). Of these lotteries 15 lotteries are "fixed lotteries" which use as probabilities the mixed strategy equilibriums of each game and 12 are "subjective lotteries" for which we used as percentages the elicited beliefs from the first part of the experiment. This was done only in the games where the mixed strategy equilibrium was different from 50%-50%. When the participant reported different beliefs in the WTA and WTP version of the game, we took the average of these beliefs. The comparison of the WTA and WTP values between the first and the second part provides us with an insightful within-subject comparison, which allows us to study how the size of the endowment effect in strategic decision-making situations compares with the size of the endowment effect in payoff-equivalent individual decision-making situations

[10] Our procedure is different than the procedures used in Plott and Zeiler (2005) and Isoni et al. (2011) for lotteries which always added a positive amount to the WTP lottery.

[11] When we designed the experiment we thought about the possibility that sophisticated participants may anticipate that if they play the game they are more likely to meet an opponent who values the game highly, and this may tell something about the action of the opponent. For example, in WTA game 2 (chicken) one can expect a rational player who values the game higher than 4 to play B (because the maximum value of playing A is 4). Note that this effect does not differ between WTA and WTP cases and cannot be the cause of a WTA-WTP gap.

[12] For the belief elicitation task, we asked each participant to indicate how many (out of 10 randomly selected) other participants have chosen action A and how many have chosen action B. Clearly, the sum of these two numbers should be equal to 10. The earnings are the number of correct predictions made, times 50 cents. For example, if the participant reported that 7 participants would choose A and 3 participants would choose B and we find that in fact 4 participants have chosen A and 6 participants have chosen B, 4 A-choices and 3 B-choices are correctly guessed and the earnings are 7*50 cents is 3.50 euros.

[13] This means that, like in the games, the payoff in WTP lotteries are 1 euro more or less than in the WTA lotteries.

(lotteries). The full set of lotteries that we used is provided in Appendix A. The order of the lotteries was the same for all participants, and we made sure that related lotteries were presented with at least 4 periods in between.

2.4 Procedures

The experiment is programmed in PHP/mysql and starts with a set of general instructions about the BDM procedure, with many examples, very much like the experiment reported by Isoni et al. (2011). This is followed by instructions about the task in part 1: the good is the right to play a game; we explain how to read a matrix game; we explain the task in each period (making a choice, reporting beliefs and value). After all participants have finished with the instructions and have correctly answered the questions that checked understanding, the first part of 20 periods starts.

After the last period of part 1 the participants receive the instructions of part 2 and make their 54 decisions for part 2. What periods would be paid, and the random values were randomly determined just before the session and put in a sealed envelope on the whiteboard, visible for all participants. After all participants have finished part 2, the sealed envelope is opened and the earnings are determined. Participants are paid according to their decisions in two randomly determined periods (possibly different) in part 1 (one WTA and one WTP game), the accuracy of their expectations in one randomly determined period in part 1 (games), and their decisions in two randomly determined periods in part 2 (one WTA and one WTP lotteries).

To calculate the earnings for the selected period of part 1, we first compare the value reported by the participant with the random bid in the envelope. The game is played out when the participant had the right to play the game (WTA case) and did not sell that right because the random bid was lower than his reported value, or, when the participant did not have the right to play the game (WTP case) and did buy that right because the random bid was lower than his reported value. In this case the participant is paired with a randomly selected participant, who also did not sell or did buy the right to play the game. The actual choices of each pair together determine their final payoff.[14] When the participant did sell the right to play game (WTA case) the participant receives the amount of the random bid. A participant who did not buy the right to play the game (WTP case) will not play the game and did not receive or pay any money. A similar procedure is used for part 2, only now no coupling is needed. Finally, participants filled in a short questionnaire (gender, age, field of study) before getting paid and leaving the lab. The experiment was run in the CREED laboratory of the University of Amsterdam and 116 participants (47% male and 53% female, 69% were students of economics or business and the remainder were mostly students in other social sciences) earned on average 22.50 euros (including a show-up fee of 7 euros) in about 1.5 hours.

[14] It might be the case that we end up with an odd number of participants who have the right to play. In this case, to avoid having problems with forming groups of two, we have randomly selected one participant (the identity of which is not known to anybody) at the beginning of the experiment, who may not play according to her/his preferences. If the randomly selected participant has the right to play the game, then s/he will not play the game. If the randomly selected participant does not have the right to play the game, then s/he will play the game (and their choices in the respective game will determine their payoff). Note that, in a session of 20 participants, the probability of being this randomly selected participant is very low (about 2.5%, because in about half of the cases the number of participants who have the right to play will be odd, and there is a 5% probability to be the randomly selected participant). In our experiment, the sessions' size varied between 18 and 20 participants, and therefore the probabilities of being randomly selected were very similar across sessions.

3. Results

The data of two participants are excluded from the analyses because they obviously did not take the task seriously: one participant filled in 8 euros for all WTA and WTP questions and another participant filled in only amounts between 0 and 1 euro for all WTP and WTA questions. Due to a minor technical problem we missed the data of one decision in part 1 and 3 decisions in part 2 of the first session. The WTP games and lotteries are constructed by adding or subtracting one euro from the corresponding WTA game or lottery (see design section); for the analyses we respectively subtracted and added 1 euro to the WTP values, to make WTA and WTP values easily comparable.

The first question to be answered is whether there is an endowment effect in games. Table 2 shows the mean, median and standard deviation of the WTA and WTP valuation per game. In 9 out of 10 games, the average WTA is larger than the WTP and this difference is statistically significant in 7 games. In 3 games, we find no significant WTA-WTP differences. Recall that we employ a within-subject design for each game, and every pair of observations can be classified as either EE (WTA>WTP), anti-EE (WTA<WTP) and no-EE (WTA=WTP). Overall we find the endowment effect in about 63%, anti-endowment effect in 26%, and exactly the same valuations (no-EE) in 11% of the cases. Game 2 is the only game with a tendency against the endowment effect (although the effect is not statistically significant), but we can see no clear explanation for this: it is a chicken game but so is game 7, which shows a clear EE. The average gap between WTP and WTA is 84 cents.

Table 2. Descriptive statistics for WTA-WTP valuations for each game

	WTA valuation			WTP valuation			p-value	Frequencies			n
	Mean	Median	Std. dev.	Mean	Median	Std. dev.		EE	No EE	Anti EE	
1 Coord.	4.41	4	1.58	2.52	2.1	1.59	0.000	92	13	9	114
2 Chicken	3.83	3.75	1.40	4.13	3.5	1.81	0.258	45	14	54	113
3 Stag Hunt	4.95	5	1.19	4.30	4	1.59	0.000	74	13	27	114
4 Coord.	4.03	4	1.80	3.05	3	1.91	0.000	79	7	28	114
5 PD	5.28	5.5	1.45	3.52	3.5	1.67	0.000	89	9	16	114
6 Coord.	4.22	4	1.83	4.08	4	2.15	0.327	55	13	46	114
7 Chicken	5.40	6	1.68	4.63	4.5	1.96	0.000	70	11	33	114
8 Stag Hunt	3.47	3.9	1.73	2.81	3	1.85	0.000	69	18	27	114
9 Coord.	3.56	3	1.82	1.91	1.5	1.95	0.000	90	10	14	114
10 PD	4.76	5	1.87	4.56	4	1.90	0.253	54	17	43	114

Note: p-values are based upon a Wilcoxon signed rank test (2-sided)

We summarise the first result:

Result 1: *The endowment effect is observed in most games and for the majority of subjects.*

The next question is whether we find an endowment effect in lotteries as well. We have to distinguish between two kinds of lotteries, the fixed and subjective ones. The probabilities in the fixed lotteries are based upon the mixed Nash equilibrium and are thus the same for everyone. The subjective lotteries are based upon the beliefs in the game as reported by that specific participant and these will thus differ between participants.

Table 3 shows the average WTA and WTP values of the fixed lotteries. Note that we have no fixed lotteries associated with game 5 and 10 because the prisoner's dilemma games do not have a mixed Nash equilibrium. We find a remarkably strong endowment effect: the WTA values are statistically significantly larger than the WTP values in all 15 lotteries.

Table 3. Descriptive statistics for WTA-WTP valuations for each fixed lottery

Related Game	Periods WTA-WTP	Option A	Option B	Prob. A	Prob. B	Exp. value	WTA offer			WTP offer				Frequencies		
							Mean	Median	Std. dev.	Mean	Median	Std. dev.	p-value	EE	No EE	Anti EE
1A	5-28	2	4	50	50	3	3.02	3	1.00	2.39	2.5	0.89	0.000	71	28	15
1B	37-50	6	0	50	50	3	3.11	3	1.28	1.79	2	1.34	0.000	83	16	15
2A	29-10	4	2	50	50	3	2.99	3	0.89	2.60	2.5	0.83	0.000	65	26	22
2B	45-38	5	1	50	50	3	2.92	3	1.07	2.64	2.78	0.91	0.025	56	23	35
3A	1-16	5	1	60	40	3.4	3.49	3.4	1.33	2.87	3	1.03	0.000	72	18	24
3B	11-44	3	4	60	40	3.4	3.43	3.4	0.93	3.06	3	0.58	0.000	63	27	24
4AB	15-30	7	0	50	50	3.5	3.40	3.5	1.33	2.26	2.05	1.57	0.000	79	18	17
6A	23-54	2	6	50	50	4	3.83	4	1.17	3.12	3	0.94	0.000	67	23	23
6B	33-46	10	-2	50	50	4	3.67	4	1.92	3.07	3	1.49	0.001	60	19	35
7A	17-2	6	3	30	70	3.9	3.87	4	0.99	3.30	3.23	0.86	0.000	71	24	19
7B	41-24	13	0	30	70	3.9	4.42	4	1.76	3.45	3	1.84	0.000	70	16	28
8A	3-18	4	-4	60	40	0.8	1.93	2	1.58	0.25	0	1.06	0.000	96	11	7
8B	25-34	0	2	60	40	0.8	1.37	1	1.15	0.50	0.5	0.75	0.000	84	20	10
9A	19-4	0	3	30	70	2.1	2.21	2	0.98	1.79	1.63	1.29	0.000	64	28	22
9B	35-14	7	0	30	70	2.1	2.72	2.5	1.47	1.24	1	1.16	0.000	85	15	14

Notes: p-values are based upon a Wilcoxon signed rank test (2-sided). The number of observations is 114 for each lottery, except for two lotteries with one missing value (periods 23 and 29).

Table 4. Descriptive statistics for WTA-WTP valuations for each subjective lottery

Related Game	Periods WTA-WTP	Option A	Option B	WTA-WTP gap		p-value	Frequencies		
				Mean	Std. dev.		EE	No EE	Anti EE
3A	39-6	5	1	0.02	1.50	0.206	56	20	38
3B	51-22	3	4	0.37	1.03	0.000	69	30	15
5A	21-40	6	0	1.38	1.66	0.000	79	24	10
5B	31-52	7	3	0.93	1.45	0.000	71	26	17
7A	47-32	6	3	0.54	1.36	0.000	70	24	20
7B	7-12	13	0	0.90	2.09	0.000	65	15	34
8A	53-42	4	-4	1.09	1.49	0.000	79	30	5
8B	13-8	0	2	0.73	1.57	0.000	81	27	6
9A	43-26	0	3	0.89	1.05	0.000	82	21	10
9B	9-48	7	0	1.52	1.83	0.000	84	17	13
10A	27-20	7	-3	0.17	1.64	0.951	46	16	52
10B	49-36	9	3	0.86	1.76	0.000	72	17	25

Note: p-values are based upon a Wilcoxon signed rank test (2-sided). The number of observations is 114 for each lottery, except for two lotteries with one missing value (period 21 and 43).

The subjective lotteries are based upon the beliefs of the participant in the related game in part 1. A participant reports beliefs both in the WTA and WTP version of a game and for the probability in the lottery we use the average of these two beliefs. Table 4 shows a statistically significant endowment effect in 10 out of the 12 subjective lotteries[15].

Result 2: *The endowment effect is observed both for the fixed and the subjective lotteries.*

We next focus on whether the endowment effect is larger or smaller in games compared with lotteries. Per individual we calculate the average difference between the WTA and WTP values for games, fixed lotteries and subjective lotteries. For 74 (72) of the 114 subjects this gap is larger for games than for fixed (subjective) lotteries. Across all 114 subjects, the average size of the gap is 84 cents for games, 80 and 79 cents for fixed and subjective lotteries respectively and this difference between games and lotteries is statistically significant (Wilcoxon test, p=0.048 for fixed and p=0.034 for subjective lotteries). The difference in the WTA-WTP gap between fixed and subjective lotteries is not statistically significant (p=0.794). Note that the smaller endowment effect in lotteries cannot be caused by learning because the participants did not receive any feedback on their choices until the end of the experiment.

[15] In appendix C we present the analyses of table 2, 3 and 4 with a selective group of participants who make no or only few mistakes which are defined as those bids which are dominated (defined as a WTA (or a WTP) bid which is higher than the maximum payoff and lower than the minimum payoff in that game (for a given action) or lottery). The results are the same for this selective group.

A second way to compare the endowment effect in games and lotteries is to compare the decisions in a given game with the decisions in the related subjective lottery. Note that when a participant has the same beliefs in the WTA and WTP game, and chooses the same action, the game is equivalent to the lottery with the only difference that the probabilities in the lottery are given (objective) while the probabilities in the game are subjective (assuming no social preferences). The beliefs about the actions of others in a game are measured in increments of 10%, and when the beliefs in the WTA and WTP game differ only by 10% or less (for example 30% and 40%, respectively) we can consider both beliefs as being equivalent to the average (35% in the example). However, when the beliefs differ more than 10%, we cannot relate the lottery with the game anymore. Table 5 shows the comparison between the endowment effect in games and the related subjective lotteries, for the cases with the same actions and about the same beliefs in the WTA and WTP games (54% of all cases). Comparing the games/actions with the lotteries we find equally often the larger effect in the game than in the lottery, but in many rows there are only few observations and thus low statistical power. Most of the significant differences (3-A, 3-B, 5-A and 7A) are all in the direction of a larger effect in games than in lotteries, and also overall we find that the gap is larger in games than in lotteries (average of 87 versus 70 cents)[16].

> **Result 3:** *The average size of the endowment effect is statistically significantly larger in the games than in the lotteries.*

We find a significant endowment effect for 7 of the 10 games (see table 2) and for 25 of the 27 lotteries (see tables 3 and 4), which suggests that the endowment effect is about equally robust both for games and lotteries (the proportions 7/10 and 25/27 are not statistically significant different, Fischer exact test p=0.11).

Table 5 also shows that the valuations of the games are typically higher than those of the corresponding lotteries. Although ambiguity aversion combined with the strategic uncertainty of a game should lead to a lower valuation of the games, our participants apparently liked playing in a game better than a lottery[17].

The next question is whether being susceptible to the endowment effect is an individual-specific characteristic. Two measures can be employed: the number of times a participant shows the endowment effect in games and in fixed lotteries, and the average individual size of the effect. Figure 2 shows a bubble graph and shows that typically the same participants display an endowment effect in games and fixed lotteries. The Spearman's rank correlations between the average individual size of the gap in games and lotteries are 0.590 (fixed) and 0.548 (subjective). Unsurprisingly, the gaps in the two kinds of lotteries are even more highly correlated: 0.772.

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[16] We have rerun the analysis with also the cases included where the actions in the WTA and WTP game are different (which could be caused by a mixed strategy) and we find very much the same results.

[17] We cannot rule out an order effect; the lotteries part of the experiment is always and necessarily after the games part, because we needed the beliefs in the games part to construct the subjective lotteries.

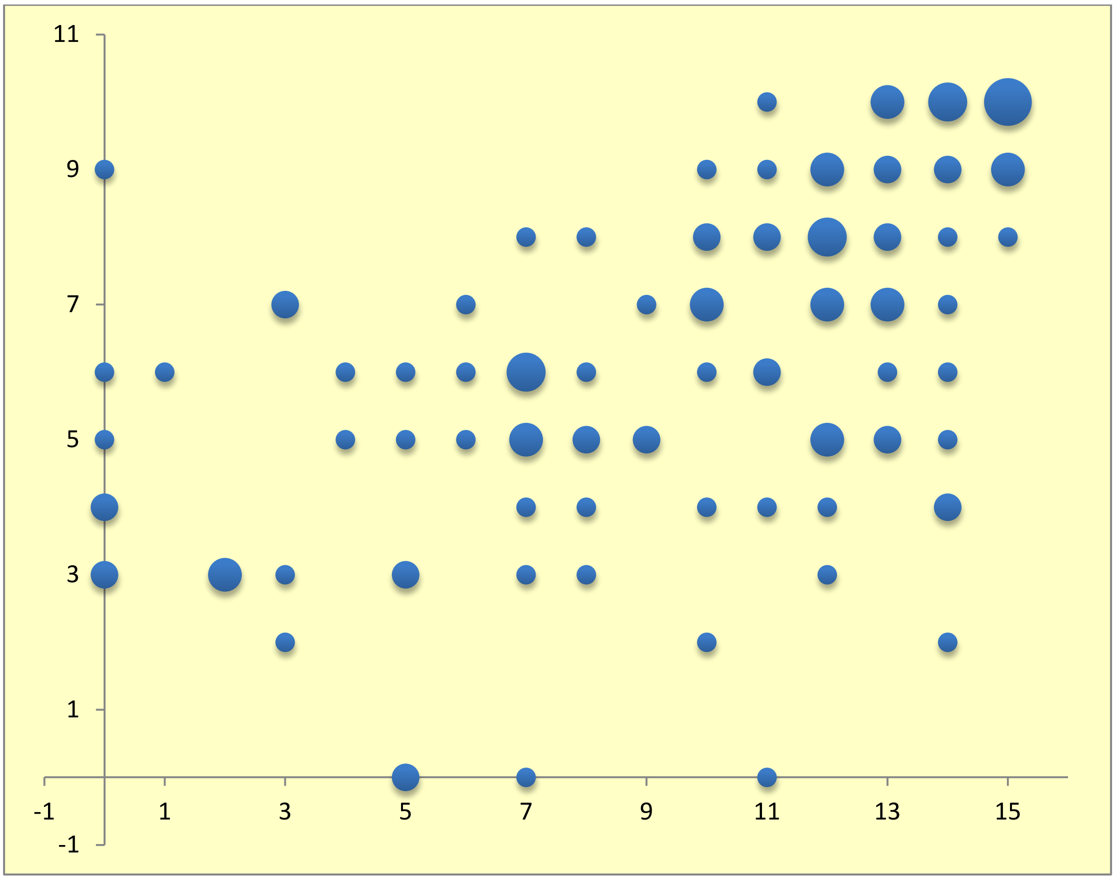
Result 4: *Participants who are prone to the endowment effect in lotteries are more likely to be prone to the endowment effect in games.*

Table 5: The size of the endowment effect compared in subjective lotteries and games

Game	Choice in the WTA and the WTP game is:	WTA-WTP Gap Games	WTA-WTP Gap Subj. Lottery	N	p-value
3	A	0.67	-0.08	59	0.004
Stag Hunt		(1.57)	(1.80)		
	B	1.19	0.34	9	0.075
		(1.01)	(0.86)		
5	A	1.84	1.24	35	0.038
PDG		(2.13)	(1.82)		
	B	1.62	1.23	22	0.211
		(2.11)	(1.38)		
7	A	1.13	0.30	26	0.067
Coord.		(2.50)	(1.54)		
	B	0.28	0.81	26	0.268
		(1.98)	(2.26)		
8	A	0.79	0.85	65	0.562
Stag Hunt		(1.55)	(1.55)		
	B	0.46	0.73	13	0.944
		(1.99)	(0.71)		
9	A	0.46	1.19	7	0.931
Coord.		(1.88)	(1.51)		
	B	1.61	1.18	39	0.211
		(2.73)	(1.95)		
10	A	0.28	0.27	30	0.934
PDG		(2.65)	(1.66)		
	B	0.05	0.86	38	0.053
		(2.17)	(1.60)		
Total		0.87	0.70	369	0.032
		(2.12)	(1.73)		

Notes: Only the cases where the actions in the WTA and WTP game are the same and the beliefs in the two games differ at most 10% are considered. Standard deviations are reported in parentheses. In the last column, we report the two-sided p-value from a Wilcoxon sign rank test for the comparison of the WTA-WTP gaps in the games and lotteries.

Figure 2: The Endowment effect in games and fixed lotteries.



Notes: For each individual we compare the number of EE cases in the fixed lotteries (horizontal axis) and games (vertical axis). The smallest bubble stands for one observation, the largest (top-right) for 6 observations.

Additional analyses

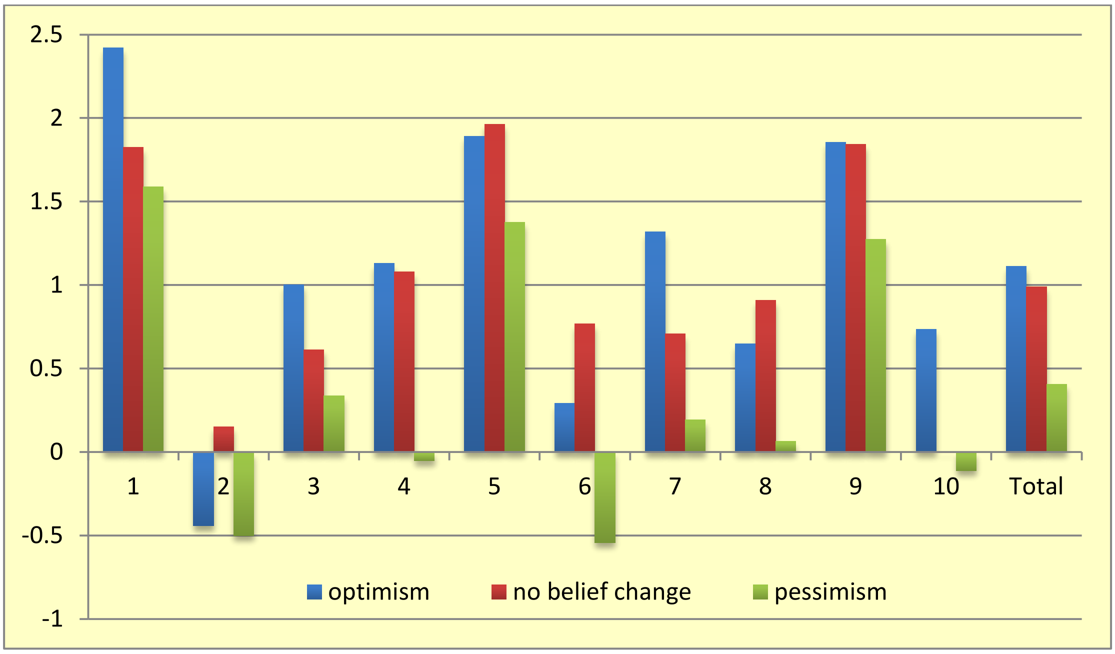
If the endowment effect is (partly) caused by optimism, the subjective expected value (based upon the decision and the subjective beliefs of the participant) of a WTA-game should be larger than the respective value of the corresponding WTP-game.[18] Likewise, we categorize cases as pessimistic when the subjective expected value in the WTA game is lower than this value in the corresponding WTP-game. Figure 3 compares the WTA-WTP gap for optimistic and pessimistic cases and the cases where the beliefs in the WTA and WTP periods are the same[19]. Over all games we find that the WTA-WTP gap is larger in optimistic cases (110.3 cent) than in pessimistic cases (39.8 cents, Wilcoxon test p=0.0000) and larger in no belief change cases (102.7 cents) than in pessimistic cases (Wilcoxon test p=0.0005).

[18] As an example, the subjective expected value of WTA game 1 of a participant who has chosen action A is computed by the sum of i) the number of participants that a subject believes have chosen action A divided by 10 and multiplied by 2 (the A-A payoff) and ii) the number of participants that a subject believes have chosen action B divided by 10 and multiplied by 4 (the A-B payoff).
[19] Note that some of the “no change in beliefs” cases may in fact be optimistic or pessimistic cases, but with a change too small to be picked up with our measurement (for example when beliefs are 46% and 54% of a A-choice the participant will report 50% in both cases).

The difference between optimistic and no belief changes is not statistically significant (Wilcoxon test p=0.1431). These tests are relatively crude because the extent of optimism and pessimism is not taken into account. Figure 3 suggests that the endowment effect is not particularly increased by optimism (as we expected) but decreased by pessimism.

Note that a difference in subjective expected value between WTA and WTP can be caused by a change in beliefs and/or a change in the action chosen in the game. In case of a change in beliefs but no change in action the average WTA-WTP gap is 1.00 in optimistic cases (N=238) and 0.37 in pessimistic cases (N=265). The effect is larger when both the beliefs and the action change: the average WTA-WTP gap is in optimistic cases 1.40 (N=91) and in pessimistic cases 0.5 (N=108). Finally there are some cases with no (reported) change in beliefs but a change in action. In the majority of these cases (44 of the 74) the beliefs are according to the mixed equilibrium and the subjective expected value is the same for WTA and WTP; in addition we have only 20 optimistic cases (gap is 0.92) and 10 pessimistic cases (gap=0.09).

Figure 3: WTA-WTP gap per game for optimistic, pessimistic and no changes in beliefs cases.



Note: There are 2 cases that do not fit in any of these categories, where there are different beliefs in WTA and WTP, but also the action changed such that the subjective expected value stayed exactly the same.

Table 6 displays OLS regressions; the dependent variable is always the WTA-WTP gap in games. In the first column we find a significant contribution of optimism as defined by the difference in the subjective expected value of a WTA and WTP game. In the second column a dummy variable representing the gender of the participant is added (1 if female and 0 if male), with an interaction effect with optimism (as separate regressor). We find that females display on average a smaller endowment effect. This is surprising, because the literature generally assumes that the endowment effect is caused by loss aversion, and numerous studies have shown that on average females are more loss averse than males (e.g. Schmidt and Traub 2002, Booij and van de Kuilen 2009). The interaction effect is not significant, so optimism seems to have the same effect on both sexes. In the third column the individual average endowment effect in lotteries is added to the equation. As expected from result 4 above, this effect is highly significant. The coefficients of the optimism and gender are similar across the three regression models. In the fourth column we add an interaction term of optimism and the endowment effect in lotteries. This interaction effect is positive, and the coefficient of optimism becomes insignificant. This means that optimism mainly explains the endowment effect in games of those individuals that are more susceptible to the endowment effect in lotteries, as measured in part 2.

Although the effect of optimism is a new and interesting finding, it cannot be the only cause of the endowment effect for two reasons. First, in the cases where there is no difference in beliefs, we still find a large average WTA-WTP gap of 98.91 cents. Second, the endowment effect is also often observed in familiar consumption goods that are in essence riskless, in which case optimism and pessimism cannot play a role.

> **Result 5:** *Optimism can partly explain the endowment effect in games. The size of the endowment effect is positively correlated with the size of optimism, especially for participants who show a large EE in the lotteries.*

Table 6: Regressions of the size of the endowment effect in games

	Dependent variable: size of the endowment effect			
	(1)	(2)	(3)	(4)
Optimism	0.186 ***	0.196 ***	0.180 ***	0.047
	(0.064)	(0.061)	(0.059)	(0.079)
Female		-0.654 **	-0.696 ***	-0.690 ***
		(0.256)	(0.223)	(0.221)
EE-lotteries			0.743 ***	0.737 ***
			(0.161)	(0.158)
Female * Optimism		-0.018	-0.000	0.048
		(0.125)	(0.118)	(0.111)
EE-lotteries * Optimism				0.155 ***
				(0.055)
Constant	0.835 ***	1.179 ***	0.603 ***	0.602 ***
	(0.134)	(0.147)	(0.162)	(0.161)
Observations	1139	1139	1139	1139

Notes. This table displays the results of four OLS regressions. The dependent variable is the size of the endowment effect in each game: the WTA-WTP. In column 1 optimism is the independent variable, in column 2 gender and an interaction effect gender*optimism is added, and in columns 3 and 4 the average individual endowment effect in lotteries and interaction effect with optimism are added. Optimism is the subjective expected value (based upon the decision and the subjective beliefs of the participant) of a WTA-game minus the subjective expected value of the corresponding WTP-game. EE-lotteries is the average size of the endowment effect in the fixed lotteries, per individual. The numbers in parentheses are standard errors. Standard errors are clustered on individuals.
*** (**) denotes significance at the 0.01 (0.05) level.

4. Conclusion

The presence of the endowment effect has been studied in relation to individual decision making in hundreds of experiments since the eighties (starting with Thaler 1980). In this paper we report an experimental study about the endowment effect in a strategic context: participants have either the right to play a game and are asked for their WTA, or they do not have the right to play and are asked for their WTP. In line with Isoni et al (2011) we use the Becker-deGroot-Marschak procedure and a within-subject design. We also elicit the beliefs about the play of others, and the participant's action in case he keeps or buys the right to play. In the second part of the experiment the endowment effect is measured with lotteries that are related to the games of the first part.

To summarize our results: We find a strong endowment effect in most of the games we study (result 1). The second part of the experiment replicates the findings of Isoni et al. (2011): we find a strong endowment effect in lotteries (result 2). Interestingly, we find that the endowment effect is stronger in games than in lotteries (result 3). There also exists a significant correlation between the average individual endowment effect in games and lotteries (result 4). And finally, we observe that optimism can partly explain the endowment effect in games (result 5).

Originally, the endowment effect was attributed only to loss aversion (Thaler 1980, Kahneman et al. 1991). Loss aversion is an essential part of Prospect Theory and the endowment effect can be considered as an illustration of loss aversion in a situation without risk (Kahneman et al. 1991). Other explanations are confusion and misunderstanding (see the experiments by Plott and Zeiler 2005, disputed by Bartling et al. 2015, and Fehr et al. 2015); decision makers may use bargaining heuristics that are reasonable outside the laboratory (and according to Huck et al. 2005 may enhance evolutionary fitness) but are inappropriate in the experimental situation; and "bad deal" aversion. Decision makers may compare the price with some reference price, and selling for a lower (or buying for a higher) price than the reference price may be considered a bad deal. If decision makers use an unprecise (interval) valuation of the good (e.g., Butler and Loomes 2007, Isoni et al., 2016), and they want to prevent a "bad deal", they will ask (bid) a price at the high (low) end of the interval. Bad deal aversion predicts a larger WTA-WTP gap when the uncertainty about the subjective value is larger. In games there is strategic uncertainty, which makes it harder to establish a subjective utility, compared with lotteries that have only explicit risk. So the finding of a larger average WTA-WTP gap in games is in line with the bad-deal aversion hypothesis. Our results are less in line with the loss aversion interpretation: if the WTA-WTP gap is interpreted as caused only by loss-aversion, the average loss-aversion parameter[20] in

[20] If v is the value of the good, and λ the loss aversion parameter, WTA=λ v (because v is lost and the WTA prize is gained) and λ WTP=v (the amount WTP is lost and the good is gained), which can be rewritten as λ =WTA/v and λ =v/WTP, multiplying these two equations gives λ^2=WTA/WTP and λ= $(\text{WTA/WTP})^{0.5}$

our study is in the range of 1.15-1.20, which is much lower than the approximately 2 often found in Prospect Theory studies.

In this paper we also study another explanation for the endowment effect: optimism. An optimist will estimate the potential value of a good he owns higher than that of a good he does not own. Since beliefs are measured, we can measure the optimism of the decision maker, which we define as the difference of the subjective expected value of the game when the right to play is owned minus the subjective value when this right is not owned. We find a positive relation between optimism and the endowment effect. Although there are many studies on the effect of optimism (and overconfidence) on human decision-making (e.g. Camerer and Lovallo 1999, Malmendier and Tate 2008), never before (to our knowledge) has a link been made with the endowment effect. However, optimism cannot be the main driver of the WTA-WTP gap, because we also find a significant effect in the cases where the beliefs in WTA and WTP cases are the same. Of course, human behavior is multi-determined and these explanations are not exclusive. Each explanation may play a smaller or larger role, depending on the circumstances and individual differences.

Although many studies on the endowment effect already exist, we believe that there are promising directions for future research. First, the endowment effect can be studied in situations that are more social and less anonymous than the present study. If the endowment effect is (irrational) heuristic behavior, we would expect the effect to decrease, in line with studies that find smaller anomalies when decision makers have to justify their actions to others (Lerner and Tetlock 1999). However, if the effect were caused by real different subjective valuations, we would expect no decrease. Second, it would be interesting to relate the endowment effect with stable personality traits like overconfidence and other empirical measures of optimism.

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Appendix 1A: Instructions

Instructions

The experiment consists of two parts. Part 2 will be explained after we have finished Part 1.

The instructions are simple, and if you follow them carefully and make good decisions, you might earn a considerable amount of money. Your earnings will depend on your decisions and may depend on other participants' decisions. You will be paid in private and in cash at the end of the experiment. At the beginning of this experiment, you will receive a show-up fee of 7 euros.

Your decisions in the experiment are private to you. We ask that you do not communicate with other people during the experiment. Please refrain from verbally reacting to events that occur during the experiment. If you have any questions, or need assistance of any kind, please raise your hand and an experimenter will come to you. If you talk, laugh, exclaim out loud, etc., you will be asked to leave and you will not be paid. We expect and appreciate your following of these rules.

In this experiment you will be asked to buy or sell a certain item. We will first explain the buying task and we will then proceed to the selling task.

Buying task

The buying task works as follows. The experimenter will offer an item for sale. Your task is to make an offer for the item.

As you will see, your best strategy is to determine the maximum you would be willing to pay for the item and offer that amount. It will not be to your advantage to offer more than this amount, and it will not be to your advantage to offer less. Simply determine the maximum you would be willing to pay and make that amount your offer.

Your offer will be compared to a fixed offer. The fixed offer will be completely unrelated to your offer and to the offers of all other persons in the room.

If your offer is more than or the same as the fixed offer, then you buy the item. You had the high offer, so you are the buyer. But, here's the interesting part:
You do not pay the amount you offered. Instead, you pay the fixed offer, an amount equal to or less than your offer.

> Example: if you offer 1,000 and the fixed offer is 950, you have the high offer. You buy the item and pay only 950.
> If your offer is less than the fixed offer then you do not buy the item. Instead, you keep your money.
>
> Example: if you offer 1,000 and the fixed offer is 1,020, you do not have the high offer. Therefore, you do not buy the item. You keep your money.

As a buyer, **you should offer exactly the maximum amount you would be willing to pay** in exchange for the item being sold.
Your best strategy is to determine your personal value for the item and record that value as your offer. There is not necessarily a "correct" value. Personal values can differ from individual to individual.

The following example illustrates how you work out what's the maximum you are willing to pay.

> Imagine that I am a buyer and Item A is up for sale. How do I know what amount is the maximum I'd be willing to pay for Item A? Start with 1 cent. Would I be willing to pay 1 cent for the item? If so, then increase the amount to 2 cent. If I'm willing to pay 2 cent, then increase further. I keep increasing until I come to an amount that makes me indifferent between keeping the money and getting Item A.
>
> Example: would I pay €1 for A? Yes. Would I pay €2 for A? Yes. Would I pay €5 for A? Yes. Would I pay €6 for A? No, not €6. So I need to decrease. Would I pay €5.50? No, not that

much. How about €5.25? I don't care whether I end up with €5.25 or the item. Then that is the maximum I'd be willing to pay for Item A.

The key to determining the maximum you'd be willing to pay is remembering that you will not pay the amount you bid. Instead, if you pay anything, you will pay the fixed *offer*.

Why is my best strategy to bid the maximum I'd be willing to pay? Let's go back to the example:

> Say that I decide that the maximum I'd be willing to pay for Item A is €5.25.
>
> What happens if I bid less than €5.25? Say I bid €5.
> If the fixed offer is, say, €5.10, then I don't get the item. Had I bid €5.25, I would have received the item and had to pay only €5.10 for an item that I think is worth €5.25. I lose out.
>
> What happens if I bid higher than €5.25? Say I bid €5.50.
> If the fixed offer is €5.45, then I have to pay €5.45 for an item that I really think is worth only €5.25. I lose out.

Selling task

The selling task works as follows. The experimenter wishes to buy an item that you own. Your task is to make an offer for the item.

As you will see, your best strategy is to determine the minimum you would be willing to accept and offer that amount. It will not be to your advantage to offer more than this amount, and it will not be to your advantage to offer less. Simply determine the minimum you would be willing to accept and make that amount your offer.

Your offer will be compared to a fixed offer. The fixed offer will be completely unrelated to your offer and to the offers of all other persons in the room.

If your offer is less than or the same as the fixed offer, then you sell the item. You had the low offer, so you are the seller. But, here's the interesting part. You do not receive your offer. Instead, you receive the fixed offer, a price equal to or higher than your offer.

> Example: if you offer 1,000 and the fixed offer is 1,020, you have the low offer. You sell the item and you receive the fixed offer of 1,020.
> If your offer is more than the fixed offer then you do not sell your item. You keep the item.
>
> Example: if you offer 1,000 and the fixed offer is 950, you do not have the low offer. Therefore, you do not sell the item.

As a seller, **you should offer the minimum amount you would be willing to accept** in exchange for the item you own.
Just as you saw in the case of the buying task, your best strategy is to determine your personal value for the item and record that value as your offer. There is not necessarily a "correct" value. Personal values can differ from individual to individual.

The following example illustrates how you work out what's the minimum you are willing to accept.

> Imagine that I am a seller and I own Item B. How do I know what amount is the minimum I'd be willing to accept to give up Item B? Start with €100. Would I be willing to give up item B in exchange for €100? If so, then decrease the amount to €95. If I'm willing to accept €95 to give up Item B, then decrease further. I keep decreasing until I come to an amount that makes me indifferent between keeping Item B and getting the money.
>
> Example. Would I accept €10 to give up Item B? Yes. Would I accept €8 for B? Yes. Would I accept €7 for B? Yes. Would I accept €6 for B? No, not €6. So I need to increase. Would I accept €6.50? I don't care whether I end up with €6.50 or Item B. Then that is the minimum I'd be willing to accept for Item B. I'll record that number on my computer.

The key to determining the minimum you'd be willing to accept is remembering that you will not receive the amount you ask for. Instead, if you receive anything, you will always get the fixed offer.

Why is my best strategy to bid the minimum I'd be willing to accept? Let's go back to the example:

Say I decide that the minimum I'd be willing to accept for Item B is €6.50.
What happens if I ask for less than €6.50? Say I ask for only €6.
If the fixed offer is, say, €6.25, then I have to sell my item. I lose out because I have to give up Item B which I think is worth €6.50, but I only get €6.25 in exchange.

What happens if I ask for more than €6.50? Say I ask for €7.
If the fixed offer is €6.75, then I do not sell. But, had I bid €6.50, I would have sold the item and received €6.75 for an item that I think is worth only €6.50. I lose out.

Offers in the buying or selling task

Offers in the buying and selling task are previously generated and are between 0.00 and 8.00 euro (all numbers are equally likely). In order to assure you that the fixed offers are completely unrelated to your offers or your personal value of the item, they were randomly generated before the start of the experiment. The offers are printed, put in a closed envelope and attached to the whiteboard. If you like, you can after the experiment check that the envelope contains indeed the offers used to determine you earnings. In the envelope, there are also the randomly determined periods that will be paid.

The item you buy or sell is the right to play a game

We didn't tell you yet what the item is that you will buy or sell. In the first part of the experiment this item will be **the right to play a game**.

At the beginning of a period you will see a two person game, similar to the one displayed below. In some periods you will have the right to play this game and we will ask you the minimum amount you are willing to accept to sell this right to the experimenter. In other periods you will not have the right to play this game and we will ask you the maximum amount you are willing to pay to purchase this right.

	A	B
◯A	4,4	1,0
◯B	0,1	12,12

This is only an illustration of the kind of game you will find in the experiment; we will not use a game with these exact numbers in the experiment itself.
The first column in the table displays your options (A and B) and the first row of the table displays the options of the other player (also A and B). The other cells in the table display the payoff for each of the players for that combination of choices. Your payoffs (first number in each cell) are printed in red and the payoffs of the other player (second number in each cell) in blue. For example, if you choose A and the other player chooses B, you will earn 1 euro and the other player will earn 0 euros, and if both players choose A, each player will earn 4 euros. Note that the numbers indicated in each cell will always correspond to Euro amounts.

What action do you choose?

In each game we will ask you what action (A or B) you choose, if you would have the right to play this game. If, at the end of the experiment, that period is (randomly) chosen to paid, we will open an envelope to find the fixed offer and first determine whether you have the right to play the game. If you have this right (either because you had the right to start with and didn't sell it, or because you purchased that right), you payoff will be determined by the action you have chosen and the action of another player in this room you will be coupled with.

What action do you expect others to choose?

In addition we are interested in your expectations about the behaviour of other players in this game. In each period we ask you how many out of 10 randomly drawn participants in this room will have chosen A and B. You will fill in these expectations in the cells below the table of the game.

You can earn money by predicting well. At the end of the experiment we will randomly choose one period and compare your expectation with the actual choices of 10 other participants. Your earnings are the number of correct predictions you made, times 50 cents. For example, if you reported that 7 participants would choose A and 3 participants would choose B and we find that in fact 4 participants have chosen A and 6 participants have chosen B, you correctly guessed 4 A-choices and 3 B-choices and you will earn 7*50 cents is 3.50 euros.

Of course, the sum of your predictions for A and B choices have to add up to 10.

Procedure per period

In each period you have to

1. Choose an action A or B;
2. Predict how many of 10 others in this room will choose A and B;
3. formulate an offer for which you are
    - willing to sell the right to play this game (in periods you have this right)
    - willing to pay for the right to play this game (in periods you don't have this right)

Part 1 earnings

You will be informed about your earnings from Part 1 after the last period of the second part of the experiment. For Part 1, you will be paid the results of:

1. <u>one period of the first part in which you did have the right to play</u>
2. The fixed offer for this period is determined randomly before the experiment started (see previous page). Now there are two possible cases:
    - Your asking price was lower than the fixed offer, you have sold your right and your earnings are equal to the fixed offer.
    - Your asking price was higher than the fixed offer, so you have kept your right to play. The computer will couple you with another participant who also has the right to play and your earnings are determined by your choice and the choice of the participant you are coupled with according to the payoff table of the game.
3. <u>one period of the first part in which you did not have the right to play</u>
4. The fixed offer for this period is determined randomly before the experiment started (see previous page). Now there are two possible cases:
    - Your offer was lower than the fixed offer. This means you will not play the game.
    - Your offer was higher than the fixed offer. This means that you have bought the right to play, and you pay the amount of the fixed offer. The computer will couple you with another participant who also has the right to play and your earnings are determined by your choice and the choice of the participant you are coupled with according to the payoff table of the game.
5. We will <u>for one randomly chosen period determine your prediction earnings</u>. The computer will randomly choose 10 participants (other than you) and compare your predictions with their choices according to the rule explained in the previous screen.

Note that depending on your decisions, you may incur losses. In this case, your show-up fee of 7 euros will be used to cover them. However, you will never end up owing us money.

Complications: odd number of players

You may wonder what happens when we have an odd number of participants with a right to play the game. We solve this problem in the following way. Before the experiment started, we have for each period separately randomly assigned one participant as the "odd player". Nobody will know who this is. If the offers of the participants combined with the offer in the envelop is such that we would have an odd number of players, the outcome for this "odd player" will not be according to his or her preferences. For example, we play out a period in which 11 participants have bought the right to play. If the "odd player" is one of these 11 players he will not buy the right to play the game and thus not play the game. If the "odd player" did not buy the right to play, he has to buy it anyhow for the fixed offer and play the game.

Note that there is a 50% probability that this will happen, and the probability that you will be the "odd player" is only 1 divided by the number of participants in this session. So if we have 20 participants there is a probability of 1/20 * 1/2= 2.5% that your earnings are not determined by your choices, and thus **with 97.5% probability your choices will determine you earnings**. So it is still very important that you make the choices you consider to be best!

Practice Questions

We will now ask you some questions to check your understanding. You can always browse back to previous screens. When you have a question for the experimenter please raise your hand.
Please note that the situations described below are hypothetical. In the experiment, decisions and earnings will depend on the actual choices of the participants.

	A	B
◯A	4,4	1,0
◯B	0,1	12,12

A.
Consider the game displayed above. What will be your earnings when you have chosen B and the other player has chosen A when the game is played?

B.
What will be the earnings of the other player when you have chosen A and the other player has chosen B when the game is played?

C.
You predicted than 3 players will have chosen A and 7 will have chosen B. We find that in fact that 6 players have played A and 4 players B. What are your earnings in euros if this period predictions will be paid?

D.
This period you have the right to play the game. The **minimum amount that you are willing to accept** in exchange for your right to play was 5.25. The fixed offer in the envelope is 6.

- O I sell my right for 5.25
- O I sell my right for 6
- O I don't sell my right and play the game

E.
This period you do not have the right to play the game. The **maximum amount you are willing to pay** to buy the right to play this game was 7 and the fixed offer in the envelope is 6.

- O I buy the right to play for 6
- O I buy the right to play for 7

- I don't buy the right to play and I will not play the game

Instructions Part 2

This part of the experiment will consist of 54 periods.

In each period you will be presented with a lottery. Below you see an example of such lottery.

60%	40%
win 5	win 0
1 … 60	61 … 100

This lottery offers a 60% chance of winning 5 euros, and a 40% chance of winning 0 euros.

In some periods you **own the right to play this lottery** and we will ask you for the **minimum amount you are willing to accept** in exchange for your right to play this lottery.

In other periods you **don't own the right to play this lottery**, and we will ask you for the **maximum amount you are willing to pay** to buy the right to play this lottery.

Like in the first part of the experiment, your offer will be compared with a fixed offer that is randomly drawn before the start of the experiment (and is in the envelope on the whiteboard).

At the end of the experiment two periods of part 2 will be played for money: one where you did own the right to play the lottery and one where you didn't have that right.

Appendix 1B: Screenshots

Period 1 of 20

In this period you do have the right to play

	A	B
A	2,2	4,6
B	6,4	0,0

I predict that of the 10 other players

will play A and will play B

You own the right to play this game.

What is the **minimum amount you are willing to accept** in exchange for your right to play this game?

euro

Type an amount between 0.00 and 8.00 euro (don't use a decimal comma but a point).

submit

Period 2 of 20

In this period you do not have the right to play

	A	B
A	3,3	1,4
B	4,1	0,0

I predict that of the 10 other players

will play A and will play B

You don't own the right to play this game.

What is **the maximum amount you are willing to pay** to buy the right to play this game?

euro

Type an amount between 0.00 and 8.00 euro (don't use a decimal comma but a point).

submit

Period 1 of 54

In this period you do have the right to play

60%		40%	
win 5		win 1	
1	60	61	100

This lottery offers a 60% chance of winning 5 euros, and a 40% chance of winning 1 euros.

You own the right to play this lottery.
What is the **minimum amount you are willing to accept** in exchange for your right to play this lottery?

Type a number between 0 and 8, please do not use more than 2 decimals and use a decimal point.

submit

Period 2 of 54

In this period you do not have the right to play

30%		70%	
win 5		win 2	
1	30	31	100

This lottery offers a 30% chance of winning 5 euros, and a 70% chance of winning 2 euros.

You don't own the right to play this lottery.
What is **the maximum amount you are willing to pay** to buy the right to play this lottery?

Type a number between 0 and 8, please do not use more than 2 decimals and use a decimal point.

submit

Appendix 1C: Instructions on handout

Summary of the Instructions

The experiment consists of two parts. Part 2 will be explained after we have finished Part 1.

In this experiment you will be asked to buy or sell a certain item. We will first explain the buying task and we will then proceed to the selling task.

Buying task

The buying task works as follows. The experimenter will offer an item for sale. Your task is to make an offer for the item. As you will see, your best strategy is to determine the maximum you would be willing to pay for the item and offer that amount. It will not be to your advantage to offer more than this amount, and it will not be to your advantage to offer less. Simply determine the maximum you would be willing to pay and make that amount your offer.

Your offer will be compared to a fixed offer. The fixed offer will be completely unrelated to your offer and to the offers of all other persons in the room. If your offer is more than or the same as the fixed offer, then you buy the item. You had the high offer, so you are the buyer. But, here's the interesting part:
You do not pay the amount you offered. Instead, you pay the fixed offer, an amount equal to or less than your offer.

As a buyer, **you should offer exactly the maximum amount you would be willing to pay** in exchange for the item being sold. Your best strategy is to determine your personal value for the item and record that value as your offer. There is not necessarily a "correct" value. Personal values can differ from individual to individual.

The key to determining the maximum you'd be willing to pay is remembering that you will not pay the amount you bid. Instead, if you pay anything, you will pay the fixed *offer*.

Selling task

The selling task works as follows. The experimenter wishes to buy an item that you own. Your task is to make an offer for the item. As you will see, your best strategy is to determine the minimum you would be willing to accept and offer that amount. It will not be to your advantage to offer more than this amount, and it will not be to your advantage to offer less. Simply determine the minimum you would be willing to accept and make that amount your offer.

Your offer will be compared to a fixed offer. The fixed offer will be completely unrelated to your offer and to the offers of all other persons in the room. If your offer is less than or the same as the fixed offer, then you sell the item. You had the low offer, so you are the seller. But, here's the interesting part. **You do not receive your offer.** Instead, you receive the fixed offer, a price equal to or higher than your offer.

As a seller, **you should offer the minimum amount you would be willing to accept** in exchange for the item you own.
Just as you saw in the case of the buying task, your best strategy is to determine your personal value for the item and record that value as your offer. There is not necessarily a "correct" value. Personal values can differ from individual to individual.

The key to determining the minimum you'd be willing to accept is remembering that you will not receive the amount you ask for. Instead, if you receive anything, you will always get the fixed offer.

Offers in the buying or selling task

Offers in the buying and selling task are previously generated and are between 0.00 and 8.00 euro (all numbers are equally likely). In order to assure you that the fixed offers are completely unrelated to your offers or your personal value of the item, they were randomly generated before the start of the experiment. The offers are printed, put in a closed envelope and attached to the whiteboard. If you like, you can after the experiment check that the envelope contains indeed the offers used to determine you earnings. In the envelope, there are also the randomly determined periods that will be paid.

The item you buy or sell is the right to play a game

We didn't tell you yet what the item is that you will buy or sell. In the first part of the experiment this item will be **the right to play a game**.

At the beginning of a period you will see a two person game, similar to the one displayed below. In some periods you will have the right to play this game and we will ask you the minimum amount you are willing to accept to sell this right to the experimenter. In other periods you will not have the right to play this game and we will ask you the maximum amount you are willing to pay to purchase this right.

	A	B
◯A	4,4	1,0
◯B	0,1	12,12

This is only an illustration of the kind of game you will find in the experiment; we will not use a game with these exact numbers in the experiment itself.
The first column in the table displays your options (A and B) and the first row of the table displays the options of the other player (also A and B). The other cells in the table display the payoff for each of the players for that combination of choices. Your payoffs (first number in each cell) are printed in red and the payoffs of the other player (second number in each cell) in blue. For example, if you choose A and the other player chooses B, you will earn 1 euro and the other player will earn 0 euros, and if both players choose A, each player will earn 4 euros. Note that the numbers indicated in each cell will always correspond to Euro amounts.

What action do you choose?

In each game we will ask you what action (A or B) you choose, if you would have the right to play this game. If, at the end of the experiment, that period is (randomly) chosen to paid, we will open an envelop to find the fixed offer and first determine whether you have the right to play the game. If you have this right (either because you had the right to start with and didn't sell it, or because you purchased that right), you payoff will be determined by the action you have chosen and the action of another player in this room you will be coupled with.

What action do you expect others to choose?

In addition we are interested in your expectations about the behaviour of other players in this game. In each period we ask you how many out of 10 randomly drawn participants in this room will have chosen A and B. You will fill in these expectations in the cells below the table of the game.

You can earn money by predicting well. At the end of the experiment we will randomly choose one period and compare your expectation with the actual choices of 10 other participants. Your earnings are the number of correct predictions you made, times 50 cents. For example, if you reported that 7 participants would choose A and 3 participants would choose B and we find that in fact 4 participants have chosen A and 6 participants have chosen B, you correctly guessed 4 A-choices and 3 B-choices and you will earn 7*50 cents is 3.50 euros.

Of course, the sum of your predictions for A and B choices have to add up to 10.

Procedure per period

In each period you have to

4. Choose an action A or B;
5. Predict how many of 10 others in this room will choose A and B;
6. formulate an offer for which you are
    - willing to sell the right to play this game (in periods you have this right)
    - willing to pay for the right to play this game (in periods you don't have this right)

Part 1 earnings

You will be informed about your earnings from Part 1 after the last period of the second part of the experiment. For Part 1, you will be paid the results of:

6. <u>one period of the first part in which you did have the right to play</u>
   The fixed offer for this period is determined randomly before the experiment started (see previous page). Now there are two possible cases:

    - Your asking price was lower than the fixed offer, you have sold your right and your earnings are equal to the fixed offer.
    - Your asking price was higher than the fixed offer, so you have kept your right to play. The computer will couple you with another participant who also has the right to play and your earnings are determined by your choice and the choice of the participant you are coupled with according to the payoff table of the game.
7. <u>one period of the first part in which you did not have the right to play</u>
   The fixed offer for this period is determined randomly before the experiment started (see previous page). Now there are two possible cases:

    - Your offer was lower than the fixed offer. This means you will not play the game.
    - Your offer was higher than the fixed offer. This means that you have bought the right to play, and you pay the amount of the fixed offer. The computer will couple you with another participant who also has the right to play and your earnings are determined by your choice and the choice of the participant you are coupled with according to the payoff table of the game.
8. We will <u>for one randomly chosen period determine your prediction earnings</u>. The computer will randomly choose 10 participants (other than you) and compare your predictions with their choices according to the rule explained in the previous screen.

Note that depending on your decisions, you may incur losses. In this case, your show-up fee of 7 euros will be used to cover them. However, you will never end up owing us money.

Appendix B: Additional tables

Table B-1: List of lotteries used in part 2. In periods where no probabilities for A and B are listed, the probabilities depend on the beliefs of the participant in the related game (subjective lotteries).

Period	WTA or WTP version	Related Game	Option A	Option B	Prob. A	Prob. B
1	WTA	3	5	1	60	40
2	WTP	7	5	2	30	70
3	WTA	8	4	-4	60	40
4	WTP	9	1	4	30	70
5	WTA	1	2	4	50	50
6	WTP	3	4	0		
7	WTA	7	13	0		
8	WTP	8	1	3		
9	WTA	9	7	0		
10	WTP	2	3	1	50	50
11	WTA	3	3	4	60	40
12	WTP	7	12	-1		
13	WTA	8	0	2		
14	WTP	9	8	1	30	70
15	WTA	4	7	0	50	50
16	WTP	3	4	0	60	40
17	WTA	7	6	3	30	70
18	WTP	8	5	-3	60	40
19	WTA	9	0	3	30	70
20	WTP	10	6	-4		
21	WTA	5	6	0		
22	WTP	3	2	3		
23	WTA	6	2	6	50	50
24	WTP	7	12	-1	30	70
25	WTA	8	0	2	60	40
26	WTP	9	1	4		
27	WTA	10	7	-3		
28	WTP	1	3	5	50	50
29	WTA	2	4	2	50	50
30	WTP	4	8	1	50	50
31	WTA	5	7	3		
32	WTP	7	5	2		
33	WTA	6	10	-2	50	50
34	WTP	8	1	3	60	40
35	WTA	9	7	0	30	70
36	WTP	10	8	2		
37	WTA	1	6	0	50	50
38	WTP	2	4	0	50	50
39	WTA	3	5	1		

40	WTP	5	7	1		
41	WTA	7	13	0	30	70
42	WTP	8	5	-3		
43	WTA	9	0	3		
44	WTP	3	2	3	60	40
45	WTA	2	5	1	50	50
46	WTP	6	9	-3	50	50
47	WTA	7	6	3		
48	WTP	9	8	1		
49	WTA	10	9	3		
50	WTP	1	7	1	50	50
51	WTA	3	3	4		
52	WTP	5	8	4		
53	WTA	8	4	-4		
54	WTP	6	1	5	50	50

Table B2: Decisions in the games in the WTA and WTP periods.

	WTP Choice							
			A	B			A	B
WTA Choice	**Game 1 Coord.**	A	51	15	**Game 6 Coord.**	A	52	17
		B	17	31		B	18	27
	Game 2 Chicken	A	76	9	**Game 7 Chicken**	A	40	17
		B	14	14		B	19	38
	Game 3 Stag Hunt	A	81	14	**Game 8 Stag Hunt**	A	76	2
		B	4	15		B	12	24
	Game 4 Coord.	A	18	23	**Game 9 Coord.**	A	12	26
		B	17	56		B	9	67
	Game 5 PDG	A	52	16	**Game 10 PDG**	A	39	11
		B	7	39		B	8	56

Appendix C: Additional tables for participants who made few or no mistakes

We have also analysed a subset of participants who make only few “mistakes”. A “mistake” is defined as a WTA (or a WTP) bid which is higher than the maximum payoff and lower than the minimum payoff in that game (for a given action) or lottery. However, note that some “mistakes” may not be mistakes at all. For example, someone with social preferences can have a value of the game that is lower than the minimum payoff, given his action, just because he doesn’t like to play this game[21]. On the other hand, some participants may have a preference of playing a game that goes above the possible earnings.

The number of participants who make either 0, 1 or 2 dominated bids (out of 10) are 70 in the WTA games and 76 in the WTP games. Out of these, the number of participants who have 0, 1 or 2 dominated bids (out of 20 decisions) in the WTP and WTA games combined, is equal to 50. By just focusing on those 50 participants, we find that their WTA/WTP bids in each game are as follows:

Table C1 (compare with table 2 in the paper) **for selected participants, N=50.** Descriptive statistics for WTA-WTP valuations for each game

	WTA valuation			WTP valuation			p-value	Frequencies		
	Mean	Median	Std. dev.	Mean	Median	Std. dev.		EE	Anti EE	No EE
Game 1	3.65	3.95	1.30	2.21	2	0.92	0.000	38	3	9
Game 2	3.30	3.25	0.93	3.30	3.13	0.91	0.942	20	19	11
Game 3	4.46	5	0.77	3.99	4	0.94	0.002	30	11	9
Game 4	3.54	3.5	1.34	2.5	2.88	1.48	0.000	37	10	3
Game 5	4.78	5	1.09	3.54	3	1.22	0.000	38	5	7
Game 6	3.81	3.88	1.64	3.54	3	1.50	0.131	26	16	8
Game 7	4.95	5	1.39	4.46	4.5	1.54	0.068	30	15	5
Game 8	2.87	3.38	1.37	2.24	2.5	1.47	0.000	29	7	14
Game 9	2.90	3	1.21	1.47	1.05	1.15	0.000	37	7	6
Game 10	4.45	4.63	1.62	4.28	4	1.34	0.587	20	20	10

Note: p-values are based upon a Wilcoxon signed rank test (2-sided)

These results are very much like the original table 2 in the paper, the only difference that the effect in game 7 is now only marginally significant (partly caused by the smaller N).

[21] For example, consider the prisoners’ dilemma WTP game 5 and consider a Fehr-Schmidt social utility function with beta=0.6 (he dislikes the outcome where the other person cooperates and he defects) and alpha=0.8 (he dislikes the other situation where he cooperates and the other player defects even more) and the decision maker expects that 50% of the players will cooperate (choice A). This decision maker will defect (B) because EU(A)=1.2<EU(B)=3.9, but have a valuation (3.9) lower than 4.

We also reanalyzed the fixed lotteries with the 83 participants with 0,1 or 2 mistakes (out of 30 decisions, so in fact this criterion is stricter). We find essentially the same results as in table 3 of the original paper.

Table C2 (compare with table 3 in the paper) **for selected participants N=83** (82 for 2A and 6A)**.** Descriptive statistics for WTA-WTP valuations for each fixed lottery

Related Game	Periods WTA-WTP	Option A	Option B	Prob. A	Prob. B	Exp. value	WTA offer			WTP offer				Frequencies		
							Mean	Median	Std. dev.	Mean	Median	Std. dev.	p-value	EE	Anti EE	No EE
1A	5-28	2	4	50	50	3	2.97	3	0.46	2.57	2.65	0.51	0.000	46	10	27
1B	37-50	6	0	50	50	3	3.15	3	0.93	1.93	2	1.20	0.000	60	8	15
2A	29-10	4	2	50	50	3	3.05	3	0.51	2.65	2.63	0.43	0.000	49	10	24
2B	45-38	5	1	50	50	3	3.04	3	0.74	2.67	2.85	0.71	0.002	43	21	19
3A	1-16	5	1	60	40	3.4	3.34	3.4	0.97	2.86	3	0.76	0.000	51	15	17
3B	11-44	3	4	60	40	3.4	3.41	3.4	0.37	3.18	3.2	0.33	0.000	45	15	23
4AB	15-30	7	0	50	50	3.5	3.36	3.5	0.87	2.31	2.5	1.18	0.000	56	12	15
6A	23-54	2	6	50	50	4	3.94	4	0.76	3.27	3.33	0.79	0.000	48	14	21
6B	33-46	10	-2	50	50	4	3.73	4	1.68	3.17	3	1.39	0.002	44	21	18
7A	17-2	6	3	30	70	3.9	3.96	4	0.57	3.42	3.5	0.57	0.000	51	10	22
7B	41-24	13	0	30	70	3.9	4.46	4	1.51	3.37	3	1.66	0.000	54	16	13
8A	3-18	4	-4	60	40	0.8	1.50	1.5	1.01	0.17	0	0.87	0.000	68	5	10
8B	25-34	0	2	60	40	0.8	1.19	1	0.64	0.52	0.5	0.41	0.000	58	6	19
9A	19-4	0	3	30	70	2.1	2.12	2	0.50	1.63	1.75	0.66	0.000	45	13	25
9B	35-14	7	0	30	70	2.1	2.70	2.5	1.33	1.29	1	0.94	0.000	61	8	14

Note: p-values are based upon a Wilcoxon signed rank test (2-sided).

Table C3 (compare with table 4 in the paper) **for selected participants N=66.** Descriptive statistics for WTA-WTP valuations for each subjective lottery

Related Game	Periods WTA-WTP	Option A	Option B	WTA-WTP gap			p-value	Frequencies		
				Mean	Median	Std. dev.		EE	No EE	Anti EE
3A	39-6	5	1	0.21	0	0.81	0.022	32	18	16
3B	51-22	3	4	0.27	0.05	0.45	0.000	35	26	5
5A	21-40	6	0	1.12	0.65	1.48	0.000	42	19	5
5B	31-52	7	3	0.72	0.5	1.19	0.000	40	19	7
7A	47-32	6	3	0.41	0.5	0.87	0.000	38	19	9
7B	7-12	13	0	0.62	0	1.90	0.028	31	13	22
8A	53-42	4	-4	0.87	0.81	1.02	0.000	42	24	0
8B	13-8	0	2	0.50	0.20	0.85	0.000	41	24	1
9A	43-26	0	3	0.70	0.50	0.94	0.000	44	15	7
9B	9-48	7	0	1.33	1	1.77	0.000	48	13	5
10A	27-20	7	-3	0.19	0	1.64	0.893	25	12	29
10B	49-36	9	3	0.86	0.60	1.26	0.000	40	13	13

Note: p-values are based upon a Wilcoxon signed rank test (2-sided).

In the subjective lotteries 66 participants made 0,1 or 2 mistakes (out of 24 decisions). Again, the results are about the same as in the original table 4, and even somewhat stronger: the endowment effect is statistically significant in 11 of the 12 comparisons (compared with 10 out of 12 in the original table 4).