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**Working Paper**

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*Suggested Citation:* Tontrup, Stephan (2019) : Trading and Attentional Focus – Why we may overestimate the Impact of the Endowment Effect, ZBW - Leibniz Information Centre for Economics, Kiel, Hamburg

This Version is available at:

<https://hdl.handle.net/10419/335549>

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# Trading and Attentional Focus – Why we may overestimate the Impact of the Endowment Effect

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## Abstract

*Most Endowment Effect studies incentivize individuals to reveal their true valuation when selling their entitlement. They provide them with a valuation task. This experimental design focuses sellers' attention on their endowment and can mislead the legal debate by elevating the size of their Endowment Effect. In our study, we present subjects with a trading task placing subjects in a market with incentives for strategic behavior. As typical for real markets, participants can earn more by demanding a sales price beyond their true valuation. We assume that the strategic incentives shift the sellers' attention to the gains from trade and the WTP of potential buyers. Our results show that trading in strategic markets reduced the endowment effect to an insignificant one-fifth of its original size.*

*As strategic behavior is typical for professional business, our findings apply to many if not most market transactions. We conclude that private ordering may need less protection against the Endowment Effect than often suggested in the legal literature.*

## I. Introduction

Hundreds of law review articles have argued that the Endowment Effect (henceforth EE) requires the law to intervene in private ordering. In free markets people should ideally exchange goods until they are owned by those who value them the most absent transaction costs (Coase, 1960). But transaction costs are not the only impediment of beneficial exchange, another are the owners themselves, when their decisions are biased. The size of the EE suggests that the bias is a severe behavioral threat for efficient trade: Prices demanded in the state of ownership can exceed buyers' willingness to pay by a factor of 3 or 4. The bias is robust and replicates reliably using the standard experimental protocols. The implications for private ordering are far reaching: Unlike in a Coasian world, the EE suggests that initial allocation matters. Owners will keep their entitlements, even when other market participants would value the property considerably more (see, for example, Thaler, 1980; Knetsch & Sinden, 1984; Knetsch 1989; Tversky & Kahneman, 1991; Kahneman, Knetsch & Thaler, 1991). Voluntary transactions cannot realize or even discover these gains from trade, because they exist only when both parties are in the same state of possession. Thus, unless owners themselves can overcome their EE, the bias seems to call for external legal intervention.

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<sup>1</sup>I thank Jennifer Arlen, Stefan Bechtold, Sudeep Bhatia, Irina Cojuharenko, Kevin Davis, Christoph Engel, Tobias Gerstenberg, Andreas Glöckner, Oliver Kirchkamp, Daphna Lewinsohn-Zamir, Sergio Mittlaender, Holger Spamann, Christopher Jon Sprigman, Eyal Zamir, Kathy Zeiler and Lilia Zhurakhovska for very helpful comments. I thank Selma Guney for her research assistance.

only when both parties are in the same state of possession. Thus, unless it can be overcome by owners themselves, the EE seems to necessitate external legal intervention.

However, in recent years, evidence about the effects of the EE, as well as policy recommendations based on that evidence, have come to be viewed more skeptically. First, Plott and Zeiler criticized the results on methodological grounds. They argue that the gap between WTA and WTP prices is often an artefact of the experimental methods used. For example, Plott and Zeiler argue that goods had often not been allocated randomly in studies on EE, consequently showing that subjects value a good more when it has been selected for them. However, while their analysis improved the experimental protocol of EE studies, the bias has since been reproduced in attending to their critique - for example, by Isoni et al (2011), Heffitz and List (2013), Arlen and Tontrup (2015 a, b), and others.

Arlen and Tontrup (2015 a), by contrast, do not question that ownership can bias valuation. They argue that the legal literature on EE tends to derive policy recommendations from experiments that do not account for the institutions that people typically use or act within when trading. As they may find out after the sale that keeping their entitlement would have been the better decision, sellers anticipate experiencing regret. The expected costs of regret can prevent them from trading. In business contexts, however, owners seldom trade alone. They employ institutions like an agent, or a board of peers votes to reach the decision to trade. These institutions allow decision-makers to share responsibility, muting the regret they expect to experience over a wrong decision. Entitlement holders even purposely involve costly institutions in order to self-debias and trade at lower regret costs<sup>2</sup>.

In this study, we analyze the debiasing capacity of strategic markets. Glöckner et al. (2015) presented first evidence that the EE decreases when owners in an Anticommons dilemma raise sales prices to exploit buyers and other sellers. Here, we depart from the narrow context of the social dilemma, which mingles strategic incentives with sellers' social concerns towards the other anticommons owners<sup>3</sup>. We want to generalize the debiasing effect of strategic markets, showing that they debias the majority of market transactions, as the task of trading debiases traders in and of itself. The sale incentivizes sellers to focus their attention on the gains from trade and on the WTP of their transaction partners, as opposed to the properties of their entitlements. Focusing on the profits from trading and strategies to earn this profit eases sellers' loss aversion. We define trading as strategic when sellers try to max out the WTP of potential buyers, pushing the prices beyond their actual costs. Strategic pricing is characteristic for many, if not most, business transactions, as most markets permit traders to increase their profit by setting prices strategically. Competition is almost never perfect. The reasons for this include the frequent lack of full transparency as to a good's quality and price, the unavailability of nearby substitutes for certain goods, and the possibility of market failures like hold-ups occurring. Both owners and buyers can exploit strategic market situations and exaggerate or downplay their true valuations. This makes the trade a strategic interaction with the same goal on both sides: to increase the own share of the gains from trade. We test our theory by placing our

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<sup>2</sup> Another strategy of bias-self-management does not remove the EE. Instead, people shift their bias such that it does not prevent them from making their preferred choice (see Arlen & Tontrup 2015 b).

<sup>3</sup> The Anticommons dilemma also refers to a different strategic incentive than we do: the incentive to outsmart the other anticommons owners' by trying to increase ones' own share of the overall sales price, relative to theirs.

experimental subjects in an actual market with incentives for strategic trading behavior. Our results suggest, at the very least, a strong reduction of the EE in a realistic market scenario.

EE experiments in the fields of Psychology and Economics are typically designed to exclude strategic behavior, on the assumption that it will confound the experiment's results. Where strategic effects are not excluded, their effect on the EE is not systematically measured, which would require both eliciting subjects' true valuations in a standard BDM design *and* placing these valuations in a strategic market to compare their EE, all else being equal. The two experimental paradigms most often used in Economics and Psychology are a random price mechanism and a random allocation design, both of which are detailed in the subsequent section of the paper concerning theory. Both paradigms incentivize subjects to focus their attention on the valuations of their entitlements. The experiments are designed to analyze the cognitive process underpinning the reference dependence of preferences. To cleanly demonstrate that valuation is state-dependent and influenced by loss aversion, these paradigms strip down the decision-making context to the point that ownership alone can affect the subjects' valuations of the goods. Besides valuing and pricing their entitlements, the participants have no other cognitive task. Accordingly, the only pieces of information they need to process are the positive and negative attributes of their entitlements.

Legal analyses of EE, by contrast, ultimately aim to determine policy applications. They are concerned with the effectiveness of private exchange, which brings strategic behavior into focus. Namely, when people trade in real markets, they often set prices strategically to increase their profit. The personal valuation elicited by most EE studies often only amounts to the sellers' well-hidden reservation price. Determining one's own true valuation constitutes just one element of the more cognitively complex task of trading. For example, sellers will study market prices to form beliefs about the WTP of potential buyers, as well as considering the quality of the goods other sellers may offer. Often, gains from trade reach beyond concrete transactions, since the traders must take the potential for future deals with the same partners into account. Moreover, fulfilling profit expectations may be crucial to a personal promotion or his own business considerations. We assume that the complexity of this trading task shifts the sellers' attention from the valuable properties of their entitlements to the social and economic context of the transactions. This change of attentional focus reduces loss aversion and the bias in their valuation of the property. The results of our study show that strategic markets form a powerful debiasing institution. Therefore, we conclude that the EE may affect private ordering much less than typically reported in the legal literature.

We base our experimental predictions on cognitive theories of attention. The original explanation for the EE is Prospect Theory's loss aversion (Kahneman & Tversky, 1979). According to loss aversion as outlined in Prospect Theory, the owner experiences selling a good as a loss, while the buyer perceives adding the same good to his endowment as a gain. The loss looms larger than the gain biasing, preferences, and sales prices. Therefore, one values the same good more in the role of a seller than as a buyer, indicated by the large gap yawning between WTA and WTP prices (Thaler, 1980). Prospect Theory, however, blackboxes the cognitive process that causes losses and gains to be experienced differently. As a result, it cannot explain why social factors tend to strongly affect the size of the EE without changing endowment status. For instance, personal attachment (Strahilevitz & Lowenstein, 1998) and self-association with the good up for trade (Maddux et al., 2010) elevate an owner's EE. Given the large impact they

have on the EE, both attachment and self-association must affect the cognitive process that causes the bias. The same holds true for the strategic markets we analyze, as we expect them to reduce the EE without altering the owners' endowment status. To analyze the influence on the EE produced by profit-oriented behavior in markets, we therefore need a better understanding of the specific cognitive process driving loss aversion.

Recent work has tried to provide this understanding<sup>4</sup>. Carmon and Ariely (2000), for example, propose that the EE is caused by a cognitive focus on the foregone: sellers focus on the good they would give up, while buyers focus on the money they would have to spend on the trade. Ashby et al. (2012) use eye-tracking to show that loss aversion focuses sellers on the positive, value-increasing aspects of their entitlement. Negative aspects, by contrast, receive little attention. Buyers, in turn, focus on the opportunity costs they would have to bear if they obtain the good. Johnson et al. (2012) show that endowment status also biases the retrieval of attributes from memory. Consequently, when sellers and buyers weigh the positive and negative aspects of a transaction, their opposing endowment status leads to the characteristic gap between WTA and WTP prices.

Attention-based theories predict that social factors can increase or reduce the EE by affecting the seller's attentional focus. Personal memories, for example, increase the EE because they focus owners on their entitlement. Strategic market incentives do the opposite, drawing the sellers' focus from their entitlement to the profit they may earn upon accomplishing a lucrative deal. Based on cognitive theories of attention, we therefore expect strategic markets to effectively debias owners, loosening their loss aversion-driven fixation on their entitlement and switching their attentional focus to gains from trade.

To test our theory, we endow subjects with tickets of a real public lottery, the Eurojackpot<sup>5</sup>. We inform the participants about the probabilities that the ticket might win a prize, allowing them to determine the ticket's expected payoff. Our 2x4 design varies the endowment status of the subjects, comparing a pair of *Endowment* and *No-Endowment* conditions for each of our treatments. In the *Baseline* treatment, we use a BDM mechanism, which incentivizes participants to reveal their true valuation for the entitlement. In the second treatment, we modify the BDM mechanism, allowing subjects to benefit from strategic trading behavior. In the third treatment, subjects trade with a real transaction partner, who may also act strategically. For the fourth and final treatment, participants act through an agent in a strategic market.

For the *Endowment* conditions, we present subjects with a price list. This list asks, for each price, whether the subject would prefer to sell or keep their lottery ticket. We compare the subjects' WTA with the random price drawn by us or when they are matched with a real interaction partner, we compare their WTA with the price their assigned partner has offered. If their WTA does not exceed either price, the subjects sell their ticket and receive either the random price or their partner's offer in exchange. Otherwise, they keep their ticket. For the *No-Endowment* conditions, we use a choosing design (Johnson et al. 2007). Subjects have to choose, for each price in the list, whether they prefer receiving the ticket or the money. If they have chosen in the price list, that for the random price or the price offered by their partner they prefer the ticket, then they receive the ticket. Otherwise, they are paid the money. As expected, a strong

<sup>4</sup> See also the overviews by Morewedge, et al., 2015 and Brown, 2005.

<sup>5</sup> The official website of the lottery: <https://www.lottoland.com/en/eurojackpot/results-winning-numbers>

EE is replicated in our *Baseline* treatment. Subjects demand an average €7.79 for selling their lottery ticket, while their choosing price under the *No-Endowment* condition is only €7.76.

For the *Strategy* treatment, we modify the random price mechanism: participants are not paid the random BDM price, but the amount they demand. As is typical in the case of real markets, they can benefit from setting a strategic price<sup>6</sup>: The higher the amount they ask for, the more money they can earn. In turn, however, strategic pricing creates the risk that the deal fails at a price they would have preferred to have sold for. The results support our attention-based theory, demonstrating that the strategic market decreases the EE sharply. Under the *Endowment* condition, subjects demand a mean WTA of €7.71, while under the *No-Endowment* condition we find a mean choosing price of €7.11. The comparison yields only a small and insignificant bias (Mann-Whitney  $p$ -value 0.33; Cohen's  $d$  -0.24).

For the *Interaction* treatment, we strengthen the strategic character of the trading task, moving our design closer to the conditions of a real market. We replace the random price mechanism with a transaction partner who can likewise act strategically, such that subjects can try to outsmart each other. Under the *Endowment* condition, subjects sell their tickets for the prices offered by their partners, should their WTAs not exceed their offers; otherwise, they keep their tickets. Under the *No-Endowment* condition, subjects receive either the ticket or the money, depending on whether they had chosen the ticket or the money in exchange for the price offered by their partner for the ticket. The interaction with a partner complicates the experimental trading task. When they form beliefs about their partners' WTPs for the tickets, subjects must consider that their partners may strategically lowball their offers. We assume that these interactions draw their attention to strategic considerations. And indeed, the WTA/WTP gap (*Endowment* condition: €4.54; *No-Endowment*: €4.14) shrinks further, to less than one-fifth of the magnitude we measured in the *Baseline* treatment. The remaining effect size is marginal ( $p$ -value 0.45 Mann Whitney; Cohen's  $d$  -0.14).

To support the debiasing effect with additional direct evidence, we employ two psychometric tests: a regret and an incentivized loss aversion measure. The measures for our *Baseline* treatment confirm that our subjects are biased. Owners experience significantly more anticipated regret over selling their tickets than participants in the *No Endowment* condition who have chosen money over the ticket. Our loss aversion measure reveals this bias as well: the subjects we identify as loss averse have a significantly stronger EE than the subjects categorized as rational. In line with the pricing decisions, the strategic market drives out the biases in both regret and loss aversion data. The difference between the regret subjects anticipate over selling their ticket in the *Endowment* condition, in comparison to under the *No-Endowment* condition, emerges as insignificant in the *Strategy* treatment and entirely disappears in the *Interaction* treatment<sup>7</sup>. The same holds for the loss aversion data. Based on our data, neither in the *Strategy* nor in the *Interaction* treatment do loss averse (or rational) subjects reveal an EE. In sum, we conclude that strategic markets are a powerful debiasing institution.

In our last treatment, we broaden the scope of our analysis to include other market institutions. To estimate the EE's true impact on private ordering, policy makers should not only

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<sup>6</sup> Assume subjects demand €8 for the ticket while their true WTA is €5. In this case they are paid €8 if the BDM price is not smaller than the €8 they asked for see with many examples the design section.

<sup>7</sup> To support our theory we estimate a linear model that includes all data (see the result section).

identify all relevant debiasing sources involved in trading. They also need to analyze these sources' cumulative impact on the level of bias. When owners trade, they will often use more than one market institution capable of debiasing them. To test their cumulative impact on the EE, we present subjects with two such institutions: strategic markets and agency. Our theory suggests that these two institutions interfere with the causal process that drives the EE on different cognitive levels, which we expect to reinforce their debiasing effects. Strategic markets reduce regret over selling by lessening the owners' fixations on their entitlements. Agents, by contrast, decrease regret over selling by allowing the principal to share the responsibility for a transaction (Arlen & Tontrup 2015 a). Tested alone, neither institution eliminated the EE completely in the descriptive results – even though, of course, the bias in the strategic markets did no longer reached significant size. In the *Agency&Markets* treatment we assign an agent to each subject. The subject can instruct the agent as to what price to demand. The agent is incentivized to follow this instruction - he is paid €2 by the experimenter if he does, and nothing otherwise – but it does not bind him, and the final trading decision is his to make. As implemented in the *Strategy* treatment, subjects sell their tickets and are paid the price the agent demands, provided that the amount of this demand is lower than that of the random price. As assumed, the two institutions seem to reinforce the debiasing effect, eliminating the WTA/WTP price gap completely (- €0.15; Mann-Whitney  $p$ -value=0.81; cohen's  $d$  -0.06).

Our study holds important implications for both legal policy and legal research on the EE. The law is concerned with private exchange and gains from trade in markets whose pricing is typically strategic, and in which owners must divide their attention between multiple economic and social cues, as well as the attributes of their entitlement. To decide whether a legal intervention is reasonable, it is crucial to determine the actual size of the EE in a typical business environment, where people trade for profit. Most economic and psychological studies, however, do not address this question. Instead, they focus their subjects' attention on the values and attributes of their entitlements, thereby elevating the subjects' biases. Because it is parsimonious and triggers a strong bias, this experimental design is ideal for isolating and analyzing phenomena produced by state-dependent preferences. By contrast, to determine policy implications and conclusions for legal research, a realistic strategic market design is vital. As such, the strategic market reduced the EE to less than one-fifth of the size we measured in the *Baseline* treatment. Our results also demonstrate that policymakers should be advised to consider all relevant debiasing institutions before deciding upon an intervention. In our study, the cumulative impact of the two market institutions considered led to the complete elimination of the EE. We ultimately conclude that, analyzed in an institutional market context, the EE poses far less of a threat for private ordering than suggested both by most legal literature and prior experimental evidence in Psychology and Economics.

This article proceeds in the following order. Section II presents our theory and the related literature. In section III we detail our experimental design, and section IV reports our results. Closing the article, Section V discusses the validity of our findings and their implications for legal research and policy.

## II. Theory and Related Literature

We assume that the EE is caused by a reference-dependent focus of attention, which leads to a biased weighting of entitlements' positive and negative attributes during the trading process (Carmon & Ariel, 2000; Nayakankuppam & Mishra, 2005; Johnson et al., 2007; Ashby et al., 2012). When owners decide whether or not to sell a good, they concentrate on the value-increasing aspects of their entitlements, giving them more weight in decision-making. Conversely, buyers focus on the transaction's opportunity costs: the money they could otherwise use for alternative causes. This process biases decision makers towards their status quo.

Two main effect channels driving the EE have been identified in the literature. The first is attachment, which pertains mostly to physical goods with qualities like beauty, elegance or usability. Because their endowment status focuses the owners' attention on these attributes, they become attached to their entitlements and correspondingly develop a higher valuation of their goods. By contrast, the characteristic attribute of both stocks and patents is the uncertainty of their future value (Lemley & Shapiro, 2005). Within a salient win or lose structure, entitlements of uncertain value trigger anticipated regret over trading choices. Neither the goods' properties nor their market prices need to be the cause of this uncertainty. The uncertainty can also result from the owner's vague preferences about the value of the good. In this case, when owners are not sure of their goods' values, they can feel regret over a sale, anticipating that they later realize they would have preferred keeping their entitlements instead<sup>8</sup>.

By endowing the subjects with lottery tickets, we conditioned the EE's dominant behavioral channel in our study to be anticipated regret. (Bar-Hillel et al., 1996; van Dijk & Zeelenberg, 2005). Therefore, we base our predictions on regret theory (Kahneman & Tversky, 1982). Our assumption is that the biased attention increases the cognitive availability of the good's positive attributes, at once increasing the values owners ascribe to their entitlements (Kahneman et al., 1986; Johnson, et al., 2007). The more valuable the goods' positive attributes appear to their owners, the more regret they will anticipate over selling their property (see Bell, 1982; Loomes & Sugden, 1982; Connolly & Butler, 2006; Zeelenberg & Pieters, 2004). For example, when patent holders consider selling their entitlements, they focus on the patent's economic potential, which increases their feelings of regret over selling. As ownership focuses the entitlement holders on their goods' benefits, gains from trade receive comparatively less attention, and accordingly less weight in the decision-making process (see Ashby et al., 2012 with direct evidence from eye tracking). Therefore, patent holders anticipate more regret over selling than over keeping their entitlements. The asymmetry of regret costs biases them against trading (Loomes & Sugden, 1982; Sugden, 1985; Landman, 1987; Baron & Ritov, 1994; Connolly & Butler, 2006; Nicolle et al., 2011). As applied to our study, subjects should experience more regret over trading their lottery tickets than over keeping them. As will be shown in the section explaining our hypothesis, we expect subjects in seller roles to seek compensation for their regret costs by asking for higher sales prices.

We assume that, when our subjects trade, both the structure of the cognitive task and the information they must process influence the focus of their attention and the size of their biases. Business contexts will often contain strategic elements that the parties can exploit for increased

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<sup>8</sup> See also Weaver and Fredrick (2012). They find that people reject selling for a price that falls short of the assumed market price, even when it exceeds their true WTA. Sellers anticipate that they will feel regret over selling for their true WTA, should an option later occur to sell at market price.

profit. For example, owners can influence the speed and likelihood of closing a deal by asking for higher or lower prices. Strategic interactions with buyers lead sellers to form beliefs about what incentives and WTP those buyers might have. This moves sellers' attention to focus on the buyers, along with all their personal motivations for the trade, their resources, as well as their traits like risk attitudes. Business relationships are typically characterized by multiple layers of strategic incentives, which sellers must then balance in their decisions. Thus, counter to standard EE experiments, which incentivize sellers to reveal their actual valuations for their goods, the actual trading process forces decision makers to consider a higher degree of information, beyond the attributes they value in their entitlements. We assume that this cognitively complex process loosens owners' attentional focus on their entitlements, reducing the biased values they ascribe to their property and the regret they anticipate over its sale.

A strategic market does not only make the decision-making task more complex. It may also switch the task's framing. If sellers trade to make a profit, we expect their attention to focus on the benefits they may gain from trading. The more pronounced this focus, the more likely, they may be in a gain frame, not a loss frame. For example, patent holders may not focus on the values their patents have for them, but on the profits they can make by selling them. A switch in framing explains nicely why professional traders, who own goods only for their exchange value, do not display any EE (see Kahneman et al. 1990). Accordingly, if our participants' attention switches from their entitlements to the possible gains from trade, they might not view their lottery tickets as potential winners. Instead, they perceive them as likely blanks that would earn them more money when sold it. In this scenario, anticipated regret over losing the ticket and with it the EE would diminish.

We test our theory by systematically increasing the strategic character of the market in which we place our subjects. The more demanding the strategic market context, the larger is the portion of the owners' attention that may be absorbed and drawn from their entitlements. In the *Strategy* treatment, the incentive structure remains simple compared to a trading task in a real market, as the random price's probability distribution informs the subjects precisely about the gains and risks of strategic pricing. Subjects can earn more by taking higher risks. Our second treatment moves the scenario closer to the conditions present in a real market. By matching subjects with trading partners who have the same strategic incentives, we add an element of strategic exchange. Subjects can earn more by second-guessing the WTP and strategic behaviors of their partners. Our theory predicts the more salient the possible profits are that depend on their decisions, the more likely subjects are to switch from loss into gain frames.

Our attention-based theory allows us to understand the EE as a continuous bias, one that institutions can reduce or eliminate without changing endowment status. In many psychological and economic EE studies, the bias is strong because the owners' focus fixates on their entitlements. When the trading task's social and economic context catches and disperses owners' attention, their biases are weakened. Once the owners predominately focus on gains from trade, as typical for businesses that trade for profit, their bias completely vanishes.

### **III. Experimental Design**

### A. Real Lottery

We endowed our subjects with tickets of the lottery Eurojackpot. The tickets can be purchased online. The lottery is conducted every week and distributes millions of Euros amongst its winners. The draw is broadcast live on the internet, with the winning numbers also publicized on the lottery's website. Players can tip 5 and two extra numbers on their tickets. In advance of the experiment, we purchased online tickets for the targeted number of observations, informing the subjects that we used software to randomly select the numbers tipped on the tickets. We then drew the tickets from an urn and numbered them following the order of the draw. We sent the first ticket drawn to the first subject to start the experiment; the second participant received the ticket we drew second, and so forth. Before the subjects began completing the study, we asked them to create anonymous e-mail accounts (see method section for details), to which we sent the lottery tickets. To confirm that they read the email messages they received, they had to indicate the first three numbers tipped on their respective ticket. The instructions clarified that the participants would only be paid if they submitted the correct numbers. As some subjects may have participated in the Eurojackpot lottery before the experiment, either with success or with disappointment, we did not reveal the lottery's name before the subjects had fully completed the study.

Under all treatments we sent subjects receipts from Eurojackpot, which confirmed the numbers tipped on the tickets. Therefore, subjects were aware that they would learn after the fact whether their tickets had won in the lottery or not. Importantly, the receipts alone did not establish ownership. We informed the participants that Eurojackpot sends separate authentication codes to all lottery participants. Only those persons who rightfully have these codes own the tickets and are authorized to claim prizes.

### B. Endowment Status

In the *Endowment* conditions for all treatments we send subjects the tickets and authentication codes which establish their ownership, entitling them to collect prizes should their tickets win. We instruct each participant that, should they sell their ticket in the course of the experiment, they give up ownership of the ticket and their right to claim a prize. In the *No-Endowment* condition by contrast, we provide subjects only with the ticket receipt and not with the authentication code. Thus, while the subjects also learn the tipped numbers, they have no ownership rights to them. We use a choosing design (Johnson et al. 2007), which prompts subjects to choose for each price listed between the lottery ticket and a payment. They receive whichever option they have chosen – the ticket or money - either at the randomly drawn price or at the price offered by their partner. In the treatments, in which we provide incentives for strategic trading behavior, subjects are paid the lowest amount for which they chose money over tickets.

### C. Price Mechanisms

Our experimental protocol allows us to measure how the effect size of the EE changes in a market scenario with incentives for strategic trading behavior. Our *Baseline* treatment implements a standard random price mechanism (hereafter BDM, see Becker, et al. 1964<sup>9</sup>) widely

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<sup>9</sup> A second experimental design type used in many EE studies is a random allocation design (see for example Knetsch, Kahneman & Taylor 1990). This design randomly assigns subjects either the role of an owner - who receives the good - or the role of a buyer who is given a monetary endowment. Assuming the valuation for the good is randomly distributed across owners and buyers, half of the owners should sell, while the other half should

used in both economic and psychological experiments to replicate the EE. The random price mechanism incentivizes subjects to reveal their actual valuations of their entitlements. We measure the effect of strategic markets on the magnitudes of their biases against the benchmark of the BDM.

In the *Strategy* treatment, we modify the price mechanism to provide subjects with incentives for strategic behavior. Instead of the random price, subjects are paid the amounts they demand. In the *Interaction* treatment they are paid the offers of their partners should they sell their entitlements. This allows the subjects to increase their profits by pushing prices beyond their true valuations. As long as their demands do not exceed the random price or their partner's offer, they receive any price asked. However, by lifting their WTA, subjects risk deals failing, even though they were offered a price they would have preferred to sell for.

### 1. Baseline: True Valuation Treatment

In the Baseline treatment, we elicit subjects' true valuations for the lottery tickets. The treatment does not provide strategic incentives. In the Endowment condition, the BDM mechanism compares the WTA subjects indicate with the random price drawn. Subjects can demand any price ranging from 25 Cents to €10 in exchange for their lottery ticket. The random prices are drawn within the same range. We present the subjects with a complete list of all 40 prices then asking them whether they want to sell or keep the ticket for each price separately (0.25; 0.50; 0.75 ... 9.75; €10.00). The lowest price that they indicate they would prefer to sell for reveals their WTA. If their demand does not exceed the random price, they sell their tickets and are paid the random price in return. By contrast, if they ask for amounts beyond the random price, they can keep their tickets and are entitled to collect any prize the tickets may win in the lottery.

In the *No-Endowment* treatment we employ a particular method of choosing prices (see Johnson et al. 2007). Subjects are presented with the same price list as in the *Endowment* condition; for each price, they must choose between the ticket and the money. The lowest price for which each subject would prefer to obtain the money reveals their WTP or choosing price.

The BDM mechanism incentivizes the subjects to reveal their true valuations for the tickets. Because they receive either the ticket or the random price, they have no influence on the size of the actual sale or the choosing price. An explanatory example can be found in the footnotes.<sup>10</sup> Thus, exaggerating the price holds no benefit for the subjects, provided their demands do not exceed the random prices. If the subject asks for an amount that turns out to exceed the random price, exaggerating the price even becomes disadvantageous. A comparison between the *Endowment* and *No-Endowment* conditions reveals the EE and serves as our *Baseline*.

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keep the good. The fewer people trade, the stronger is the evidence for the EE. The design avoids strategic incentives: As sellers and buyers trade for the market clearing price, they do not benefit from setting a strategic price. Sellers should act as price takers in this setting.

<sup>10</sup> For example, assume a participant demands €5 for selling his ticket, while a random price of €8 is drawn (note in all examples we will assume a random price of €8). Since the random price is larger than the €5 the subject is willing to accept, the subject collects the random price in exchange for the ticket. Setting a price beyond his or her true valuation of the ticket can only make a subject worse off. For example, assume the subject demands €6 instead of his or her true WTA of €5. Then, the subject does not benefit, but would still obtain the same random price. However, if the subject pushes the price even higher and demands €9, then his or her WTA exceeds the random price and the subject has to keep the ticket, even though he or she would have preferred to trade for the €8 of the random price.

## 2. Strategy Treatment

We modify the BDM mechanism to provide subjects with incentives for strategic behavior. While the original mechanism allocates the random price to the subjects, even if they demand prices lower than the random price, participants obtain the prices they ask for in our modified version. In an example scenario, the subject demands €5, consistent with his actual valuation, as compensation for the sale of his ticket, and €8 is then drawn as the random price. The subject then sells the ticket and receives the €5 he asked for in exchange. If the subject demands €7, exaggerating his actual valuation, then the subject can increase his earnings by €2. Thus, our modified BDM mechanism allows the participants to benefit from pushing the price beyond their actual valuations. In turn, however, the design attaches a risk to this strategic behavior. For example, consider that the subject demands €9. Now he must keep the ticket, even though he would have preferred to sell it for the random price.

In the *No-Endowment* condition, subjects obtain either their choosing price or the ticket. For example, the subject states a price of €7, while the lowest price for which he actually prefers money over the ticket is €5. By overstating his valuation, the subject obtains €2 more than his actual valuation, providing the incentive for strategic behavior. However, just as in the *Endowment* condition, if the subject, in exaggerating, pushes his choosing price above what turns out to be the random price, then he is allocated the lottery ticket. The gap between *Endowment* and *No-Endowment* conditions allows us to estimate whether the strategic market has reduced the EE relative to the effect size measured in the *Baseline* treatment.

## 3. Interaction Treatment

In order to move the study design closer to a real market, in which both counterparts can act strategically, we assign the subjects real partners for their transactions<sup>11</sup>. The two roles - subjects and partners - are randomly assigned. As for each treatment, we implement a pair of *Endowment* and *No-Endowment* conditions as a means to compare the magnitude of the WTA/WTP gap with the other treatments.

In the *Endowment* condition, a subject sells his ticket, should the lowest price he is willing to sell for not exceed the amount his partner offers. The subject obtains this price in exchange for the ticket, and the experimenter collects any difference between the offer and the subject's WTA. If he asks for a price higher than his partner's offer, the deal fails, and the participant keeps his ticket.

In the *No-Endowment* condition, subjects state for each price whether they would prefer to obtain the money or a ticket. If subjects stated they would prefer the ticket over the price offered by their partner, the subjects receive a ticket. In turn, if the choosing price the subjects state (the price at which they prefer to receive the money over the ticket), does not exceed the price offered by their partner, then the subjects receive the choosing price they stated<sup>12</sup>. The

<sup>11</sup> The treatment increases the cognitive complexity of subjects' decision-making task. In the *Strategy* treatment subjects can calculate risk and benefits of setting a strategic price, as they know the distribution of prices in the BDM mechanism. In the *Interaction* treatment, by contrast, the subjects have to anticipate the strategic behavior of their counterpart if they want to trade successfully.

<sup>12</sup> Assume a subject indicates his true choosing price of €5. If the partner offers €8 for the ticket, then the subject obtains his choosing price of €5. However, if the subject sets a strategic price of €7, then he would obtain €7 instead of €5, because his partner's WTP of €8 is still higher. Yet, if the strategic price is €9, then the deal fails.

higher the subjects set their choosing prices, the larger are the profits they earn giving the subjects an incentive for strategic behavior. However, if a subject strategically pushes the price higher than what his partner turns out to offer, he is then allocated a ticket, even though he would have preferred to have obtained the monetary price.

Our experimental design does not change the partner's role in either the *Endowment* or *No-Endowment* conditions. In both, the partner makes an offer to buy the ticket. This design keeps the manipulation consistent across the two endowment state conditions. By being matched with real counterparts, the subjects are forced to anticipate their partners' (potentially strategic) behavior. Would their individual counterparts be owners in one condition and buyers in the other, subjects may expect their counterparts to offer widely different prices based on their endowment status. For instance, subjects may anticipate EEs in their partners they may consider in their own pricing decisions (see van Boven et al. 2003). By giving the partner a €10 endowment in both *Endowment* and *No-Endowment* conditions and asking him to indicate his WTP for the ticket, we avoid this potential confound. Just like the subjects, the partner has incentives encouraging strategic behavior. Namely, he can offer any price within his budget to buy the ticket and keep the amount that remains unspent. The choosing design allows for an intuitive implementation of the transaction in the *No-Endowment* condition. If the partner states that he values the ticket at least as highly as the subject, the partner gets the ticket and the subject receives his choosing price. Otherwise, if the partner offers a price lower than the subject's choosing price, then the subject receives the ticket and the partner keeps all his endowment. The instructions informed the subjects of their partners' trading incentives.

#### 4. Agency&Markets Treatment

In order to analyze whether multiple institutions can reinforce each other's debiasing effects, we assign the subjects an agent and place them in our otherwise unchanged *Strategy* treatment. Agency is an institution that people often use for trading and that has been shown to decrease their EE (Arlen & Tontrup, 2015 a). By sharing the responsibility for the trade with an agent, owners can reduce regret over the sale of their entitlements. In the *Strategy* treatment, we randomly match each subject with a second participant who acts as their agent. The agent sets the price; his decision is final, leaving the subject with no veto. However, subjects instruct the agent by selecting their preferred sale or choosing price. The agent is paid €2 from the experimenter if he complies with the instruction and nothing if he does not comply, incentivizing the agent to follow the subject's instructions. The agent has no monetary interest in the transaction itself and receives no other compensation for the study.

In the *Endowment* condition, subjects sell their tickets if their agents demand prices equal to or lower than the random price. In the *No-Endowment* condition, a subject is paid the money if the agent has chosen money over the ticket for the random price; otherwise the subject receives a ticket. Since the subjects receive the prices their agents demand and not the random price, both conditions *Endowment* and *No-Endowment* provide incentives for the subjects to let their agents set strategic prices.

In addition, we implement a control group, in which subject and agent are placed in the *Baseline* treatment without incentives for strategic trading behavior. The treatment allows us to isolate the debiasing effect of the agent alone and compare it to the cumulative effect of agent and

strategic markets. In the control treatment, the subject receives the random price, neither the price the agent demands nor the ticket.

#### **D. Second Market**

Our theory suggests that strategic markets loosen the sellers' focus on their entitlements' positive attributes, instead drawing their attention to gains from trade and estimating the buyers' potential WTP. We assume that this redirection of focus reduces their regret over trading and their loss aversion. To provide further support for our theory, we seek to identify the subjects who respond to the strategic market's incentives, pushing the prices beyond their true valuations. We expect these subjects to reveal smaller biases. In order to identify the particular subjects acting strategically, we implement a second, hypothetical market, which presents the *Strategy* and *Interaction* treatments' subjects with the *True Valuation Baseline* treatment. In turn, subjects who first completed the *Baseline* treatment are presented with the *Strategy* treatment in the second market.

Whenever the price a subjects sets in the strategic market exceeds the price he sets in the true valuation market, the subject has made a strategic decision. As such, comparing the prices set in the two markets reveals evidence of strategic trading. This identification method allows us to compare the EE of subjects who by acting strategically revealed that they devoted attention to the market incentives with those subjects who did not.

Since all subjects were already familiar with the price mechanism, we only needed to inform them about how the second market's rules differ from those of the treatment they had completed in the first market. To illustrate the meaning of the changes, we provided them with scenarios and control questions, which either tested why they could benefit from asking for more than their true WTA in a strategic market or why they should reveal their actual preferences in a market presenting them with the *True Valuation* treatment.

### **IV. Additional Measures**

#### **A. Regret**

Our experimental predictions refer to regret theory. We assume that the strategic markets reduce the subjects' biased focus on their entitlements, thereby reducing the degree of regret they anticipate experiencing over a potential loss. To support our theory with direct evidence, we elicit the levels of regret the subjects expect to experience, over a negative outcome following both a decision to trade and a decision to keep their tickets. The difference between the two we refer to as differential regret<sup>13</sup>. A comparison between differential regret costs in the *Endowment* and the *No-Endowment* conditions reveals the EE. For example, in the *Baseline* treatment, we ex-

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<sup>13</sup> In the *Endowment* conditions, we ask participants to indicate how much regret they anticipate over selling their lottery tickets, considering that they might lose the prize their ticket may ultimately win. n. And secondly, we assess how much regret the participants anticipate over keeping their tickets, considering that they might lose the tickets' sales price without the tickets ever winning a prize. In the *No-Endowment* conditions, we query the subjects both as to how much regret they anticipate over collecting the money, considering that they might lose a prize the ticket might win, and as to how much regret they anticipate over receiving the tickets, considering that they may lose the sales price without the ticket ever winning a prize.

pect differential regret costs to be higher in the *Endowment* than in the *No-Endowment* condition. We use Likert items with 10 ordered response levels, ranging from 1=no regret at all to 10=very strong regret.

## B. Loss Aversion

To provide direct evidence that strategic markets reduce loss aversions' impact on trading behavior, we use an incentivized measure (Goette et al. 2004) that gives subjects the opportunity to participate in two lotteries. The first lottery offers subjects a 0.5 chance of either winning € or losing €. The second lottery offers the same payoffs but is repeated six times. Subjects are paid the average outcome of all six draws, considerably lowering the chance that participation leads to an overall loss. An unbiased participant should accept both lotteries, because the expected outcome of both is positive. We classify the choices participants make into two categories: (1) the "loss averse" type, who rejects one or both lotteries; and (2) the "rational" type, who participates in both lotteries. In the *True Valuation* treatment, we expect loss averse subjects to ask for higher sales prices than rational types. By contrast, the strategic markets should reduce the loss averse subjects' fixations on their tickets, with the difference between the types' EEs expected to diminish correspondingly.

## V. Methods

Participants are current and former students of the University of Münster. We recruited the subjects through the University's main mail server. The server reaches the enrolled students of all departments (over 42,000 in total) and many graduates of the university. About 30% of the participants in our study have graduated and work as professionals. Subjects signed up for the experiment by clicking on a link in their invitation. The invitation contained an individual key, which they had to enter to begin with the study. Once used, the key became invalid. To keep the dropout rate as low as possible, we paid the subjects only if they finished the experiment; only 8 percent of the subjects who began the study dropped out.

Participation was anonymous. We asked the subjects to create an anonymous and cost-free e-mail account; to open the account, the subjects did not have to provide any personal information<sup>14</sup>. We used the account to send the subjects their lottery tickets and authentication codes. The payment was also anonymous. We instructed subjects to make up a 5-digit number. After the experiment, they could pick up their earnings in the student government offices, after indicating their personal code<sup>15</sup>. The subjects have different academic backgrounds, coming from both the social and natural sciences. We invited an equal number of men and women to participate in the experiment. When we controlled for demographic variables in our regressions, gender and age did not significantly affect our results.

To ensure that the subjects fully understood the operation of the price mechanism, they had to complete a set of control questions, reported in the appendix to this study. The participants could only proceed with the experiment if they answered all questions correctly. The questions presented the subjects with various scenarios, for each of which they were asked to

<sup>14</sup> The provider of the anonymous e-mail account is: <https://securemail.hidemyass.com/>.

<sup>15</sup> Subjects could opt out of the anonymous payment and choose to be paid via bank transfer or PayPal.

calculate the payoffs<sup>16</sup>. Participants did not demonstrate any difficulty understanding the instructions and the price mechanism. We determined to elicit 50 observations for each treatment condition and closed each treatment once we collected the observations.

## VI. Hypothesis

### A. Comparing WTA and WTP prices

We expect ownership to focus the subjects' attention on the positive attributes of their lottery tickets (Ashby et al., 2012). The biased attention should lead subjects to give more weight to the potential prize the lottery ticket may win than to the money they would earn from its sale. In the *No-Endowment* choosing condition, subjects' focus should neither be biased towards the ticket nor the money, because they own neither of the two. We therefore expect to observe a gap between WTA and WTP prices that reveals an EE.

*H1a: Ownership Causes WTA/ WTP Price Gap*

We theorize that strategic markets draw sellers' attention away from their entitlements and towards gains from trade and to estimating buyers' potential WTP. Loosening their fixation on their entitlements should reduce the biased weight given by sellers to their lottery tickets. The profit subjects can earn might even switch the framing of the trade. Instead of experiencing the sale of the tickets as the loss of an entitlement, the subjects may be pushed into a gain frame by the potential profits they could earn asking for prices beyond their actual valuations of the tickets. We predict that the strategic market has a significant debiasing effect compared with the *True Valuation Baseline*.

*H2a: Strategy Treatment Reduces EE*

This debiasing effect should also appear in our second strategic market treatment, which presents subjects with real trading partners.. The counterparts increase the complexity of the subjects' cognitive task, because they must keep in mind that their partner has the same incentives to act strategically. To earn a profit, subjects have to anticipate their partners' decisions and set their prices accordingly. this strategic interaction –typical for real markets – should draw the subjects' attention away from their entitlements, refocusing it on the motivations and the potential WTP's of their counterparts, as well as gains from trade possibly to be earned. As a result we expect a strong debiasing of the sellers compared to the *True Valuation* treatment.

*H3a: Strategic Interaction Reduces EE*

We assume that the two institutions – strategic markets and agency – reinforce each other's debiasing effects. Strategic markets we expect to loosen the subjects' focus on their endowment, lowering their valuations of the tickets and their regret over giving them up. By contrast, agency should reduce regret over the ticket's sale, because it allows the owner to share the responsibility for the trade with an agent (Arlen & Tontrup 2015 a). As such, the two institutions interfere on two different cognitive levels with the causal process driving the EE. We therefore assume they will debias subjects more effectively, potentially driving out the EE completely.

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<sup>16</sup> . The scenarios tested whether subjects understood both that they were best off when they revealed their actual WTA in the Baseline treatment and that they could increase their profit in the strategic market treatments at the risk of losing a beneficial deal.

*H<sub>4a</sub>: Multiple Institutions can Reinforce Debiasing*

### **B. Regret Costs and Loss Aversion Data**

Because sellers focus on their entitlements, subjects should experience more regret over selling their tickets than over forgoing the sales price. We refer to the difference between the two values as differential regret costs. Positive differential regret costs suggest that a subject is biased against trading. Differential regret costs should be large in the *Endowment* condition because of the EE. In contrast, they should be small in the *No-Endowment* condition, as subjects should not be biased towards either option, the money or the ticket. Comparing the two conditions, we expect to find a significant EE in *Baseline*. Our loss aversion measure allows us to categorize the subjects as either loss-averse or rational types. We assume that the loss-averse types should focus their attention more strongly on their entitlements. Therefore we expect the comparison of *Endowment* and *No-Endowment* conditions to reveal, that loss-averse types have a stronger EE than rational subjects.

*H<sub>1b</sub>: EE in Differential Regret Costs and Loss Aversion Data*

Loosening the subjects' focus on their entitlements should reduce the regret they anticipate over giving them up. Comparing the *Strategy* and the *True Valuation* treatments, we expect the strategic market to have a significant debiasing effect. Secondly, if, as we assume, loss-averse types are more likely to be focused on their entitlement, they should also be more likely to benefit from the change of focus the strategic markets induce. Therefore, we expect the price gap between loss-averse and rational types to decrease in a comparison between the *Strategy* and *Baseline* treatments.

*H<sub>2b</sub>: Strategic Markets Reduce Bias in Regret Costs and Loss Aversion Data*

While subjects deliberate as to the strategic elements of interacting with their counterpart, we expect them to focus less on their entitlements' positive attributes'. Strategic interaction should thereby decrease differential regret costs in comparison to the *True Valuation* treatment. As loss-averse subjects should benefit from the debiasing effect more, we expect the gap between loss-averse and rational subjects to be smaller in the *Interaction* than the *True Valuation* treatment.

*H<sub>3b</sub>: Strategic Interaction Reduces Bias in Regret Costs and Loss Aversion Data*

Strategic markets and agency should impact and reduce regret costs over trading with separate mechanisms: by changing the owners' attentional focus and by allowing subjects to share responsibility. The more loss-averse subjects should experience higher level of regret costs, thus leading them to ask for higher sales prices than the rational types. Reducing regret effectively should remove the price gap between loss-averse and rational subjects.

*H<sub>4b</sub>: Multiple Institutions Reduce Bias in Regret Costs and Loss Aversion Data*

### **C. Second Market: The Effect of Strategic Decision Making on the EE**

We cannot directly observe whether strategic markets shift subjects' attention from their entitlements' attributes to the gains from trade. However, if participants set a strategic price, they must have devoted some attention to strategic reasoning, rather than having been focused on their entitlement alone. We assume that this change of focus reduces their bias. To test our prediction, we compare subjects who set a strategic price with subjects who ask for the same

price, both in the true valuation and the strategic market. We expect strategic sellers will reveal a smaller EE in comparison to the *Endowment* and *No-Endowment* conditions (H<sub>5</sub>).

*H<sub>5</sub>: Strategically Acting Subjects have a Smaller Bias.*

## VII. Results

We first report the WTA and WTP prices across all treatments to analyze the EE and the effect strategic markets have on the bias. In the second part, we present the results for differential regret costs and the loss aversion data; we conclude the result section with the second market data, in order to analyze whether subjects who act strategically have a smaller bias.

### A. Pricing Decisions

Comparing the *Endowment* and *No-Endowment* conditions of the *True Valuation Baseline* treatment shows that ownership causes a strong EE (H<sub>1a</sub>). We find the characteristic gap between the mean WTA price that subjects demand for selling their ticket (€5.79) and the mean choosing price (€3.76). The price gap yields €2.03 and is significant at  $p$ -value  $<0.01$  (two-tailed Mann Whitney); the cohen's  $d$  of -0.82 is suggests a bias of a large effect size (see Table 1<sup>17</sup>).

**Table 1: Non-Parametric Treatment Comparisons**

Treatments	Price € (WTA / WTP)		Differential Regret Costs		Loss Aversion		
					Loss Averse	Rational	$p$ -value
Endow <i>True Value</i>	5.79	$p < .01$	2.13	$p < .01$	6.62	3.47	$p < .01$
No-Endow <i>True Value</i>	3.76		0.28		4.04	3.47	$p = .23$
Endow <i>Strategy</i>	5.71	$p = .33$	0.89	$p = .84$	5.93	5.41	$p = .53$
No-Endow <i>Strategy</i>	5.11		0.49		5.25	4.82	$p = .47$
Endow <i>Interaction</i>	4.54	$p = .45$	-0.24	$p = .76$	4.86	4.39	$p = .78$
No-Endow <i>Interaction</i>	4.14		-0.03		3.87	4.56	$p = .23$
Endow <i>Agency&amp;Markets</i>	4.03	$p = .72$	-0.20	$p = .95$	4.1	3.97	$p = .70$
No-Endow <i>Agency&amp;Markets</i>	4.18		-0.22		4.39	4.0	$p = .37$

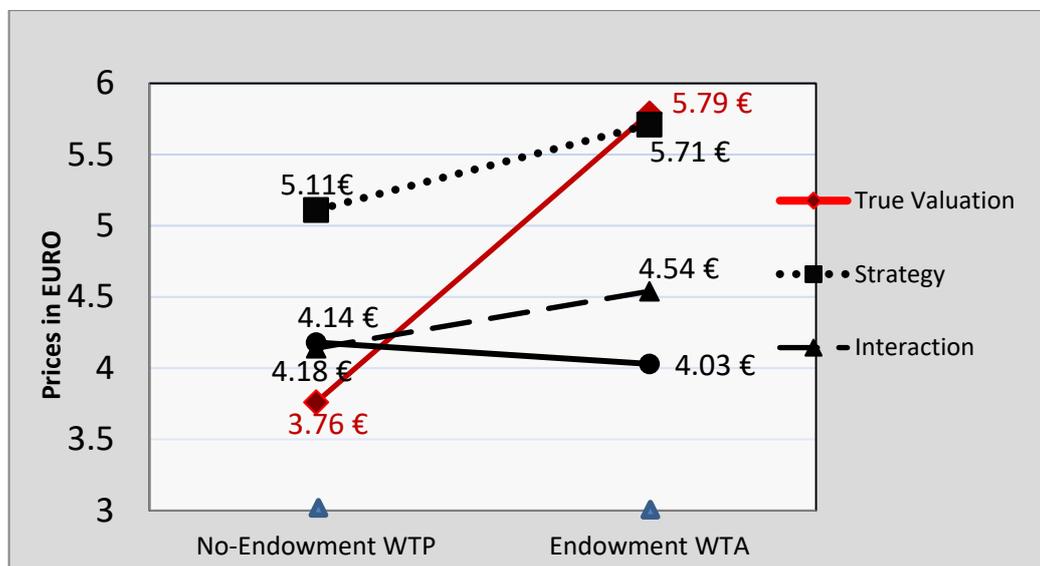
\* $p$ -values refer to two tailed Mann-Whitney tests.

Comparing the two conditions of the *Strategy* treatment shows that, in support of H<sub>2a</sub>, the strategic market reduces the WTA/ WTP price gap considerably. In the *Endowment* condition, the sellers demand a mean price of €5.71 for their tickets; the mean choosing price in the *No-Endowment* condition is only marginally lower at €5.11. The gap between WTA/ WTP prices having thus shrunk to €0.60, the price gap becomes insignificant and the effect size becomes smaller ( $p$ -value 0.33 two-tailed Mann Whitney; cohen's  $d$  -0.24). Keep in mind that

<sup>17</sup> As it is practice in Experimental Economics we will report non-parametric test results for the treatment comparisons and then regression results. However, our data do also fulfill the requirements for parametric testing; the results are not affected by our choice of method.

subjects in both conditions strategically increase their pricing in response to the market incentives (see below for the second market data)<sup>18</sup>.

**Figure 1: Debiasing Effect of WTA and WTP Prices**



The *Interaction* treatment has an even stronger debiasing effect. The mean WTA is €4.54, and the choosing price in the *No-Endowment* condition differs only insignificantly from this value, with a mean WTP of €4.14. In line with H<sub>3a</sub>, the treatment comparison reveals that the strategic interaction has shrunk the gap between WTA and WTP prices even further, to a difference of only €0.40 ( $p$ -value 0.45 two-tailed Mann Whitney) and a Cohen's  $d$  of -0.14, which suggests less than a small effect size<sup>19</sup>. In the *Interaction* treatment, the bias has not only shrunk to only one-fifth of its original size in *Baseline*. The WTA is also significantly lower than in the *Endowment* condition of the *Baseline* treatment.

Finally, we report the results of the *Agency&Markets* treatment, which presents subjects with two debiasing institutions. Supporting H<sub>4a</sub>, the EE vanishes in this treatment completely: With a WTA of €4.03 and a WTP of €4.18 the price gap is even slightly reversed with a negative -€0.15 ( $p$ -value 0.72 two-tailed Mann Whitney; Cohen's  $d$  -0.06).

## Debiasing Effects

<sup>18</sup> At first, the reduction of the WTA/WTP gap in the *Strategy* treatment may not seem to be caused by debiasing. Subjects increasing their WTP in the *No-Endowment* condition appear to be closing the gap. However, the participants lift both the prices both in the *Endowment* and the *No-Endowment* condition when presented with the incentives for strategic trading (see the second market data section IV.3b). Because debiasing in turn reduces the price, the WTA does not rise. In the *No-Endowment* condition, by contrast, strategic behavior drives the subjects' WTP up, because the strategic market has no debiasing effect. Thus, the small gap between the WTA/WTP prices reveals the powerful debiasing effect of the strategic market.

<sup>19</sup> Note also that the WTA prices in the strategic markets differ from the WTA price in the true valuation *Baseline* market. Subjects' in the strategic market have strategically lifted the price; to reach an agreement in a negotiation they may reduce the price. In the *True Valuation* treatment by contrast the WTA reflects the subjects' biased but not exaggerated valuation of the ticket. In a negotiation the owner therefore is unlikely to accept a lower price. The different nature of the two WTA prices further supports that the debiasing effect of the strategic markets creates a larger range for agreement facilitating trades.

In order to show that the strategic market has a significant debiasing effect, we estimate a linear regression model, which allows us to compare the size of the EE across the different treatments. We construct dummy variables for *EndowmentStatus* and the three treatments: *Strategy*, *Interaction* and *Agency&Markets*. *EndowmentStatus* measures the difference between prices in the *Endowment* and the *No-Endowment* conditions, and thus estimates the size of the EE across the treatments. To test our main hypotheses, we construct three interaction terms. *Strategy\*EndowmentStatus* measures whether the strategic market of the *Strategy* treatment reduces the size of the EE. Accordingly, the second term, *Interaction\*EndowmentStatus* measures whether the strategic trading with a counterpart decreases the EE. Thirdly, the term *Agency&Markets\*EndowmentStatus* estimates whether the two institutions – agency and markets – have a cumulative debiasing effect. We also include demographic variables in the model to control for age and gender.

**Table 2: Regressions for Pricing Decisions, Regret Costs and Loss Aversion**

	Column I. Pricing Decisions	Column II. Differential Regret Costs		Column III. Loss Aversion		Column IV. Strategic Be- havior
Endowment Status	2.030*** (0.486)	1.600*** (0.556)	Endowment Status	0.360 (0.369)	Endowment Status	3.357*** (0.601)
Strategy	1.345*** (0.486)	0.120 (0.556)	Loss-Aversion Type	0.761 (0.500)	Strategic Behavior	0.878 (0.413)
Interaction	0.375 (0.486)	-0.440 (0.556)	Strategy	1.393 (0.554)	Strategic Markets	-0.305 (0.368)
Agency & Markets	-0.420 (0.486)	-0.680 (0.556)	Interaction	0.420 (0.541)	Strategic Markets *Endowment	-1.817*** (0.588)
Strategy* Endowment	-1.425** (0.688)	-1.300* (0.786)	Agency & Markets	0.252 (0.510)	Strategic Behavior *Endowment	-1.964*** (0.518)
Interaction* Endowment	-1.625 (0.688)	-1.940** (0.786)	Endowment Status *Loss-Aversion Type	2.219*** (0.721)	Constant	3.558 (0.420)
Agency&Markets* Endowment	-0.2180 (0.688)	-1.580** (0.786)	Endowment Status *Loss-Aversion Type *Strategy	0.127 (0.290)	R <sup>2</sup>	0.12
Constant	3.765 (0.344)	0.460 (0.393)	EndowmentStatus *Loss-Aversion Type *Interaction*	-2.169** (0.887)		
R <sup>2</sup>	0.09	0.08	Endowment Status *Loss-Aversion Type *Agency&Markets	-2.861*** (0.942)		
			Agency&Markets *Loss Aversion Type	0.093 (0.852)		
			Interaction *Loss-Aversion Type	-0.193 (0.829)		
			Strategy *Loss Aversion Type	-0.182 (0.834)		
			Constant	3.559		
			R <sup>2</sup>	0.12		

\*, \*\*, \*\*\* indicate significance at the 10%, 5%, and 1% level. Standard errors are reported in parentheses.

First, the analysis confirms that ownership induces a strong bias ( $H_{1a}$ ). The result shows a significant effect of *EndowmentStatus* on sales prices with  $\beta = 2.030$   $p$ -value  $< 0.01$ . Our main hypothesis – that strategic markets debias subjects ( $H_{2a}$   $H_{3a}$  and  $H_{4a}$ ) – also finds strong support the *Strategy* treatment (*Strategy\*EndowmentStatus*  $\beta = -1.425$  and  $p$ -value 0.04) substantially reduces the biasing impact *EndowmentStatus* has on pricing decisions. The debiasing effect of the *Interaction* treatment is even stronger: the treatment reduces the EE with  $\beta = -1.625$  and  $p$ -

value 0.02 for *Interaction\*EndowmentStatus*. Confirming the non-parametric results, we find the most effective debiasing for the *Agency&Markets* treatment to be  $\beta = -2.180$  and  $p$ -value  $< 0.01$ . We have seen above that the two institutions completely drive out the bias. The coefficient also suggests that the two institutions together produce the strongest debiasing effect of the three strategic market treatments. However, as the debiasing effect of the *Strategy* treatment alone is already so strong, it does not leave us with a large enough window to show significant evidence. The regression results are reported in Column I. of Table 2.

## B. Additional Measures: Regret Costs and Loss Aversion Data

### 1. Regret Costs

In the *Endowment* conditions, we elicit differential regret costs by subtracting the level of regret they anticipate over keeping their ticket (losing the sales price) from the level of regret subjects anticipate over selling their ticket (losing a potential lottery prize). Similarly, in the *No-Endowment* conditions, we elicit differential regret costs by subtracting the regret subjects anticipate over choosing the money (forging a potential lottery prize) from the regret the subjects expect to feel over choosing the ticket (forging the money for a ticket that may be a blank)

In the *True Valuation Baseline* treatment, differential regret costs should bias subjects against trading ( $H_{1b}$ ). Indeed, in the *Endowment* condition, subjects anticipate differential regret costs of 2.13 pushing against the trade (6.71 over selling and 4.58 over keeping the ticket). In the *No-Endowment* condition, by contrast, differential regret costs approximate zero with 0.28 (5.00 over choosing the money and 4.72 over choosing the ticket). Comparing the regret costs across the two conditions shows strong support for an EE: the costs are significantly larger in the *Endowment* than in the *No-Endowment* condition (+1.85; two-tailed Mann-Whitney  $p$ -value  $< 0.01$ ).

We expect the strategic market in the *Strategy* treatment to reduce this bias ( $H_{2b}$ ). In the *Endowment* condition of the *Strategy* treatment, subjects anticipate differential costs of 0.89 (4.60 over selling their ticket and 3.71 over keeping it). In the *No-Endowment* condition, the differential regret costs are 0.49 (4.19 over choosing the money and 3.70 over choosing the ticket). Comparing the *Endowment* with *No-Endowment* condition shows a much weaker and insignificant EE in regret costs with 0.40 ( $p$ -value 0.64 two-tailed Mann-Whitney).

Regret costs in the *Interaction* treatment provide an even stronger support for our theory that strategic markets decrease the EE. In fact, subjects anticipate experiencing more regret costs over forgoing the sales price (4.06) than over selling their tickets (3.82), leading to negative differential regret costs of -0.24 in the *Endowment* condition. In the *No-Endowment* condition, regret costs are balanced with -0.03 (4.18 over choosing the ticket and 4.21 over choosing the money). Comparing the regret costs between the *Endowment* and *No-Endowment* conditions shows that the EE has completely disappeared in line with  $H_{3b}$  (-0.21<sup>20</sup>;  $p$ -value=0.76 two-tailed Mann-Whitney).

Finally, the *Agency&Markets* treatment also completely wipes out the bias. With a -0.20 differential, regret costs are almost balanced in the *Endowment* condition (3.46 over selling their ticket and 3.66 over keeping it). In the *No-Endowment* condition, we find regret costs of

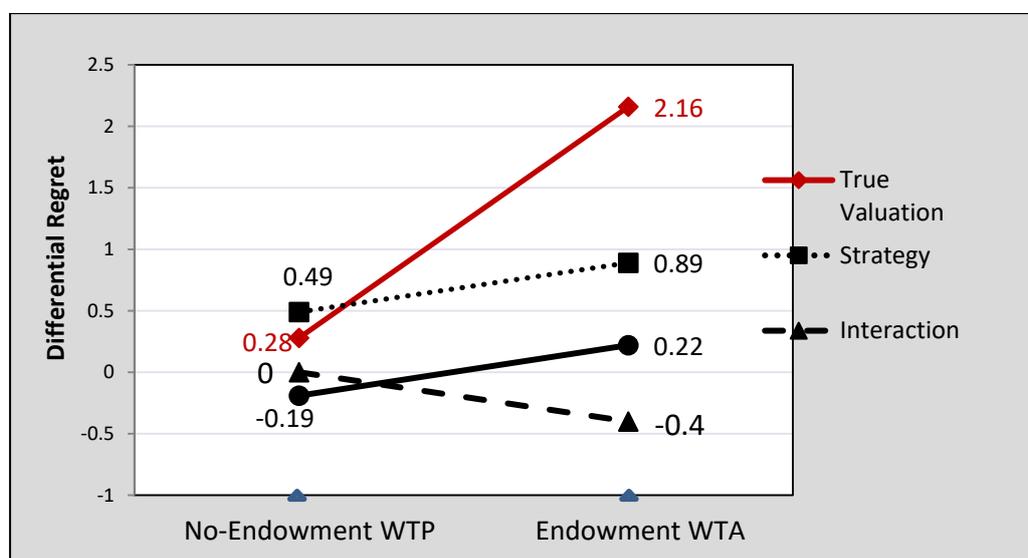
<sup>20</sup> The negative sign indicates that, if anything, regret pushes subjects slightly towards trading.

0.22 (3.58 over choosing the ticket and 3.80 over choosing the money). In line with  $H_{4b}$ , the EE has vanished: comparing the *Endowment* and *No-Endowment* conditions yields practically no bias ( $-0.02^{21}$ ;  $p$ -value=0.95 two-tailed Mann-Whitney).

### Debiasing Effects

Once more, we estimate a linear model to show that the strategic markets significantly debias differential regret costs. We construct dummy variables for *Endowment Status* and our three treatments. To measure the debiasing effect the treatments have on the WTA/ WTP price gap, we estimate the interaction terms *Strategy\*EndowmentStatus*, *Interaction\*EndowmentStatus* and *Agency&Markets\*EndowmentStatus*.

**Figure 2: Debiasing Effect on Differential Regret Costs**



First, the results show evidence for an EE ( $H_{1b}$ ): *EndowmentStatus* biases regret costs significantly ( $\beta = 1.600$   $p$ -value  $< 0.01$ ). Second, we find strong support for our central claim that strategic markets have a substantial debiasing effect. All three strategic market treatments – the *Strategy* treatment ( $\beta = -1.300$  and  $p$ -value 0.09), the *Interaction* treatment ( $\beta = -2.039$  and  $p$ -value 0.01) and the *Agency&Markets* treatment ( $\beta = -1.580$  and  $p$ -value 0.04) – significantly decrease the bias in respect to regret costs. We report all results below in table 2, Column II.

## 2. Loss Aversion Data

We distinguish between rational subjects who enter both lotteries and loss averse subjects who enter either only one or no lottery<sup>22</sup>. As hypothesized ( $H_{1b}$ ) in the *Baseline* treatment, the loss-averse participants reveal a strong bias of €2.58 ( $p$ -value  $< 0.01$  two-tailed Mann-Whitney)<sup>23</sup>,

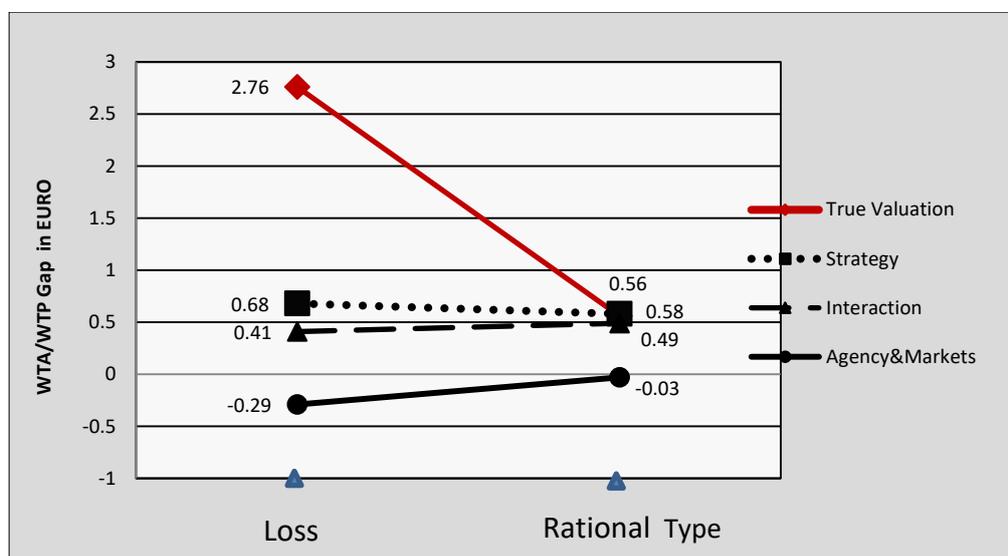
<sup>21</sup> The negative sign indicates that, if anything, regret pushes subjects slightly towards trading.

<sup>22</sup> Distinguishing between stronger and weaker loss-averse subjects does not change our results.

<sup>23</sup> We have a few subjects with inconsistent choices, who enter the first but not the second lottery, even though the likelihood that they will experience a loss is considerably smaller in the second lottery. The results we report here include these subjects, because the subjects' decisions nevertheless suggest that they are loss-averse. The results do not change when we remove the inconsistent observations from the sample.

while the rational types reveal a much smaller gap between WTA/WTP prices at €0.56 ( $p$ -value 0.38 two-tailed Mann-Whitney). Supporting our predictions ( $H_{2b}$ ,  $H_{3b}$  and  $H_{4b}$ ), all three strategic market treatments reduce the price gap and leave both loss averse and rational types without a significant EE. In the *Strategy* treatment we find a gap of €0.68 for loss-averse ( $p$ -value 0.61 two-tailed Mann-Whitney) and a gap of €0.59 for rational types ( $p$ -value 0.58 two-tailed Mann-Whitney). In the *Interaction* treatment, we measure €0.41 ( $p$ -value 0.49 two-tailed Mann-Whitney) for loss-averse and €0.49 for rational subjects ( $p$ -value 0.70 two-tailed Mann-Whitney). Finally, in the *Agency&Markets* treatment we observe a gap of €0.29 ( $p$ -value 0.61 two-tailed Mann-Whitney) for loss-averse and €0.03 for rational subjects ( $p$ -value 0.88 two-tailed Mann-Whitney).

**Figure 3: Debiasing Effect by Subject Type (Loss Averse vs. Rational)**



### Debiasing Effects

To measure the strategic markets' effects on both rational and loss-averse subjects, we estimate a linear model, including dummy variables for *EndowmentStatus* and *LossAversionType*, as well as one for each of the three strategic market treatments. The term *EndowmentStatus\*LossAversionType* reveals whether loss-averse subjects have a stronger bias than rational types. The two-way interaction terms *EndowmentStatus\*LossAversionType\*treatment* measure the debiasing effect the three market treatments have on the EE. As expected, *EndowmentStatus\*LossAversionType* suggests that the WTA/ WTP gap for loss-averse subjects is significantly larger than for rational subjects, whose bias is much smaller ( $\beta = 2.219$   $p$ -value  $< 0.01$ ). Each of the market treatments significantly reduces this gap between the two subject types: for *EndowmentStatus\*LossAversionType\*Interaction* we find ( $\beta = -2.169$   $p$ -value 0.01); the two-way interaction with the *Strategy* treatment yields ( $\beta = -1.905$   $p$ -value 0.02); and, finally, for the interaction with the *Agency&Markets* treatment, we measure the strongest debiasing effect ( $\beta = -2.861$   $p$ -value  $< 0.01$ ).

### 3. Second Market Prices: Strategic Sellers have a Smaller EE

In order to provide further evidence that focusing on the incentives of the strategic market reduces subjects' EE, we compare subjects' pricing decisions in the first and second markets. Subjects who ask for a higher price in the first strategic market than in the second true valuation market reveal that they do not focus their attention on their entitlement alone, but also on the profit they can make in the trading process. Our theory suggests that these strategically-acting subjects should have a comparatively smaller bias (H<sub>5</sub>). In the *True Valuation* treatment, strategic subjects may ask for a higher price in the second strategic market. We expect both types – strategic and non-strategic subjects – to be equally biased.

To test our prediction, we elicit the gap between WTA/ WTP prices of participants who set a strategic price, then comparing them with the subjects who did not try to earn an extra profit in the strategic market. We pool the *Strategy* and the *Interaction* treatments. The results support our prediction. Strategic types do indeed not reveal an ownership bias<sup>24</sup>; they ask for almost exactly the same price in the *Endowment* than the *No-Endowment* condition (€0.02; *p*-value 0.77 two-tailed Mann Whitney). The subjects who did not make a strategic decision, by contrast, reveal a larger gap of €0.98 between WTA/ WTP prices (*p*-value 0.14 two-tailed Mann Whitney)<sup>25</sup>.

As expected in the *True Valuation Baseline* treatment, in the absence of a debiasing effect, we find a similar gap for both types: for strategic types we find €2.06 (*p*-value <0.01 two-tailed Mann Whitney) and €1.82 for non-strategic types (*p*-value <0.01 two-tailed Mann Whitney).

We estimate a linear model to test whether the strategic types are, as hypothesized, significantly less biased by their endowment status than the non-strategic types. A dummy variable captures the subject type. The dummy variables of *EndowmentStatus* and *StrategicMarket* serve to distinguish whether or not subjects were endowed and placed into a strategic market. We construct the following interaction terms. First, the EE should decrease when subjects are placed in a strategic market, as measured by *Strategic Market\*Endowment Status*. Our central claim - that the size of the EE measured will depend on whether the subjects act strategically or not – is captured by *Subject Type\*Endowment Status*.

Supporting our hypothesis (H<sub>5</sub>), the interaction is significant ( $\beta = -1.945$  and *p*-value <0.01), suggesting that subjects who made a strategic pricing decision have a significantly smaller bias. The finding fits our attention-based explanation for the debiasing effect of strategic markets: when subjects act strategically, they focus less attention on their entitlement and therefore have a smaller or no bias at all. Interestingly, the main effect of *SubjectType* on prices is insignificant ( $\beta = 0.305$  and *p*-value 0.41), suggesting that strategic behavior is not generally associated with overall higher prices. Our theory explains this finding: the smaller EE of the strategic subjects counterbalances the price increase caused by their strategic trading behavior. We report the full regression results in Column IV. of Table 2.

<sup>24</sup> Results for the *Strategy* treatment (strategic: 0.01; non-strategic:1.4) and the *Interaction* (strategic: 0.06; non-strategic:0.72) treatment show the same pattern.

<sup>25</sup> The subjects who do not set a strategic price may also focus some attention on the incentives in their decision-making process, even though they do not decide in the end to set a strategic price. For our purposes, the opposite claim is sufficient: the subjects who set a strategic price did focus some attention on the market incentives.

## VIII. Discussion and Policy Implications

### A. Discussion

In their seminal series of papers, *Plott and Zeiler* (2005, 2007, 2011) have identified confounds and misconceptions in the experimental design of many EE studies. We attended to their critique when we designed this study. For example, *Plott and Zeiler* have argued that endowing subjects with goods selected by the experimenter deliberately for them may signal to the participants that the good they receive is of particular value. This perception may then cause endowed participants to ask for a higher sales price. We avoid this confound by allocating the tickets randomly (see design section); the instructions inform the subjects about the protocol that we use for the random assignment. The instructions also clarify that a software program has sampled the seven numbers we tipped on the lottery tickets.

*Plott and Zeiler* (2005, 2007 and 2011) also suggested that random allocation experiments often impose higher transaction costs on trading than keeping the entitlement. For example, in some studies, experimenters seated all participants in a classroom, with subjects who wanted to trade needing to raise their hands. Additionally, if subjects who want to keep their entitlements can remain inactive, they may feel less responsible for the outcome, in comparison to the subjects who have to act in order to trade. Action triggers more responsibility than omission (Baron et al. 1994). The more responsible the subjects feel, the more regret they may anticipate over potential negative outcomes to their decisions. In other words, the gap between WTA and WTP prices may increase because of an omission bias, and not because of loss aversion. In our study we ensured that the participants had to perform the same action, whether they wanted to trade or keep their entitlement. In both conditions, the subjects are presented with price lists and must in the *Endowment* condition state for each price whether they want to sell or keep the tickets and in the *No-Endowment* condition, they must state whether they prefer the money or the ticket.

Our experimental design also prevents the subjects from influencing each other's choices: When participants seated in the same room raise their hands in order to trade, this may affect the choices of other subjects, who might be induced to follow the example (see Arlen & Tontrup 2015 b). In our online study, participants could not observe the behavior of other subjects, remaining anonymous during the entire experiment. Finally, *Plott and Zeiler* suggest that subjects may not understand that the random price mechanism incentivizes them to reveal their true valuation. They show that the BDM mechanism can lead some subjects to make confused pricing decisions. To avoid this problem, as well as to teach the subjects how the mechanism operates, we employed a set of training scenarios and control questions (all instructions are provided in the appendix). Subjects could only proceed with the experiment if they had completed the questions correctly. The participants – current university students and university graduates - did not show any difficulty understanding our experimental design and instructions. In particular, the subjects recognized in the *True Valuation* treatment that they would be paid the random price, not the amounts they demanded for selling their tickets. That they were required to perform payoff calculations made the fact that they could not increase their profit by asking for a higher price salient. In the *Strategy* treatment, by contrast, the subjects realized that they could benefit from strategic behavior by pushing the price beyond their true valuation. Their answers also showed that the subjects were aware, that by overstating their valuation,

they could risk losing all gains from trading. The participants appeared to understand the treatments that employed the random price mechanism with equivalent ease to those involving interaction with a real counterpart.

Our replication of the EE in the *Baseline* treatment succeeds a recent series of studies observing an EE while also attending to *Plott* and *Zeiler's* methodological critique (see Isoni et al. 2011; Arlen & Tontrup 2015 a, b; Marcin & Nicklisch 2016 and others). This evinces that, even after *Plott* and *Zeiler's* push for improving experimental protocols, the EE remains a robust phenomenon of human decision-making.

We avoid potential experimenter demand effects by maintaining the participants' anonymity throughout the entirety of the study, including the payment process. To ensure full privacy, we prompt the subjects to create anonymous e-mail accounts and to invent personal codes allowing us to pay them without forcing them to reveal their identities. In order to prevent the participants from deducing the study's goal, we only informed the subjects about the particular treatment in which they participated.

Studies that use a random price mechanism often provide subjects in the *No-Endowment* condition with an initial monetary endowment, which can be used to buy the entitlement. This design leads to varying wealth levels in the two conditions, in particular because the budget needs to be large enough for higher WTP's to not be truncated. Strictly speaking, this design varies two factors at once: endowment status and budget. The choosing design that we implement for eliciting the subjects' valuations does not require allocating budgets, permitting us to vary only the endowment status across treatments (see Johnson 2007).

Although we made a design choice to endow subjects with lottery tickets, this does not limit our results' applicability to entitlements of uncertain value. The cognitive process we suggest drives our findings pertains to all types of goods. Strategic incentives can draw attention from the positive attributes of an entitlement – no matter whether the entitlement is a consumer good, real property, or a patent.

## **B. Policy Implications**

### **1. Legal Interventions and their Information Problems**

The EE has attained such prominence in the legal literature for two reasons. First, the bias is immediately relevant for the efficiency of trading. Private ordering rests on the idea that, supported by an infrastructure of institutions, people will voluntarily trade their entitlements until they are owned by those who value them the most. The more the EE affects trading behavior, the greater the chance that more goods could end up in the hand of owners who, in comparison to other market participants, would value those goods considerably less.

The second reason why the EE appears to severely threaten private ordering derives from its effect size. A meta-analysis of 45 empirical studies by Horowitz and McConnell (2002) found a median gap between WTA and WTP prices with a ratio of 2.6. Following this analysis, people will assign a 2.6 times higher value to the same good once they own it. The size of the EE can even increase by a factor of 10 in relation to health and safety goods (see also the meta-

analysis by Tunçel & Kammit, 2014). If this data on the EE held for transactions in real markets, many buyers and owners would not be able to identify – let alone complete – an exchange that is beneficial, absent the bias.

Given the wealth of empirical evidence about the EE, it is not surprising that one can find many proposed interventions to address the bias in the legal literature: Korobkin (2013) counted more than 1,600 articles. When we categorize the suggested interventions, we can distinguish two general types. A first type aims to reduce the EE directly, by weakening people's feeling of entitlement for their property (Buccafusco and Sprigman 2011; Korobkin 2000; Rachlinski and Jourden 1998). In one example, the authors propose replacing property with liability rules to weaken owners' entitlements. The absence of EE property rules might allow private ordering to more efficiently allocate entitlements. However, in a world where entitlement holders are biased by ownership, limiting entitlement property rights could increase efficiency. Liability rules also enable involuntary appropriations, allowing those who value the goods more to gain entitlements for prices below the owners' biased valuations (Calabresi & Melamed 1972).

A second category of interventions aims to attenuate the harm the EE inflicts without trying to remove the bias. For example, there are a number of scholars who want to adopt contractual default rules and resource allocations favoring groups who will supposedly value the property more than the current owners, but who will not enter a trade as long as the current owners' demand is biased (e.g., Jolls 2000; Jolls et al. 1998; Korobkin 1998; Sunstein 2002).

Both types of policy interventions impose costs and face a severe information problem. Ideally, policymakers would observe people's actual choices to identify the default contract terms most likely to maximize welfare (Coase 1960). However, if most market participants are biased, then policymakers cannot rely on the market; they have to adopt provisions they expect to be welfare-enhancing on theoretical grounds (see Sunstein 1986, 2002). This is a very difficult task, as valuations are deeply subjective, affected by an endless number of personal motives, uncertainty and change.

In a related problem, policymakers cannot differentiate between those actors who are biased and those who are not, and cannot identify what transactions would occur if the bias was absent. This makes it difficult to determine how strongly the EE really affects pricing in a particular market. If the EE does not affect the majority of owners, then liability rules cannot substantially increase the number of transfers that would occur under a regime of property rules. Nevertheless, the intervention would impose costs on all owners, independently of whether they are, in fact, biased or not (see Arlen & Tontrup 2015 a). Whenever the presumption that the EE impacts most trading behavior in the targeted area is invalid, the intervention is likely to be inefficient<sup>26</sup>. Our results suggest that a general presumption that the EE biases and impairs trading behavior may often be false and may produce more costs than benefits.

## 2. Strategic Markets Reduce the Endowment Effect

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<sup>26</sup> It requires field work to analyze whether a WTA/ WTP price gap exists in a particular market or not.

When lawyers recommend policy interventions that aim to attenuate the impact of the EE, their actions seem to be thoroughly justified by a large body of empirical evidence. We argue, however, that most of the evidence ultimately misleads policy recommendations, as it does not speak to the main legal concern: whether or not the EE substantially impairs private exchange. The two standard experimental paradigms used in EE studies – the random allocation and the random price design – incentivize subjects to reveal the true valuations they accord to their entitlements (see the theory section). Both paradigms were developed to analyze and proof various phenomena of loss aversion and reference dependence. They present subjects with a single task: figuring out the personal value the good holds for them. In order to decide what price to request, the subjects need only to process and weigh the good's value-increasing and value-decreasing attributes; other information is not relevant and is not provided to the participants.

Trading in real markets has little in common with this simple valuation task. The goal of market exchange is typically to earn a profit, presenting sellers with a much more complex cognitive task. Sellers will study market prices and their trends; they will try to anticipate the buyers' actual WTP; they will consider their partners' business reputation and solvency; and they will take into account the potential for future deals, as well as many other relevant economic factors. After all, professional sellers will be more concerned with potential buyers than with their own valuations for the sales goods. Our theory and evidence suggest that the much more cognitively complex task of strategic trading loosens the owners' focus on their entitlements, thereby reducing or even eliminating their bias. We increase the strategic complexity of the cognitive task required of participants across our three treatments, approximating actual trading behavior. The *True Valuation* treatment presents subjects with a standard design focusing subjects on their entitlements, as only the good's attributes are relevant to their pricing decisions. In the *Strategy* treatment, by contrast, participants have to make a strategic trading decision: given the distribution of prices that may be randomly drawn, they have to find a balance between the potential profit gained from pushing prices beyond their true preferences, and the risks they may be willing to take that could spoil the deal. In the *Interaction* treatment, finally, seller and buyer interact with each other, requiring them to anticipate and respond to the (potentially) strategic behavior of their counterpart. Our second market results demonstrate that subjects who respond to the incentives and ask for a strategic price beyond their true WTA do not reveal any EE at all. The finding stands in line with the body of literature reporting that professional traders, who trade for profit by definition, often do not reveal any bias (see List 2003). List attributes this finding to the professional sellers' experience and better knowledge of market prices. On the contrary, our theory and evidence suggest that traders may focus their attention fully on gains from trade because their personal valuations of the goods hold little relevance to the prices they demand.

Our findings do not question the assumption that the EE is a robust phenomenon of human decision-making. Our study is concerned with the policy and legal relevance of this bias. We show that the size of the bias is heavily dependent on the cognitive task presented to the owners, or that they wish to solve. If they are presented with the task of valuing their entitlements, they focus their attention on their entitlements' positive attributes, with ownership strongly biasing their valuations, as shown in many previous studies. However, when sellers trade in a market context, in which pricing decisions are strategic and in which their goal is to earn a profit, the EE shrinks dramatically - leaving only insignificant evidence of a very small

effect size in our study. When trading in strategic markets involves also other market institutions, like agency, the bias seems to disappear entirely.

### 3. Policy Relevance of our Theory and Evidence

As trading characteristically has strategic elements, our results should apply to many, if not most transactions. Strategic trading behavior is ever-present in markets with incomplete competition –, for example, whenever goods are not standardized, and prices are not easily comparable or transparent. Assets with uncertain prospects are often priced with a large prognostic element, such as when patents are licensed or sold. The more difficult the future return is to estimate, the larger is the space for strategic pricing and bargaining. The same holds true for real property or used goods, whose value is often uncertain. The trading situation can also assign strategic market power. In a hold up scenario, for example we expect owners to focus their attention primarily on how far they can push up the price without jeopardizing the trade. Hidden transaction costs can also complicate the direct comparison of prices, enabling market participants to strategically exploit a lack of transparency. For many products and services, bargaining over additional terms is typical.

In real markets the strategic complexity of the decision-making task will often be considerably higher compared with the study we implemented which supports the ecological validity of our findings. Traders in real markets face thick layers of strategic incentives that can reach far beyond the immediate trading context: reputation costs for future deals that prevent sellers from taking advantage of their partners; the long-term price trends of their entitlement, suggesting to either sell or keep their stocks and real property; outside offers that may occur at a later point; other deals they could use the sales price for; promotion; and many more. Trading encompasses the consideration of all these strategic elements, which reduces the sellers' focus on their entitlement, and as a result, reduces their bias.

In order to estimate the actual relevance of the EE for private ordering, policy interventions should also consider the interplay of all institutions holding debiasing potential. Their debiasing effects may reinforce each other, should the institutions provide separate debiasing mechanisms that interfere with the process causing the bias. Professionals typically employ many institutions when they trade, the most common being the ones we tested: strategic markets and agency. Our theory and evidence indicate that strategic markets reduce owners' attentional focus on their property, thereby debiasing their valuations of the goods; positive attributes. Agency, by contrast, reduces the regret owners anticipate over trading, as they can share the responsibility for the trade (Arlen & Tontrup, 2015 a). Presented with both institutions in the same treatment, our subjects did not reveal an EE. Because trading will very often involve both institutions, our findings hold important implications for future policy-making.

## IX. Conclusions

In this study, we have presented evidence that strategic markets severely reduce the EE. The result may surprise given the overwhelming empirical evidence research in Psychology and Economics has collected demonstrating that the EE is a robust phenomenon of human decision making. Our study does cast any doubt on the validity of these results. Instead, we argue that, while these studies are tailored to promote theory-building and -testing in Economics and Psy-

chology, they disregard the strategic nature of the private exchanges with which the law is concerned. This leads to policy recommendations seeming to overestimate the relevance of the bias for private ordering. Typically, EE experiments incentivize participants to state their true valuations for the entitlements that they can buy or sell. This experimental design is well-suited to demonstrate that valuation depends on reference points, to proof loss aversion, and to underpin Prospect theory. However, as it elevates the bias in comparison to a strategic market context, this design therefore can mislead legal policy.

When people trade their goal is typically to earn a profit. Their behavior is often strategic, and they process large amounts of information holding little connection to the relevant good's attributes and the valuation they personally accord to it: market prices and trends, their personal reputations in business and their communities, the option value of future deals, or strategic situations like hold-ups. Their true valuation of goods is only one cue among many relevant to their ultimate pricing decision.

Because ownership focuses peoples` attention on the positive attributes of their property and biases their valuation, losses loom larger than gains. Our theory and evidence suggest that the strategic elements of trading draw the sellers` attention away from the entitlement to gains from trade. In our study the strategic market eliminates more than 80% of the EE. The subjects who set strategic prices did not reveal a bias at all, in line with the observation that most professional traders are not affected by bias (List, 2003). Trading for profit, they may entirely focus on the gains from trade, rather than the loss of their entitlement, which they keep only with the goal of selling.

Finally, our study demonstrates the importance of taking all potential sources of debiasing into account. When people trade in markets, they typically use more than one institution that can help them debias. When we placed our subjects into strategic markets and provided them with agents for trading, the EE disappeared entirely.

The legal literature has proposed many interventions to prevent the EE from affecting private exchange. These external interventions cannot distinguish whether a transaction does not occur due to the owner's bias or because the transaction is not beneficial, their central problem. Liability rules, for example, weaken all owners' senses of entitlement, whether they are biased or not. External interventions operate on the presumption that the EE substantially impairs trading in the target area, otherwise they are inefficient. Our results suggest that this presumption may often lack validity. Interventions should be undertaken cautiously, based upon the existence of actual empirical evidence of relevant price gaps in a particular market. Otherwise, they may impose more costs than benefits.

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## Appendix for Online Publication

### I. Summary of Treatments and Conditions

#### A. True Valuation Treatment

##### 1. Endowment True Valuation

Subjects are endowed with lottery ticket and authentication code. They sell their ticket in exchange for the *random price*, if the lowest price for which they are willing to sell their ticket (sales price), does not exceed the random price, otherwise they keep their ticket.

##### 2. No-Endowment True Valuation

Participants choose for each random price whether they prefer to obtain ticket or money. Subjects are paid the *random price* if the lowest amount for which they state to prefer the money over the ticket, does not exceed the random price. Otherwise they receive a ticket.

#### B. Strategy Treatment

##### 1. Endowment Strategy

Subjects are endowed with lottery ticket and authentication code. If their demand does not exceed the random price, they sell their ticket and are paid *the amount they asked for* in exchange. Otherwise they keep their ticket.

##### 2. No-Endowment Strategy

Participants choose for each possible random price whether they prefer ticket or money. Subjects are paid *the lowest amount for which they state to prefer the money* (their choosing price), if this amount does not exceed the random price. Otherwise they receive a ticket.

#### C. Interaction Treatment

##### 1. Endowment Interaction

Subjects sell their ticket if the price they demand does not exceed the offer of their real partner. They receive the price they ask for, even if the partner has offered a higher amount. If the subjects demand more than the real partner offers then they keep their ticket.

##### 2. No-Endowment\*Interaction

Subjects choose for each possible price their partner may offer whether they prefer obtaining ticket or money. The subjects are paid their choosing price, if they prefer the money for the price the partner offers. Otherwise they obtain a ticket.

#### D. Agency&Markets Treatment

##### 1. Endowment Agency&Markets

Subjects are endowed with lottery ticket and authentication code. They instruct the agent, who is not bound, but paid only if he follows instructions. If the price set by the agent does not exceed the random price, the owner sells his ticket and is paid *the amount the agent asked for* in exchange. Otherwise he keeps his ticket.

##### 2. No-Endowment\*Agency&Markets

The agent chooses for each possible random price whether ticket or money is preferred. The principal is paid *the lowest amount for which the agent states the money is preferred* (the choosing price), should this amount not exceed the random price. Otherwise the principal receives a ticket.

## II. Instructions

*This is an English translation of the German instructions that we used in our study. In the main text we will report the instructions of the No-Endowment condition. The text of the manipulation that differs between the No-Endowment and Endowment conditions is reported in italics. We report the corresponding text for the Endowment condition in squared brackets directly after the manipulation. The instructions for the Endowment condition are also set in italics. Only when it seems necessary, we present the whole text of the two conditions in separate sections. We first (A) report the instructions for the two True-Valuation conditions; second (B) we present the two conditions of the Strategy treatment; under (C) you find the instructions for the Interaction treatment. Finally, under (D) we present the instructions for our last treatment Agency&Markets. At the end, under (E), we report the instructions for our regret and loss aversion measures.*

### A. Instructions True Valuation Treatment

#### [Endowment and No-Endowment]

##### General

Thank you very much for participating in our experiment! All necessary instructions will be presented on the screen. Note that you cannot use your login key more than once. If you logout before you have fully completed the experiment you will not be able to finish and receive a payment. You will be able to earn a sum of money, depending on the decisions you make. It is therefore very important that you read these instructions carefully.

##### Anonymity

In the study you will be given the opportunity to trade an online lottery ticket in a market. The receipt of the lottery ticket is sent to you before the experiment begins. It states all winnings numbers. Note however, you do not own the ticket. The receipt does not establish ownership. For claiming any winnings you need an authentication code. In the course of the experiment you will be presented with choice options. *If you choose the ticket you will be send the authentication code. [Endowment Condition: You are also send an authentication code, which identifies you as the owner of the ticket and allows you to claim any winnings of the ticket.]*

All data will be anonymous. Therefore, in order to receive the lottery ticket you need an anonymous email account. Please go to this website and create an account for this study: <https://securemail.hidemyass.com/>

You do not have to provide any personal information. When prompted to state your “real” email address make one up. Please use an alias for your new email address. The account is created within 30 seconds. Please keep the new account open, until you have completed this study.

Please register here with the email address of your new account:

@Hmamail.com

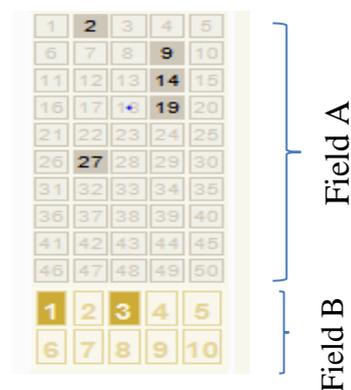
Once we have received your message we will send you *the receipt of the [Endowment Condition: your]* lottery ticket to the new email address.

## Payment

Your income is calculated in €. Your payment is going to be anonymous. You can either choose a pick up or payment via PayPal. You can pick up your earnings in the main office of the AStA in the University castle of Münster. You will be asked to make up a 5 digit code for identification. Your earnings will be put in an envelope marked with your code and deposited for pick up under this code. The employee who will had you the envelope was not involved in the study and does not know what content is in the envelope. Alternatively you can be paid using PayPal if you register your @Hmamail.com mail address at PayPal. If you choose PayPal, you earnings will be sent to your Hmamail account.

## Lottery

In this study you can *receive* [**Endowment Condition: trade**] a real lottery ticket in a market transaction. The lottery ticket was sent to your anonymous email account. The header of the mail is: Lottery Ticket. Please open the email. *The ticket receipt* [**Endowment Condition: Your ticket**] looks like this:



*The lottery ticket that you can receive in the market was selected randomly* [**Endowment Condition: Your lottery ticket was assigned randomly to you**]. We purchased the lottery tickets for the targeted number of experimental participants in advance. Then we randomly drew the tickets and numbered them following the order of the draw. The ticket selected first is sent to the first subject that starts with the experiment, the second is sent to the second participant and so forth.

In the lottery, 5 numbers for field A ranging from 1 to 50 and 2 numbers in field B from 1 to 10 are drawn (see the picture). The rule of the game is therefore: “5 out of 50 plus 2 out of 10.” *As explained above, you do not own the ticket. The receipt does not establish ownership. For claiming any winnings you need to provide the authentication code. Owner is who can provide the code. In the course of the experiment you will be presented with choice options. If you choose the ticket you will be sent the authentication code* [**Endowment Condition: Here is your authentication code for the lottery ticket. The code identifies you as the owners of the lottery ticket and allows you to collect any prize the ticket might win:**

### Order Number: AN 54283402

The winning numbers are marked on the ticket. We used a computer program to randomly select the winning numbers for each ticket.

The lottery distributes several millions of Euro amongst the victors. The winning numbers are publicized on the lotteries` website; we will send you the link to the website of the lottery at the end of the study. Your lottery ticket is for this week`s draw.

There are 12 different winning classes in the lottery. For a prize in the lowest winning class, 3 correct numbers (from both fields A & B) are required. For the top prize, all numbers have to

be correct (five from field A and two from field B). The table below shows the probability of winning and the expected winnings in the 12 classes (for one ticket).

Rank	Number of Correct Numbers Required for a Winning	Probability of Winning	Profit Share*
Rank 1	(5 correct + 2 Euro numbers) -- TOP	1 : 59,325,280	34,000,000.00 EUR
Rank 2	(5 correct + 1 Euro numbers)	1 : 4,943,773	567,839.40 EUR
Rank 3	(5 correct + 0 Euro numbers)	1 : 3,955,019	54,756.30 EUR
Rank 4	(4 correct + 2 Euro numbers)	1 : 263,668	3,683.20 EUR
Rank 5	(4 correct + 1 Euro numbers)	1 : 21,972	242.90 EUR
Rank 6	(4 correct + 0 Euro numbers)	1 : 17,578	113.70 EUR
Rank 7	(3 correct + 2 Euro numbers)	1 : 5,992	56.10 EUR
Rank 8	(3 correct + 1 Euro numbers)	1 : 499	21.80 EUR
Rank 9	(2 correct + 2 Euro numbers)	1 : 418	15.00 EUR
Rank 10	(3 correct + 0 Euro numbers)	1 : 399	13.10 EUR
Rank 11	(1 correct + 2 Euro numbers)	1 : 80	9.70 EUR
Rank 12	(2 correct + 1 Euro numbers)	1 : 35	8.50 EUR

\* The top-prize may be split.

Please confirm that you received and read the E-mail with *the receipt of the [Endowment Condition: your]* lottery ticket. Please state below the first three winning numbers of the ticket you were sent. You will be paid for the experiment only if the numbers you submit are correct.

2	9	14
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### Market Transaction

You are given the opportunity to *choose between an amount of money that is offered to you and the lottery ticket [Endowment Condition: trade your lottery ticket]* in a market. If you receive the ticket, then the experimenter will immediately sent you the authentication code making you the ticket owner.

The outcome of the market, does not depend on your decision alone, it also depends on a random price that will be drawn publicly. Contingent on your decision you will either *receive [Endowment Condition: keep]* the lottery ticket or you will obtain an amount of money. Please note this is not a hypothetical transaction. Your pricing decisions are final and binding!

### The Rules of the Market

You will be presented with a list of all prices between €0.25 and €10.00. [0.25; 0.50; 0.75...9.75; 10.00] You have to decide for each price whether you prefer to *obtain the money or the lottery ticket [Endowment Condition: to sell or keep your lottery ticket]*.

#### At a price of ...

- |         |  |   |
|---------|--|---|
| €10.00: | <input type="radio"/> I would choose the money | <input type="radio"/> I would choose the lottery ticket |
| € 9.75: | <input type="radio"/> I would choose the money | <input type="radio"/> I would choose the lottery ticket |
| ...     |  |   |
| € 5.50: | <input type="radio"/> I would choose the money | <input type="radio"/> I would choose the lottery ticket |
| € 0.25: | <input type="radio"/> I would choose the money | <input type="radio"/> I would choose the lottery ticket |

*[For the Endowment Condition]*

**At a price of ...**

- € 10.00:       I would sell the lottery ticket       I would keep the lottery ticket  
 € 9.75:       I would sell the lottery ticket       I would keep the lottery ticket  
 ...  
 € 0.50:       I would sell the lottery ticket       I would keep the lottery ticket  
 € 0.25:       I would sell the lottery ticket       I would keep the lottery ticket

Your decisions will be compared with a random price that will be drawn in a public lottery after the experiment is over. If you stated that for the random price and all higher prices you prefer to obtain the money [**Endowment Condition: to sell your lottery ticket**], then you receive the random price. If you stated by contrast that you prefer to receive [**Endowment Condition: to keep**] the lottery ticket at the drawn price and at all lower prices, then you receive [**Endowment Condition: keep**] the lottery ticket and the experimenter will send you right after the Eurojackpot draw the authentication code for the ticket [**Endowment Condition: no text**]

**Here are two examples:**

1) Assume the random price is 4 Euro. Then the experimenter will check in your price list, what decision you have made for this price:

**At a price of ...**

- €10.00:       I would choose the money       I would choose the lottery ticket  
 € 9.75:       I would choose the money       I would choose the lottery ticket  
 ...  
 € 4.00:       I would choose the money       I would choose the lottery ticket  
 € 3.75:       I would choose the money       I would choose the lottery ticket  
 ...

The markings show that for the random price and for all lower prices, you want to obtain the lottery ticket. So the experimenter would send you the authentication code for the lottery ticket.

2.) Now assume that the random price would have been 4.25 Euro.

**At a price of ...**

- €10.00:       I would choose the money       I would choose the lottery ticket  
 € 9.75:       I would choose the money       I would choose the lottery ticket  
 ...  
 € 4.25:       I would choose the money       I would choose the lottery ticket  
 € 4.00:       I would choose the money       I would choose the lottery ticket

In this case the list shows that for the random price and all higher prices, you want to obtain the money. So you would receive the random price and the experimenter pays you 4.25 Euro.

**[For the Endowment Condition]****At a price of ...**

- € 10.00:       I would sell the lottery ticket       I would keep the lottery ticket  
 € 9.75:       I would sell the lottery ticket       I would keep the lottery ticket  
 ...  
 € 4.00:       I would sell the lottery ticket       I would keep the lottery ticket

€ 3.75:       I would sell the lottery ticket       I would keep the lottery ticket

...

The markings show that for the random price and all higher prices, you want to keep the lottery ticket.

Now assume that the random price would have been 4.25 Euro.

At a price of ...

€ 10.00:       I would sell the lottery ticket       I would keep the lottery ticket

€ 9.75:       I would sell the lottery ticket       I would keep the lottery ticket

...

€ 4.25:       I would sell the lottery ticket       I would keep the lottery ticket

€ 4.00:       I would sell the lottery ticket       I would keep the lottery ticket

In this case the markings show that for the random price and for all higher prices, you want to obtain the money. So you would sell your lottery ticket and would receive the random price in return; the experimenter pays you 4.25 Euro.

### How We Determine the Random Price

We use the last two numbers that are drawn in the online lottery to determine the random price. The last two numbers are all one-digit numbers, except the “10”; we transform “10” into a zero, so the numbers that can be drawn are: 0.1.2.3.4.5.6.7.8.9. We take the first number as the first digit of the price, so it determines the Euro amount; the second number serves as the second digit and determines the decimal place of Euro Cent; we add a “0” for the single Cent. Finally, we round up the price to the next full 25 Cent for instance 1.20 > €1.25 or 4.32 > €4.50.

Here are two examples: Assume the drawn numbers are: First Number: 9; Second Number: 8. Then the drawn price would be 9.80 Euro. Rounding up to the next full 25 Cent gives us a random price of exactly 10 Euro. Here is a second example: First Number: 10; Second Number: 6. This leads to a price of 0.60 Euro, transforming “10” into “0”. Since we round up to the next full 25 Cent we get a random price of 0.75 Euro. The random price can range from 0.25 Cent up to 10 Euro with each price having an equal chance to be drawn.

Please confirm by checking the box that you accept the rules of the market.



### Questions about the Market Transaction

To ensure that you fully understand the rules of the market, we will present you with a set of short scenarios. Please select the correct answer (notice, you can only proceed with the experiment, if you answer the questions correctly):

1) The random price drawn in the lottery is €4.00. Max has stated that for €3.00 and all higher prices he prefers to obtain the money [**Endowment Condition**: wants to sell his ticket]. What happens?

- Max receives €4.00. [**Endowment Condition**: Max sells his ticket for €4.00.]
- Max receives the lottery ticket. [**Endowment Condition**: Max keeps the ticket.]
- Max receives €3.00. [**Endowment Condition**: Max sells his ticket for €3.00.]

2) The random price drawn in the lottery is €4.00. Max has stated that for €4.50 and all higher prices he prefers *to obtain the money* [**Endowment Condition: to sell his ticket**]. What happens?

- Max receives €4.50 [**Endowment Condition: Max sells his ticket for €4.50.**]
- Max receives the ticket [**Endowment Condition: Max keeps the ticket.**].
- Max receives €4.00. [**Endowment Condition: Max sells his ticket for €4.00.**]

3) The random price drawn in the lottery is €4.00. Assume now that Max has overstated the price. He indicated that for €4.50 and all higher prices he prefers *to obtain the money* [**Endowment Condition: to sell his ticket**]. In truth however, he prefers *to obtain the money* [**Endowment Condition: wants to sell his ticket**] already for a price 4.00 and all higher prices. What happens?

- Max receives €4.50 [**Endowment Condition: Max sells his ticket for €4.50.**]
- Max receives the ticket [**Endowment Condition: Max keeps the ticket.**].
- Max receives €4.00. [**Endowment Condition: Max sells his ticket for €4.00.**]

**What happens if Max would have stated his true preference of €4.00?**

- Max receives €4.50 [**Endowment Condition: Max sells his ticket for €4.50.**]
- Max receives the ticket [**Endowment Condition: Max keeps the ticket.**].
- Max receives €4.00. [**Endowment Condition: Max sells his ticket for €4.00.**]

**What happens if €5.00 was drawn as the random price?**

- Max receives €4.50 [**Endowment Condition: Max sells his ticket for €4.50.**]
- Max receives the ticket [**Endowment Condition: Max keeps the ticket.**].
- Max receives €4.00. [**Endowment Condition: Max sells his ticket for €4.00.**]

4) The random price drawn in the lottery is €4.00. Assume now that Max has understated the price. He indicated that for €4.00 and all higher prices he prefers *to obtain the money* [**Endowment Condition: wants to sell his ticket**]. In truth however, he prefers *to obtain the money* [**Endowment Condition: to sell his ticket**] only at a price of 4.50 and all higher prices. What happens?

- Max receives €4.50 [**Endowment Condition: Max sells his ticket for €4.50.**]
- Max receives the ticket [**Endowment Condition: Max keeps the ticket.**].
- Max receives €4.00. [**Endowment Condition: Max sells his ticket for €4.00.**]

**What happens if Max would have stated his true preference of €4.50?**

- Max receives €4.50 [**Endowment Condition: Max sells his ticket for €4.50.**]
- Max receives the ticket [**Endowment Condition: Max keeps the ticket.**].
- Max receives €4.00. [**Endowment Condition: Max sells his ticket for €4.00.**]

**What happens if €5.00 was drawn as the random price?**

- Max receives €4.50 [**Endowment Condition: Max sells his ticket for €4.50.**]
- Max receives the ticket [**Endowment Condition: Max keeps the ticket.**].
- Max receives €4.00. [**Endowment Condition: Max sells his ticket for €4.00.**]

**At what price do you prefer the money over the ticket?**

Please state for **each** of the listed prices whether you would like to receive the money or obtain the lottery ticket. Your decisions are binding!

**At a price of ...**

- |         |  |   |
|---------|--|---|
| €10.00: | <input type="radio"/> I would choose the money | <input type="radio"/> I would choose the lottery ticket |
| € 9.75: | <input type="radio"/> I would choose the money | <input type="radio"/> I would choose the lottery ticket |
| ...     |  |   |
| € 0.25: | <input type="radio"/> I would choose the money | <input type="radio"/> I would choose the lottery ticket |

**[For the Endowment Condition]:**

**At what price do you want to sell your ticket?**

Please indicate for **each** of the listed prices whether you would like to sell the lottery ticket or keep the ticket. Your decisions are binding!

**At a price of...**

- |         |   |   |
|---------|---|---|
| €10.00: | <input type="radio"/> I would sell the lottery ticket | <input type="radio"/> I would keep the lottery ticket |
| € 9.75: | <input type="radio"/> I would sell the lottery ticket | <input type="radio"/> I would keep the lottery ticket |
| ...     |   |   |
| € 0.25: | <input type="radio"/> I would sell the lottery ticket | <input type="radio"/> I would keep the lottery ticket |

## Second Market

Please assume that you can *choose between the ticket and the money* [**Endowment Condition: sell your ticket**] in a market just as you did before. A random price is drawn and you *receive the money* [**Endowment Condition: sell your ticket**], if you have preferred the money over the ticket for this price. The rules of the market are the same as in the first market you just participated in, except for one rule: In this market, when you receive the money [**Endowment Condition: sell your ticket**], then you are paid the lowest price for which you *prefer the money* [**Endowment Condition: are willing to sell**], not the random price.

Assume for example the lowest price for which you *prefer the money over the ticket* [**Endowment Condition: are willing to sell your ticket**] is 4€ and a random price of 5€ is drawn. In this case you would receive 4€. If the lowest price for which you *prefer the money* would be 6€ [**Endowment Condition: would demand 6€ for selling your ticket**] - one Euro more than the random price - then you would keep your ticket. Let's assume now that you overstate your valuation and indicate that you *prefer the money over the ticket* at a price of 5€ [**Endowment Condition: ask for 5€ for selling your ticket**], while your actual valuation is only 4€. In this case you would receive 5€. However, if you would indicate to *prefer money over the ticket* at 6€ [**Endowment Condition: ask for 6€ for selling your ticket**], while your true valuation is in fact 5€, then you would *receive the ticket* [**Endowment Condition: have to keep your ticket**], even though you would have preferred the money over the ticket at [**Endowment Condition: to sell the ticket for**] the random price of 5€.

Just as in the first market before we ask you now

**at what price do you prefer the money over the ticket?**

Please state for **each** of the listed prices whether you would like to receive the money or obtain the lottery ticket. Your decisions are binding!

**At a price of ...**

- |         |  |   |
|---------|--|---|
| €10.00: | <input type="radio"/> I would choose the money | <input type="radio"/> I would choose the lottery ticket |
|---------|--|---|

- € 9.75:       I would choose the money       I would choose the lottery ticket  
 ...  
 € 0.25:       I would choose the money       I would choose the lottery ticket

**[For the Endowment Condition]:**

**At what price do you want to sell your ticket?**

Please indicate for *each* of the listed prices whether you would like to sell the lottery ticket or keep the ticket. Your decisions are binding!

**At a price of...**

- € 10.00:       I would sell the lottery ticket       I would keep the lottery ticket  
 € 9.75:       I would sell the lottery ticket       I would keep the lottery ticket  
 ...  
 € 0.25:       I would sell the lottery ticket       I would keep the lottery ticket

## B. Strategy Treatment [Endowment & No-Endowment]

Note that we only report the section about “The Rules of the Market”. All other passages of the instructions do not differ from the True-Valuation treatment that we presented above.

### The Rules of the Market

You will be presented with a list of all prices between €0.25 and €10.00. [0.25; 0.50; 0.75...9.75; 10.00] You have to decide for each price whether you prefer *to obtain the money or the lottery ticket* [**Endowment Condition: to sell or keep your lottery ticket**].

**At a price of ...**

- €10.00:       I would choose the money       I would choose the lottery ticket  
 € 9.75:       I would choose the money       I would choose the lottery ticket  
 ...

**[For the Endowment Condition]**

**At a price of ...**

- € 10.00:       I would sell the lottery ticket       I would keep the lottery ticket  
 € 9.75:       I would sell the lottery ticket       I would keep the lottery ticket

Your decisions will be compared with a random price that will be drawn in a public lottery after the experiment is over. If you stated that for the random price you prefer *to obtain the money* [**Endowment Condition: to sell your lottery ticket**], then you are paid the lowest price for which you prefer the money [**Endowment Condition: are willing to sell**]. If you stated by contrast that you prefer *to receive* [**Endowment Condition: to keep**] the lottery ticket at the drawn price and at all lower prices, then you receive [**Endowment Condition: keep**] the lottery ticket *and the experimenter will send you the authentication code for the ticket* [**Endowment Condition: no text**].

### Here are two examples:

1) Assume the random price is 4 Euro. Then the experimenter will check in your price list, what decision you have made for this price:

**At a price of ...**

- €10.00:       I would choose the money       I would choose the lottery ticket  
 € 9.75:       I would choose the money       I would choose the lottery ticket  
 ...  
 € 4.00:       I would choose the money       I would choose the lottery ticket  
 € 3.75:       I would choose the money       I would choose the lottery ticket  
 ...

The list shows that for the random price and all lower prices, you want to obtain the lottery ticket. So the experimenter would send you the authentication code for the lottery ticket.

**2) Now assume that the random price would have been 4.50 Euro.****At a price of ...**

- €10.00:       I would choose the money       I would choose the lottery ticket  
 € 9.75:       I would choose the money       I would choose the lottery ticket  
 ...  
 € 4.50:       I would choose the money       I would choose the lottery ticket  
 € 4.25:       I would choose the money       I would choose the lottery ticket  
 € 4.00:       I would choose the money       I would choose the lottery ticket

In this case the list shows that for the random price of €4.50, you want to obtain the money. So you would receive the lowest price for which you in fact prefer to obtain the money; the experimenter pays you 4.25 Euro.

**[For the Endowment Condition]**

1) Assume the random price is 4 Euro. Then the experimenter will check in your price list, what decision you have made for this price:

**At a price of ...**

- € 10.00:       I would sell the lottery ticket       I would keep the lottery ticket  
 € 9.75:       I would sell the lottery ticket       I would keep the lottery ticket  
 ...  
 € 4.00:       I would sell the lottery ticket       I would keep the lottery ticket  
 € 3.75:       I would sell the lottery ticket       I would keep the lottery ticket  
 ...

The list shows that for the random price and all lower prices, you want to keep your lottery ticket.

**2) Now assume that the random price would have been 4.50 Euro.****At a price of ...**

- € 10.00:       I would sell the lottery ticket       I would keep the lottery ticket  
 € 9.75:       I would sell the lottery ticket       I would keep the lottery ticket  
 ...  
 € 4.50:       I would sell the lottery ticket       I would keep the lottery ticket  
 € 4.25:       I would sell the lottery ticket       I would keep the lottery ticket  
 € 4.00:       I would sell the lottery ticket       I would keep the lottery ticket

*In this case the list shows that for the random price of €4.50, you want to sell your lottery ticket. So you would receive the lowest price for which you in fact are willing to sell the ticket; the experimenter pays you 4.25 Euro.*

### Questions about the Market Transaction

To ensure that you fully understand the rules of the market, we will present you with a set of short scenarios. Please select the correct answer (notice, you can only proceed with the experiment, if you answer the questions correctly):

1) The random price drawn in the lottery is €4.00. Max has stated that for €3.00 and all higher prices he prefers to *obtain the money* [**Endowment Condition: to sell his ticket**]. What happens?

- Max receives €4.00. [**Endowment Condition: Max sells his ticket for €4.00.**]
- Max receives the ticket [**Endowment Condition: Max keeps the ticket.**].
- Max receives €3.00. [**Endowment Condition: Max sells his ticket for €3.00.**]

2) The random price drawn in the lottery is €4.00. Max has stated that for €4.50 and all higher prices he prefers to *obtain the money* [**Endowment Condition: to sell his ticket**]. What happens?

- Max receives €4.50 [**Endowment Condition: Max sells his ticket for €4.50.**]
- Max receives the ticket [**Endowment Condition: Max keeps the ticket.**].
- Max receives €4.00. [**Endowment Condition: Max sells his ticket for €4.00.**]

3) The random price drawn in the lottery is €4.00. Assume now that Max has overstated the price. He indicated that for €4.50 and all higher prices he prefers to *obtain the money* [**Endowment Condition: to sell his ticket**]. In truth however, he prefers to *obtain the money* [**Endowment Condition: wants to sell his ticket**] already for a price of 4.00 and all higher prices. What happens?

- Max receives €4.50 [**Endowment Condition: Max sells his ticket for €4.50.**]
- Max receives the ticket [**Endowment Condition: Max keeps the ticket.**].
- Max receives €4.00. [**Endowment Condition: Max sells his ticket for €4.00.**]

**What happens if Max would have stated his true preference of €4.00?**

- Max receives €4.50 [**Endowment Condition: Max sells his ticket for €4.50.**]
- Max receives the ticket [**Endowment Condition: Max keeps the ticket.**].
- Max receives €4.00. [**Endowment Condition: Max sells his ticket for €4.00.**]

**What happens if €5.00 was drawn as the random price?**

- Max receives €4.50 [**Endowment Condition: Max sells his ticket for €4.50.**]
- Max receives the ticket [**Endowment Condition: Max keeps the ticket.**].
- Max receives €4.00. [**Endowment Condition: Max sells his ticket for €4.00.**]

4) The random price drawn in the lottery is €4.00. Assume now that Max has understated the price. He indicated that for €4.00 and all higher prices he prefers to *obtain the money* [**Endowment Condition: to sell his ticket**]. In truth however, he prefers to *obtain the money* [**Endowment Condition: to sell his ticket**] only at a price of 4.50 and all higher prices. What happens?

- Max receives €4.50 [**Endowment Condition: Max sells his ticket for €4.50.**]
- Max receives the ticket [**Endowment Condition: Max keeps the ticket.**].
- Max receives €4.00. [**Endowment Condition: Max sells his ticket for €4.00.**]

**What happens if Max would have stated his true preference of €4.50?**

- Max receives €4.50 [**Endowment Condition: Max sells his ticket for €4.50.**]
- Max receives the ticket [**Endowment Condition: Max keeps the ticket.**].
- Max receives €4.00. [**Endowment Condition: Max sells his ticket for €4.00.**]

**What happens if €5.00 was drawn as the random price?**

- Max receives €4.50 [**Endowment Condition: Max sells his ticket for €4.50.**]
- Max receives the ticket [**Endowment Condition: Max keeps the ticket.**].
- Max receives €4.00. [**Endowment Condition: Max sells his ticket for €4.00.**]

**At what price do you prefer the money over the ticket?**

Please state for **each** of the listed prices whether you would like to receive the money or obtain the lottery ticket. Your decisions are binding!

**At a price of ...**

- |         |  |   |
|---------|--|---|
| €10.00: | <input type="radio"/> I would choose the money | <input type="radio"/> I would choose the lottery ticket |
| € 9.75: | <input type="radio"/> I would choose the money | <input type="radio"/> I would choose the lottery ticket |
| ...     |  |   |
| € 0.25: | <input type="radio"/> I would choose the money | <input type="radio"/> I would choose the lottery ticket |

**[For the Endowment Condition]:**

**At what price do you want to sell the ticket?**

Please indicate for **each** of the listed prices whether you would like to sell the lottery ticket or keep the ticket. Your decisions are binding!

**At a price of...**

- |          |   |   |
|----------|---|---|
| € 10.00: | <input type="radio"/> I would sell the lottery ticket | <input type="radio"/> I would keep the lottery ticket |
| € 9.75:  | <input type="radio"/> I would sell the lottery ticket | <input type="radio"/> I would keep the lottery ticket |
| ...      |   |   |
| € 0.25:  | <input type="radio"/> I would sell the lottery ticket | <input type="radio"/> I would keep the lottery ticket |

**Second Market**

Please assume that you can *choose between the ticket and the money* [**Endowment Condition: sell your ticket**] in a market just as you did before. A random price is drawn and you *receive the money* [**Endowment Condition: sell your ticket**], if you have preferred the money over the ticket [**Endowment Condition: to sell your ticket**] for this price. The rules of the market are the same as in the first market you just participated in, except for one rule: In this market, when you receive the money [**Endowment Condition: sell your ticket**], then you are paid the random

price not the lowest price for which you *prefer the money* [**Endowment Condition**: are willing to sell].

Assume for example the lowest price for which you *prefer the money over the ticket* [**Endowment Condition**: are willing to sell your ticket for] is 4€ and a random price of 5€ is drawn. In this case you would receive 5€. If the lowest price for which you *prefer the money* would be 6€ [**Endowment Condition**: you would demand 6€ for selling your ticket] - one Euro more than the random price - then you would keep your ticket. Let's assume now that you overstate your valuation and indicate that you prefer the money over the ticket at a price of 5€ [**Endowment Condition**: ask for 5€ for selling your ticket], while your actual valuation is only 4€. In this case you would still receive the random price of 5€. However, if you would indicate to prefer money over the ticket at 6€ [**Endowment Condition**: ask for 6€ for selling your ticket], while your true valuation is in fact 5€, then you would *receive the ticket* [**Endowment Condition**: have to keep your ticket], even though you would have preferred the money over the ticket at [**Endowment Condition**: to sell the ticket for] the random price of 5€

Just as in the market before we ask you now:

**At what price do you prefer the money over the ticket?**

Please state for **each** of the listed prices whether you would like to receive the money or obtain the lottery ticket. Your decisions are binding!

**At a price of ...**

- |         |  |   |
|---------|--|---|
| €10.00: | <input type="radio"/> I would choose the money | <input type="radio"/> I would choose the lottery ticket |
| € 9.75: | <input type="radio"/> I would choose the money | <input type="radio"/> I would choose the lottery ticket |
| ...     |  |   |
| € 0.25: | <input type="radio"/> I would choose the money | <input type="radio"/> I would choose the lottery ticket |

**[For the Endowment Condition]:**

**At what price do you want to sell your ticket?**

Please indicate for **each** of the listed prices whether you would like to sell the lottery ticket or keep the ticket. Your decisions are binding!

**At a price of...**

- |          |   |   |
|----------|---|---|
| € 10.00: | <input type="radio"/> I would sell the lottery ticket | <input type="radio"/> I would keep the lottery ticket |
| € 9.75:  | <input type="radio"/> I would sell the lottery ticket | <input type="radio"/> I would keep the lottery ticket |
| ...      |   |   |
| € 0.25:  | <input type="radio"/> I would sell the lottery ticket | <input type="radio"/> I would keep the lottery ticket |

**C. Interaction Treatment [Endowment & No-Endowment]**

(Note that we only report the sections about the "Market Transaction" and "The Rules of the Market". All other passages of the instructions do not differ from the True-Valuation treatment that we presented above (A).)

**1. Instructions for the Main Subjects**

**Market Transaction**

You are given the opportunity to *choose between an amount of money and the lottery ticket* [**Endowment Condition**: to trade your lottery ticket] in a market. If you receive the ticket, then

*the experimenter will immediately send you the authentication code making you the owner of the ticket [Endowment Condition: no text].*

The outcome of the market does not depend on your decision alone, it also depends on a second participant who is randomly selected and assigned to you. Contingent on your decision and the decision of your partner you will either *receive [Endowment Condition: keep]* the lottery ticket or you will obtain an amount of money. Please note this is not a hypothetical transaction. Your pricing decisions and the decisions of your partner are final and binding!

### The Rules of the Market:

You will be presented with a list of all prices between €0.25 and €10.00. [0.25; 0.50; 0.75...9.75; 10.00] You have to decide for each price whether you prefer to *obtain the money or the lottery ticket [Endowment Condition: to sell or keep your lottery ticket].*

#### At a price of ...

€10.00:       I would choose the money       I would choose the lottery ticket  
 € 9.75:       I would choose the money       I would choose the lottery ticket

...

#### [For the Endowment Condition]

#### At a price of ...

€10.00:       I would sell the lottery ticket       I would keep the lottery ticket  
 € 9.75:       I would sell the lottery ticket       I would keep the lottery ticket

...

Your decisions will be compared with the highest price that your partner is willing to pay for the ticket. We refer to this price as the **offer** of your partner. If you stated that for your partner's offer price you prefer to *obtain the money [Endowment Condition: to sell your lottery ticket]*, then you are paid the lowest price for which you prefer the money. If you stated by contrast that you prefer to *receive [Endowment Condition: to keep]* the lottery ticket at the price that your partner offers, then you *receive [Endowment Condition: keep]* the lottery ticket *and the experimenter will send you authentication code for the ticket [Endowment Condition: no text.]*

### Here are two examples:

1) Assume your partner has offered a price of 4 Euro. Then the experimenter will check in your price list, what decision you have made for this price:

#### At a price of ...

€10.00:       I would choose the money       I would choose the lottery ticket  
 € 9.75:       I would choose the money       I would choose the lottery ticket

...

€ 4.00:       I would choose the money       I would choose the lottery ticket  
 € 3.75:       I would choose the money       I would choose the lottery ticket

...

The list shows that for the price of €4.00 that your partner offers, you want to obtain the lottery ticket. So the experimenter would send you the authentication code for the lottery ticket.

### 2) Now assume that your partner has offered 4.50 Euro.

#### At a price of ...

- €10.00:       I would choose the money       I would choose the lottery ticket  
 € 9.75:       I would choose the money       I would choose the lottery ticket  
 ....  
 € 4.50:       I would choose the money       I would choose the lottery ticket  
 € 4.25:       I would choose the money       I would choose the lottery ticket  
 € 4.00:       I would choose the money       I would choose the lottery ticket

In this case the list shows that for the price of €4.50 that your partner offers, you want to obtain the money. So you would receive the lowest price for which you in fact prefer to obtain the money; the experimenter pays you 4.25 Euro.

**[For the Endowment Condition]**

1) Assume your partner has offered a price of 4 Euro. Then the experimenter will check in your price list, what decision you have made for this price:

**At a price of ...**

- €10.00:       I would sell the lottery ticket       I would keep the lottery ticket  
 € 9.75:       I would sell the lottery ticket       I would keep the lottery ticket  
 ....  
 € 4.00:       I would sell the lottery ticket       I would keep the lottery ticket  
 € 3.75:       I would sell the lottery ticket       I would keep the lottery ticket  
 ...

The list shows that for the price of €4.00 that your partner offers, you want to obtain the lottery ticket. So the experimenter would send you the authentication code for the lottery ticket.

2) Now assume that your partner has offered 4.50 Euro.

**At a price of ...**

- €10.00:       I would sell the lottery ticket       I would keep the lottery ticket  
 € 9.75:       I would sell the lottery ticket       I would keep the lottery ticket  
 ....  
 € 4.50:       I would sell the lottery ticket       I would keep the lottery ticket  
 € 4.25:       I would sell the lottery ticket       I would keep the lottery ticket  
 € 4.00:       I would sell the lottery ticket       I would keep the lottery ticket

In this case the list shows that for the price of €4.50 that your partner offers, you want to sell your lottery ticket. So you would receive the lowest price for which you in fact are willing to sell the ticket; the experimenter pays you 4.25 Euro.

**Questions about the Market Transaction**

To ensure that you fully understand the rules of the market, we will present you with a set of short scenarios. Please select the correct answer (notice, you can only proceed with the experiment, if you answer the questions correctly):

- 1) Max stated that for €3.00 and all higher prices he prefers to *obtain the money* [**Endowment Condition: to sell his ticket**]. His partner has offered a price of €4.00. What happens?
- Max receives €4.00. [**Endowment Condition: Max sells his ticket for €4.00.**]
  - Max receives the ticket [**Endowment Condition: Max keeps the ticket.**].
  - Max receives €3.00. [**Endowment Condition: Max sells his ticket for €3.00.**]

2) Max has stated that for €4.50 and all higher prices he prefers to *obtain the money* [**Endowment Condition: to sell his ticket**]. His partner has offered a price of €4.00. What happens?

- Max receives €4.50 [**Endowment Condition: Max sells his ticket for €4.50.**]
- Max receives the ticket [**Endowment Condition: Max keeps the ticket.**].
- Max receives €4.00. [**Endowment Condition: Max sells his ticket for €4.00.**]

3) Assume now that Max has overstated the price. He indicated that for €4.50 and all higher prices he prefers to *obtain the money* [**Endowment Condition: to sell his ticket**]. In truth however, he prefers to *obtain the money* [**Endowment Condition: wants to sell his ticket**] already for a price of 4.00 and all higher prices. His partner has offered a price of €4.00. What happens?

- Max receives €4.50 [**Endowment Condition: Max sells his ticket for €4.50.**]
- Max receives the ticket [**Endowment Condition: Max keeps the ticket.**].
- Max receives €4.00. [**Endowment Condition: Max sells his ticket for €4.00.**]

**What happens if Max would have stated his true preference of €4.00?**

- Max receives €4.50 [**Endowment Condition: Max sells his ticket for €4.50.**]
- Max receives the ticket [**Endowment Condition: Max keeps the ticket.**].
- Max receives €4.00. [**Endowment Condition: Max sells his ticket for €4.00.**]

**What happens if €5.00 was drawn as the random price?**

- Max receives €4.50 [**Endowment Condition: Max sells his ticket for €4.50.**]
- Max receives the ticket [**Endowment Condition: Max keeps the ticket.**].
- Max receives €4.00. [**Endowment Condition: Max sells his ticket for €4.00.**]

4) Assume now that Max has understated the price. He indicated that for €4.00 and all higher prices he prefers to *obtain the money* [**Endowment Condition: to sell his ticket**]. In truth however, he prefers to *obtain the money* [**Endowment Condition: to sell his ticket**] only at a price of 4.50 and all higher prices. His partner has offered a price of €4.00. What happens?

- Max receives €4.50 [**Endowment Condition: Max sells his ticket for €4.50.**]
- Max receives the ticket [**Endowment Condition: Max keeps the ticket.**].
- Max receives €4.00. [**Endowment Condition: Max sells his ticket for €4.00.**]

**What happens if Max would have stated his true preference of €4.50?**

- Max receives €4.50 [**Endowment Condition: Max sells his ticket for €4.50.**]
- Max receives the ticket [**Endowment Condition: Max keeps the ticket.**].
- Max receives €4.00. [**Endowment Condition: Max sells his ticket for €4.00.**]

**What happens if €5.00 was drawn as the random price?**

- Max receives €4.50 [**Endowment Condition: Max sells his ticket for €4.50.**]
- Max receives the ticket [**Endowment Condition: Max keeps the ticket.**].
- Max receives €4.00. [**Endowment Condition: Max sells his ticket for €4.00.**]

**At what price do you prefer the money over the ticket?**

Please state for **each** of the listed prices whether you would like to receive the money or obtain the lottery ticket. Your decisions are binding!

**At a price of ...**

- |         |  |   |
|---------|--|---|
| €10.00: | <input type="radio"/> I would choose the money | <input type="radio"/> I would choose the lottery ticket |
| € 9.75: | <input type="radio"/> I would choose the money | <input type="radio"/> I would choose the lottery ticket |
| ...     |  |   |
| € 0.25: | <input type="radio"/> I would choose the money | <input type="radio"/> I would choose the lottery ticket |

**[For the Endowment Condition]:**

**At what price do you want to sell the ticket?**

Please indicate for **each** of the listed prices whether you would like to sell the lottery ticket or keep the ticket. Your decisions are binding!

**At a price of...**

- |         |   |   |
|---------|---|---|
| €10.00: | <input type="radio"/> I would sell the lottery ticket | <input type="radio"/> I would keep the lottery ticket |
| € 9.75: | <input type="radio"/> I would sell the lottery ticket | <input type="radio"/> I would keep the lottery ticket |
| ...     |   |   |
| € 0.25: | <input type="radio"/> I would sell the lottery ticket | <input type="radio"/> I would keep the lottery ticket |

## Second Market

Please assume that you can *choose between the ticket and the money* [**Endowment Condition: sell your ticket**] in a market just as you did before. However, this time you are not matched with a real partner. Instead of a real partner making an offer, a random price is drawn from an urn. Each price between 0.25, 0.50, 0.75 ...9.75, 10 is represented once in the urn. The price you indicate is compared with the random price. You *receive the money* [**Endowment Condition: sell your ticket**], if you have preferred the money over the ticket [**Endowment Condition: to sell your ticket**] for this random price. When you *receive the money* [**Endowment Condition: sell your ticket**], then you are paid the random price.

Assume for example the lowest price for which you *prefer the money over the ticket* [**Endowment Condition: are willing to sell your ticket for**] is 4€ and a random price of 5€ is drawn. In this case you would receive 5€. If the lowest price for which you *prefer the money* would be 6€ [**Endowment Condition: you would demand 6€ for selling your ticket**] - one Euro more than the random price - then you would keep your ticket. Let's assume now that you overstate your valuation and indicate that you *prefer the money over the ticket at a price of 5€* [**Endowment Condition: ask for 5€ for selling your ticket**], while your actual valuation is only 4€. In this case you would still receive the random price of 5€. However, if you would *indicate to prefer money over the ticket at 6€* [**Endowment Condition: ask for 6€ for selling your ticket**], while your true valuation is in fact 5€, then you would *receive the ticket* [**Endowment Condition: have to keep your ticket**], even though you would have preferred the money over the ticket at [**Endowment Condition: to sell the ticket for**] the random price of 5€.

Just as in the first market before we ask you now

**At what price do you prefer the money over the ticket?**

Please state for **each** of the listed prices whether you would like to receive the money or obtain the lottery ticket. Your decisions are binding!

**At a price of ...**

- €10.00:       I would choose the money       I would choose the lottery ticket  
 € 9.75:       I would choose the money       I would choose the lottery ticket  
 ...  
 € 0.25:       I would choose the money       I would choose the lottery ticket

**[For the Endowment Condition]:**

**At what price do you want to sell your ticket?**

*Please indicate for **each** of the listed prices whether you would like to sell the lottery ticket or keep the ticket. Your decisions are binding!*

**At a price of...**

- € 10.00:       I would sell the lottery ticket       I would keep the lottery ticket  
 € 9.75:       I would sell the lottery ticket       I would keep the lottery ticket  
 ...  
 € 0.25:       I would sell the lottery ticket       I would keep the lottery ticket

## 2. Instructions the Main Subjects Receive about their Partner

*(In the following we present the information Subjects were given about their Partner's Instructions in the Interaction Treatment. The instructions are identical for both conditions Endowment and No-Endowment.)*

### Your Partner's Instructions

Your partner is asked at what price he would buy the lottery ticket. He received an endowment of 10 Euro. He can spend any portion of his endowment on buying the ticket; he keeps the rest of the endowment that he does not spend.

He will be presented with a list of all prices between €0.25 and €10.00 and has to decide for each price whether he wants to buy the lottery ticket or not.

### Your Partner's Payoff

Your partner buys the lottery ticket, if he states that he values the ticket at a higher price or at the same price as you. As any buyer in the real world, your partner keeps the money that he does not spend on buying the ticket. Thus he earns the more the less he spends on the ticket. However, if he offers a price for the ticket that is lower than the price you indicate then he does not get the ticket.

## 3. Instructions for the Interaction Partner

*(The instructions are identical for all conditions. We only report the relevant sections that differ from the instructions that the subjects received.)*

### The Rules of the Market:

You are given an endowment of 10 Euro for which you can buy a lottery ticket in a real market. You can spend any portion of your endowment on buying the ticket; you keep the rest of the endowment that you did not spend on the transaction.

You will be presented with a list of all prices between €0.25 and €10.00. [0.25; 0.50; 0.75...9.75; 10.00] You have to decide for each price whether you want to buy the lottery ticket or not.

**At a price of ...**

- |         |  |  |
|---------|--|--|
| €10.00: | <input type="radio"/> I would buy the ticket | <input type="radio"/> I would keep the money |
| € 9.75: | <input type="radio"/> I would buy the ticket | <input type="radio"/> I would keep the money |
| ...     |  |  |
| € 5.50: | <input type="radio"/> I would buy the ticket | <input type="radio"/> I would keep the money |
| € 0.25: | <input type="radio"/> I would buy the ticket | <input type="radio"/> I would keep the money |

**Your Payoff**

You buy the lottery ticket, if you state a higher price for the ticket as your partner or the same price. Otherwise no transaction takes place and you will keep the money, but will not get a lottery ticket.

**Here are examples:**

**Assume you have stated to value the lottery ticket at a price of 4€**

- a) Your partner indicates that he prefers to receive the money over the ticket at a price of 3.75€ Then you get the ticket and keep a rest of 6 Euro of your endowment. Your partner is paid €3.75.
- b) Your partner indicates that he prefers to receive the money over the ticket at a price of 4.25€ Then the transaction fails and you keep your full endowment. Your partner gets the lottery ticket.

**D. Agency&Markets Treatment [Endowment & No-Endowment]**

*(Note that we only report the sections about the “Market Transaction”. All other passages of the instructions do not differ from the Strategy treatment that we presented above (A).)*

**1. Instructions for the Main Subjects****Market Transaction**

You are given the opportunity to *choose between an amount of money that is offered to you and the lottery ticket* [**Endowment Condition: trade your lottery ticket**] in a market. If you receive the ticket, then the experimenter will immediately sent you the authentication code making you the ticket owner.

You are assigned an agent, who is acting for you in the market. You instruct the agent with the pricing decision you make. The agent`s payment is conditioned on following your instruction. When implementing your pricing decision the agent will be paid €2 otherwise he receives nothing. Other than this payment, the agent does not have any own monetary interest in the transaction. However, the agent is not bound; he alone decides for what price *to choose the money over the ticket* [**Endowment Condition: to sell the ticket**] and his decision is final. The price you select is the instruction for the agent. The outcome of the market, does not depend on the agent`s decision alone, it also depends on a random price that will be drawn publicly. Contingent on the agent`s decision you will either *receive* [**Endowment Condition: keep**] the lottery ticket or you will obtain an amount of money. Please note this is not a hypothetical transaction. The agent`s decisions are final and binding!  
[.....]

The agent`s decisions will be compared with a random price that will be drawn in a public lottery after the experiment is over. If the agent stated that for the random price and all higher

prices you prefer to obtain the money [**Endowment Condition: to sell your lottery ticket**], then you receive the random price. If the agent stated by contrast that you prefer to receive [**Endowment Condition: to keep**] the lottery ticket at the drawn price and at all lower prices, then you receive [**Endowment Condition: keep**] the lottery ticket and the experimenter will send you right after the Eurojackpot draw the authentication code for the ticket [**Endowment Condition: no text**]

### Here are two examples:

1) Assume the random price is 4 Euro. Then the experimenter will check, what decision the agent has made for this price:

At a price of ...

- |  |   |  |
|--|---|--|
| €10.00:                                  | <input checked="" type="radio"/> I would choose the money | <input type="radio"/> I would choose the lottery ticket            |
| € 9.75:                                  | <input checked="" type="radio"/> I would choose the money | <input type="radio"/> I would choose the lottery ticket            |
| ...                                      |   |  |
| <input checked="" type="radio"/> € 4.00: | <input type="radio"/> I would choose the money            | <input checked="" type="radio"/> I would choose the lottery ticket |
| € 3.75:                                  | <input type="radio"/> I would choose the money            | <input checked="" type="radio"/> I would choose the lottery ticket |
| ...                                      |   |  |

The list shows that for the random price and for all lower prices, you want to obtain the lottery ticket. If the agent follows your instructions, the experimenter would send you the authentication code for the lottery ticket.

...

### Questions about the Market Transaction

To ensure that you fully understand the rules of the market, we will present you with a set of short scenarios. Please select the correct answer (notice, you can only proceed with the experiment, if you answer the questions correctly):

5) The random price drawn in the lottery is €4.00. Max has stated that for €3.75 and all higher prices he prefers to obtain the money [**Endowment Condition: wants to sell his ticket**]. The agent follows his instructions. What happens?

- Max receives €4.00. [**Endowment Condition: Max sells his ticket for €4.00.**]
- Max receives the lottery ticket. [**Endowment Condition: Max keeps the ticket.**]
- Max receives €3.00. [**Endowment Condition: Max sells his ticket for €3.00.**]

What happens if the agent would have stated that Max prefers €4.25 instead of the €3.75 he instructed the agent to indicate?

- Max receives €4.00. [**Endowment Condition: Max sells his ticket for €4.00.**]
- Max receives the lottery ticket. [**Endowment Condition: Max keeps the ticket.**]
- Max receives €3.00. [**Endowment Condition: Max sells his ticket for €3.00.**]

....

### Second Market

Please assume that you can choose between the ticket and the money [**Endowment Condition: sell your ticket**] in a market just as you did before. Your agent is still acting for you; he is paid € only, if he follows your instructions; otherwise he receives nothing. Other than this payment, he does not have any own monetary interest in the transaction. A random price is drawn and you receive the money [**Endowment Condition: sell your ticket**], if you have indicated to prefer the money over the ticket [**Endowment Condition: to sell your ticket**] for this price and the

agent implemented your instructions. The rules of the market are the same as in the first market you just participated in, except for one rule: In this market, when you receive the money [**Endowment Condition: sell your ticket**], then you are paid the random price not the lowest price for which you prefer the money [**Endowment Condition: are willing to sell**].

Notice, the agent's decision is final; whether he follows or does not follow your instructions you will receive money or ticket according to his decision. In the following examples we assume that the agent implements your instructions. Assume for example the lowest price for which you prefer the money over the ticket [**Endowment Condition: are willing to sell your ticket**] is 4€ and a random price of 5€ is drawn. In this case you would receive 4€ If

....

## 2. Instructions for the Agent

(We report only the main sections of the instructions that differ from the instructions of the other subjects.)

### Lottery

In this study you will act for a different participant. This participant can receive [**Endowment Condition: trade**] a real lottery ticket in a market transaction depending on the decisions you make. You will be informed about the other participant's instructions. When you follow the participant's instructions you are paid €2, if not, you do not receive any payment. However, you are not bound by the participant's instructions; your decision is final and according to your decision the participant will receive either money or ticket.

### Market Transaction

You are supposed to choose in a market between an amount of money that the other participant is offered and the lottery ticket he will receive [**Endowment Condition: trade your lottery ticket**].

The outcome of the market, does not depend on your decision alone, it also depends on a random price that will be drawn publicly. Contingent on your decision the other participant will either receive [**Endowment Condition: keep**] the lottery ticket or he will obtain an amount of money. Please note this is not a hypothetical transaction. Your pricing decisions are final and binding!

### The Rules of the Market

You will be presented with a list of all prices between €0.25 and €10.00. [0.25; 0.50; 0.75...9.75; 10.00] You have to decide for each price whether the participant shall obtain the money or the lottery ticket [**Endowment Condition: to sell or keep your lottery ticket**].

At a price of ...

€10.00: I choose participant gets the money      I choose participant gets the ticket

€ 9.75: I choose participant gets the money      I choose participant gets the ticket

## E. Additional Measures

### 1. Regret

[No-Endowment Condition]

Regret over Choosing the Money

Assume that you choose the money over the ticket. When you choose the money, you cannot collect a prize. How much regret do you anticipate to feel over choosing the money while being aware that you forgo the prize?

Please mark one of the boxes you see below. Low values express little regret; high values represent a strong feeling of regret.

1	2	3	4	5	6	7	8	9	10

### **Regret over *Choosing the Ticket***

Assume that you *choose the ticket over the money*. When you *choose the ticket*, you cannot collect the money. How much regret do you anticipate to feel over *choosing the ticket* while being aware that you forgo the money?

Please mark one of the boxes you see below. Low values express little regret; high values represent a strong feeling of regret

1	2	3	4	5	6	7	8	9	10

### **[Endowment Condition]**

### **Regret over *Selling the Ticket***

Assume that you *sell your ticket*. When you *sell the ticket*, you will not be eligible to collect a prize. How much regret do you anticipate to feel over *selling the ticket* while being aware that you forgo winning a prize?

Please mark one of the boxes you see below. Low values express little regret; high values represent a strong feeling of regret.

1	2	3	4	5	6	7	8	9	10

### **Regret over *Keeping the Ticket***

Assume that you *keep your ticket*. When you *keep the ticket*, you cannot collect a sales price. How much regret do you anticipate to feel over *keeping the ticket* while being aware that you forgo the sales price?

Please mark one of the boxes you see below. Low values express little regret; high values represent a strong feeling of regret

1	2	3	4	5	6	7	8	9	10

## **2. Loss Aversion**

### The Lotteries

You are given the option to participate in two lotteries. To enable you to participate, you receive an endowment of 2.50€ You can increase your earnings when you participate in the lotteries, but you can also lose your endowment. You can decide separately for each lottery whether you want to participate in it or not. So you may decline to participate in one lottery, but take part in the other; you can also reject both lotteries, or participate in both of them.

The outcome of both lotteries will be determined by the public draw of the online lottery. The first drawn number decides the outcome of the first lottery, the second number determines the outcome of the second lottery. You win either lottery if the drawn number is even and you lose either lottery if the drawn number is uneven.

You will only be paid for one of the two lotteries. Which lottery is paid for, will also be determined randomly by the online lottery. If the third number drawn in the online lottery is uneven, then the first lottery is selected for payment, if it turns out to be even, then the second lottery is selected.

#### Lottery 1

Lottery 1 has the following payoff: You win €1 with a probability of  $\frac{1}{2}$  and you lose €2.50 with a probability of  $\frac{1}{2}$ . If you reject to participate in Lottery 1 then you neither win an additional payoff, nor can you lose your endowment.

Please click on the “Yes” button if you want to participate in the lottery and the “No” button if you do not want to participate in Lottery 1.



#### Lottery 2

Lottery 2 has the same payoff as Lottery 1: You win €1 with a probability of  $\frac{1}{2}$  and lose €2.50 with a probability of  $\frac{1}{2}$ . However, the lottery is repeated for six times. You are paid the average of the six outcomes.

Here is an example: Assume you win the lottery three times ( $3 \times €1$ ) and you lose the lottery three times ( $3 \times €2.50$ ). In this case the overall payoff for Lottery 2 would be:  $\frac{(3 \times 1) - (3 \times 2.50)}{6} = €0.75$

If you reject to participate in Lottery 2 then you neither win an additional payoff, nor can you lose your endowment.

Please click on the “Yes” button if you want to participate in the lottery and the “No” button if you do not want to participate in Lottery 2.