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Contents

Chapter 1

Introduction

The focus of this work is on behavioral economics, which incorporates approaches from psychology and economics and thus represents a research area departing from the standard assumptions of traditional economic theory. Especially in the realm of decision making, the assumption of the agent as *homo oeconomicus* is relaxed (Mullainathan and Thaler, 2000). More precisely, this dissertation covers two distinct fields of research within behavioral "decision making". The first two chapters deal with deviations from the standard economic approach in consumer choice. The last two chapters investigate decisions in experimental labor markets.

Chapter 2 comprises an experimental study which allows to test two different theoretical approaches against each other namely theories based on limited attention versus loss-aversion based theories. While both approaches can account for a wide range of cognitive biases, loss-aversion based theories like prospect theory yield different predictions regarding exchange asymmetries for bads, i.e., items yielding a negative utility, than theories based on limited attention like salience theory. Exchange asymmetries denote exchange rates for endowments in exchange experiments which differ from the rates rational choice theory predicts. This phenomenon is established for goods as the *endowment effect*. While rational choice theory would predict the exchange rate for goods to be around 50%, laboratory and field experimental evidence usually report recognizably lower trading rates (see for example Knetsch, 1989; Kahneman *et al.*, 1990; 1991 and many subsequent studies). This is in line with both theoretical approaches. The predictions, however, differ regarding exchange asymmetries for bads. While loss-aversion based theories predict an endowment effect for goods and bads, attention-based theories predict an endowment effect for goods, but a reverse endowment effect (that is, a particularly high willingness to exchange the endowment) for bads. This study is based on a laboratoy experiment which tests the two approaches against each other and it provides the first incentivized test of exchange asymmetries for unpleasant items. As the predictions of both approaches differ in this respect while they share many other predictions concerning biased decision making, the investigation of exchange asymmetries for bads is a key element to distinguish between the validity of loss aversion- and attention-based theories. Detecting a strong endowment effect for bads, our results speak in favor of prospect theory. Thus, in an incentivzed trading situation, attention effects may not be strong enough to offset subjects' loss aversion which seems to be a ubiquituous aspect of decision making.

In chapter 3, we test two predictions of salience theory central to consumer choice between vertically differentiated products in a laboratory experiment. Salience theory (Bordalo *et al.*, 2012b, 2013) states that agents overemphasize especially salient features of choices and underrate less prominent, but possibly important aspects. This assumption is supported by psychological evidence suggesting that a decision maker's attention is limited and therefore allocated to outstanding features (Taylor and Thompson, 1982; Kahneman, 2011). If an agent purchases one of two vertically differentiated products, this theory makes the following two distinct predictions. First, it hypothesizes that a higher expected price level for both products shifts demand toward the more expensive, high-quality product. Second, it predicts that demand for the high-quality product is larger if the price level is expectedly high than if it is unexpectedly high. Deciding between goods and services which are differentiated with respect to their price and quality is one of the most common purchase decisions a consumer faces. Hence, understanding the underlying evaluation criteria yields implications for commercial decisions like the range of products and marketing purposes, as well as for related fields, for example, psychology and consumer decision research in economics (Azar, 2011). In our experiment, subjects purchased fast (the high-quality product) or slow internet access (the low-quality product) at either low or high general price levels. Our results strongly support both predictions of salience theory. Thus, our findings may explain why suppliers can sustain high margins for premium products in high-price environments where quality is more likely to be overweighted while prices tend to be disregarded.

Chapter 4 analyzes an experimental labor market in which agents (workers/employees) can state non-binding wage requests before principals (employers) offer their wage payment. The study provides a robustness check of one of the workhorse models in experimental labor markets, the gift-exchange game, by investigating the impact of non-binding wage requests on reciprocal behavior, especially on workers' effort provision. The economic literature on gift-exchange games has repeatedly shown that higher wage payments are reciprocated with higher effort levels, which is denoted the fair wage-effort relation (Akerlof, 1982, 1984). However, the aforementioned result may not necessarily hold with wage requests, i.e., employees should reciprocate higher wages when employers fulfill employees' requests but not or less so when requests are not met. The reason is that agents may perceive the same wage offer distinctly from a situation without the option of stating a request when the wage offer differs from the revealed wage requirement. The results largely support this. We find that for most cases the wage payment is lower than the request of the agent and, accordingly, performance levels are lower than when workers could not state a request in the first instance. Furthermore, effort in a treatment with requests differs more from effort in a treatment without requests the more the actual remuneration differs from the wage request. This suggests practical implications for wage negotiations.

Chapter 5 investigates worker participation and its role for the success of minimum remuneration policies. It is a common view that worker participation positively affects the motivation and reciprocity of workers, for example, by receiving "voice" in their companies. Voice can be acquired by employees in labor unions or works councils. These institutions provide workers with a platform to negotiate their wages and working conditions. Understanding the behavioral effects of worker participation may be helpful for the success of labor policies. If workers positively respond to participation in organizational decisions, labor market policies such as minimum wages may benefit from this practice. Thus, we study a real-effort experiment in which workers may enforce minimum remuneration policies by collective bargaining. Workers generated the firm income after employers decided on their remuneration. In our main treatment employees bargain with the employer over the enforcement of a minimum remuneration requirement in form of a minimum share of revenue (MSR). These policies are exogenously introduced in the control treatment. We find the highest performance when the remuneration requirements were enforced. Conversely, exogenous requirements have detrimental effects on reciprocity. That is, employers pay a premium maintaining the fair wage-effort relationship. Interestingly, the relationship becomes less important under enforced remuneration requirements, i.e., workers perform well even when remuneration is low. Worker participation may therefore be an effective means to enhance the efficiency of labor market institutions.

Chapter 2

Exchange Asymmetries for Bads? Experimental Evidence

Co-authored with Markus Dertwinkel-Kalt

2.1 Introduction

Recent attention-based theories of individual decision making challenge the prevalence of loss aversion-based theories in behavioral economics. Attention-based theories, such as salience theory (Bordalo *et al.*, 2012a,b), a theory of attention and reference dependence (Bhatia and Golman, 2013), and focusing theory (Kőszegi and Szeidl, 2013) assume that agents overemphasize features which stand out in a certain context. In contrast, theories based on loss aversion (Kahneman and Tversky, 1979; Tversky and Kahneman, 1991; Kőszegi and Rabin, 2006; 2007) assume that agents evaluate outcomes with respect to a reference point and put more weight on outcomes below the reference point (*losses*) than on outcomes above it (*gains*). Bordalo *et al.* (2012b) compare salience and prospect theory and show that both can account for a wide range of cognitive biases relevant to decision theory, such as the Allais paradox, preference reversals or the *endowment effect* for goods (Thaler, 1980). Thus, the investigation of these well-known decision biases does not allow us to distinguish between the validity of the two classes of models.

In order to test the two approaches against each other, we implement a laboratory experiment which yields contradicting predictions. Specifically, we investigate exchange asymmetries for unpleasant items (*bads*).[1] For pleasant items (*goods*), agents typically reveal an endowment effect, that is, they exchange their endowments less often than standard theory predicts. According to prospect theory, this effect emerges as a result of loss aversion. In contrast, attention-based theories argue that an agent overemphasizes salient pleasant features of the endowment and therefore refrains from exchanging it. In a setting with unpleasant items, the approaches yield different predictions. Since agents are loss averse with respect to their reference point, prospect theory predicts the usual endowment effect regardless of the characteristics of the reference good. In contrast, according to attention-based theories the endowed bad's downside is salient and is therefore overemphasized by the agent. Thus, the agent wants to exchange her endowment, such that the endowment effect reverses for bads.

This study tests for exchange asymmetries for bads. First, we randomly assign each subject one of the two unpleasant tasks "sorting" or "zeros and ones." For "sorting," a specific amount of two-colored confetti is to be sorted. For "zeros and ones," the subject has to write zeros and ones into boxes of one and a half sheets of checkered paper. Before the actual task starts, each subject is given the unexpected chance to switch tasks. This approach enables us to test for the specific exchange asymmetries as predicted either by loss aversion-based or by attention-based theories.

Our results are in line with prospect theory. In contrast to salience theory's prediction of a reverse endowment effect for bads, subjects do not exchange the bad they are endowed with. That is, we find a robust endowment effect as has been documented for goods in Knetsch (1989), Kahneman *et al.* (1990; 1991) and many subsequent studies.

In apparent contrast to our results, Brenner *et al.* (2007) and Bhatia and Turan (2012) find no endowment effect for bads in a hypothetical frame. We reproduce this finding in two hypothetical treatments, in which the tasks "sorting" and "zeros and ones" serve as bads. The strong discrepancy between incentivized and non-incentivized setups can be rationalized as follows. As Bordalo *et al.* (2012a) propose, an agent immediately disapprobates an assigned bad due to focused attention on its downside. Therefore, she wishes to exchange her bad, such that the endowment effect is eliminated in hypothetical scenarios. The agent, however, reconsiders this wish in an incentivized setup. She realizes the alternative's downsides and her reference point adjusts toward her endowed bad. Then,

[1] Exchange asymmetries denote exchange rates for endowments in exchange experiments which differ from the rates rational choice theory predicts.

loss aversion superposes the disappreciation of the endowment, such that the agent refrains from switching. Thus, she follows her first disapprobation of the endowed bad only in the hypothetical, but not in the incentivized setup.

Subsequently, we review the theoretical approaches to exchange asymmetries for bads and the related experimental literature. Section 2.3 introduces the experimental design, before we present the results in section 2.4. In section 2.5, we discuss the crucial features of our setup and the discrepancy between the hypothetical and the incentivized results. Finally, section 2.6 concludes.

2.2 Exchange asymmetries for bads: Predictions and related literature

We compare two classes of behavioral models with respect to their predictions on exchange rates for bads in a two-stage exchange experiment. At the first stage (*the endowment stage*), an agent is endowed with one of two bads, each of which is characterized by two attributes and an upside in one, but a downside in the other. We assume that according to rational choice theory, both bads provide the same disutility.[2] At the second stage (*the trading stage*), the agent gets the unexpected opportunity to exchange her endowment for the alternative. We sketch the two approaches in the following with details provided in section 2.A.

2.2.1 Over-trading according to attention-based theories

Attention-based theories in general and Bordalo *et al.* (2012a) and Bhatia and Golman (2013) in particular predict a reversal of the endowment effect, that is, over-trading, for bads. First, we introduce the corresponding mechanism by Bordalo *et al.* (2012a). Second, we sketch how focusing theory (Kőszegi and Szeidl, 2013) can similarly explain over-trading.

According to the salience mechanism (Bordalo *et al.*, 2012a), agents overemphasize salient features of their endowments. As a consequence, exchange asymmetries emerge. If an agent is endowed with a bad, she compares it to her initial status quo in which she held no item. Suppose that the bad differs from the agent's initial status quo only in its down-, but not in its upside, such that only the downside sticks out. Thus, at the first stage, the endowment's downside is

[2] We impose the assumption that both bads yield the same negative utility for illustrative reasons. It is also supported by our data. In general, it is sufficient to assume that both items yield a negative utility and that none of the options is universally preferred over the alternative by all subjects.

salient and overemphasized. Consequently, an agent undervalues her assigned bad. As soon as she gets the chance to switch, she compares her endowment to the available alternative. Here, she evaluates the items equally as both have, relative to each other, one downside and one upside. According to Bordalo *et al.* (2012a), the final valuation of the endowment is a convex combination of its first- and second-stage valuations and is, consequently, below the valuation of the alternative.[3] This mechanism predicts over-trading, that is, a switching rate above 50% (for details, see section 2.A).

Over-trading for bads can similarly be explained by focusing theory (Kőszegi and Szeidl, 2013). An agent puts more weight on an attribute in which her options differ more, i.e., in which her range of choice is broader. Since at the first stage only the assigned item is available, she compares it to the option of holding nothing. Her options differ more in the attribute the endowed item is particularly bad in, such that she overemphasizes it. This results in a first-stage undervaluation of the assigned bad. At the second stage, the endowed item's valuation is unbiased as agents focus on all attributes equally if both items are available. Given that the final valuation of the endowment equals a compound of the valuations at both stages (as in Bordalo *et al.*, 2012a), focusing theory predicts over-trading.

Therefore, attention-based theories yield the following hypothesis.

Hypothesis 2.1:
The probability of switching an endowed bad is at least 50% ("over-trading").[4]

2.2.2 Under-trading according to loss aversion-based theories

This section investigates whether subjects prefer to exchange bads according to loss aversion-based theories. As Bhatia and Golman (2013) state, prospect theory does not distinguish between a reference point in the gain or loss domain of the utility function. In fact, Tversky and Kahneman (1991) predict an endowment effect for bads as follows. They assume that an agent's reference point equals her status quo. Consider two bads x and y, each of which has a different, unique negative feature. Suppose that $x = (-1, 0)$ takes the negative value -1 in dimen-

[3] There is a "cold glow of ownership" for bads, such that the first stage's undervaluation of the endowment is persistent (Bordalo *et al.*, 2012a).

[4] Attention-based theories even predict that the switching probability of an endowed bad lies strictly above 50% as long as one item does not clearly dominate the alternative for all subjects.

sion 1 and $y = (0, -1)$ takes the negative value -1 in dimension 2. An agent's utility inferred from an item is given by an additively separable, piecewise linear utility function that puts equal weight on the item's different dimensions. The utility derived from each dimension relative to an exogenous reference point is given by a positively sloped value function with a kink at the reference point. The value function assigns greater weights to losses (i.e., outcomes below the reference point) than to equally sized gains (i.e., outcomes above the reference point). The agent adjusts her reference point toward the endowment when receiving it, that is, her reference point r becomes x as long as she expects to keep the item.[5] If hereafter the agent is allowed to exchange her bad x for y, she sticks to her endowment as relative to the reference point $r = x$, the perceived "gain" in dimension 1 is rated lower than the perceived "loss" in dimension 2 when switching.[6]

Different versions of prospect theory provide the same predictions concerning our experimental setup. Whether the status quo (Kahneman *et al.*, 1991; Samuelson and Zeckhauser, 1988) or a subject's expectations (Kőszegi and Rabin, 2006) represent the reference point is irrelevant in our setup as it equals the endowed task in each case (for details, see section 2.A). Consequently, loss aversion-based theories predict an endowment effect for bads. In particular, exchange rates are hypothesized to be equally low for goods and bads. Thus, the preceding Hypothesis stands in contrast to loss aversion-based theories.

2.2.3 Related literature on exchange asymmetries for bads

Experimental evidence in favor of the reverse exchange asymmetry for bads, as predicted by attention-based theories, is scarce. While there is no incentivized test of this effect, it has been detected in two hypothetical studies.[7] Brenner *et al.* (2007) incorporate driving lessons and the payment of a certain fine for speeding as bads. They document a reverse endowment effect which, however, is much weaker than the endowment effect observed in classical exchange experiments. Bhatia and Turan (2012) reconsider this hypothetical setting and replicate the effect. In addition, they eliminate the reverse endowment effect by shifting the subjects' focus toward the alternative option. This finding is in line with salience theory as well.

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5 In section 2.A we also discuss the predictions of both approaches if subjects expect to trade with some probability p.

6 This finding also holds under the weaker assumption that $x = (-q, -p)$ and $y = (-p, -q)$ with $q > p$.

7 In a study unrelated to our setup, Neugebauer and Traub (2012) use an incentivized bad (waiting time) as well.

Further studies provide indicative support for a reverse exchange asymmetry for bads. Psychological studies, for example Lerner *et al.* (2004), find that negative emotions induced in a pre-test situation eliminate or even reverse the endowment effect for goods, although the pre-test situtation was irrelevant to the economic decision. Carry-over effects of subjects' emotions on subsequent decision making can explain these results. If bad emotions are incidentally induced, subjects assess the endowed good itself as a bad as if it was the cause of the negative emotion. The aim to change one's (emotional) conditions may result in the desire to get rid of the endowment. This yields a reverse exchange asymmetry.[8]

To sum up, the existing literature on exchange asymmetries for bads is very limited and results are inconclusive. In particular, to the best of our knowledge, to date there are no incentivized studies on this topic.

2.3 Experimental design

In this section, we provide the experimental setup for both our incentivized and the hypothetical studies. Supplementary material such as instructions, questionnaires, and detailed information about the procedure of the experiment can be found in section 2.B.

2.3.1 Incentivized setup

Two unpleasant tasks serve as bads in our experiment. The first task consists of sorting a basket of mixed black and white confetti according to color (task "sorting"). The second task consists of completely filling one and a half sheets of checkered paper with zeros and ones in alternating order (task "zeros and ones").[9] [10]

[8] There are a few studies which incorporate goods with one negative aspect (such as Dhar and Sherman, 1996; Dhar *et al.*, 1999; Antonides *et al.*, 2010). Some of these studies observe higher exchange rates if the negative aspect is made salient and some do not. These studies, however, are not fully incentivized and do neither involve bads (but only goods with a downside, such as a voucher for a restaurant with unfriendly service) nor find a reversal of the endowment effect.

[9] The bads' two dimensions we refer to may be defined as follows. The first dimension states how "fiddly" a task is (fiddliness is the unique negative feature of the task sorting), whereas the second dimension states how "exhaustive" a task is (exhaustiveness is the unique negative feature attributed to the task zeros and ones). The predictions derived in Section 2.2 hold as long as one task is more fiddly than the alternative, while the alternative is more exhaustive.

[10] To ensure that the disutilities of both tasks were generally balanced, we ran an anonymous online survey with 677 participants. Here, we asked for subjects' preferences with respect to sorting two-colored confetti for 30 minutes and writing zeros and ones on checkered

After arriving at the laboratory, each subject was randomly assigned to an individual cubicle which contained the material for one of the tasks. The separated cubicles ensured that subjects did not see the tasks the other participants were endowed with. As soon as everybody was seated we distributed the instructions. These informed subjects about their assigned task first and the alternative task subsequently, along with general information on the experiment. As subjects had to answer control questions on both tasks, we ensured that the participants read both sets of instructions. Subjects were informed that both tasks would take approximately the same amount of time and were calibrated to be doable within 30 minutes. In addition, they were told that they could continue working in the unlikely case of not fulfilling their task on time, but they would have to wait for the remaining time if they finished within less than 30 minutes. Payments were independent of the time needed for completing the task. If a subject accomplished her task, her overall payment was €12. In case of errors or a cancellation of the task (cases which did not occur), they would have only received €4. Even though tasks were paid, we regard them as bads as they are more unpleasant than the tasks which are usually employed in laboratory experiments (for a more detailed discussion of this issue, see section 2.5.1).

In an introductory round, subjects had to answer questions about their assigned task and were also allowed to do a practice run.[11] At the end of the introductory phase, the tasks were set back to their original state: partly filled out sheets were replaced and the confetti were remixed.

After the introductory phase, we informed subjects of the chance to exchange their assigned task for the alternative task described in the instructions; up to this point subjects had not known about this opportunity. The instructions pointed out that the payment for the task was independent of the switching decision. Subjects received a decision form with two boxes ("switching" and "not switching"), one of which they needed to check. We instantaneously endowed those subjects who wanted to switch with the material for their desired task.

All subjects simultaneously started working on their alloted task. Participants could always check the progress of time via a large analog clock which we projected onto the laboratory's walls. After 30 minutes, subjects received a final

paper for 30 minutes: 51% of subjects preferred the sorting task, 34% preferred the task zeros and ones and 15% were indifferent between the two tasks, such that our tasks are roughly balanced. We also observe a weak preference for the task sorting in our experiment.

11 This procedure should lay a subject's focus on her assigned bad as this is a necessary condition for the salience mechanism to apply. This procedure is also in line with conventional studies on exchange asymmetries, where subjects get some time to inspect their endowment.

questionnaire. Once the material was handed in, and after a thorough check of their work for correctness and completeness, the participants were paid.

To exclude the possibility that testing the endowed task in the introductory phase had confounded our results, we conducted a second treatment in which the subjects did not have the opportunity to test their task. Instead, subjects only had to fill out a questionnaire which stated: "Please write three sentences on your task. What do you think about your task?" This treatment rules out that learning effects during the introductory phase had driven our results.[12]

We ran this experiment at the laboratory of DICE, University of Düsseldorf, between June 2013 and February 2014. Subjects were recruited via ORSEE (Greiner, 2004) and the experiment was carried out with pen and paper. All subjects finished and fulfilled their respective task correctly, so that earnings amounted to €12 per subject. On average, the experiment took about 55 minutes.

2.3.2 Hypothetical setup

In line with Brenner *et al.* (2007) and Bhatia and Turan (2012), we designed hypothetical treatments in which the subjects' decisions did not involve real consequences. Students received the instructions (see section 2.B, figures 2.7 and 2.8) and answered the corresponding questions. As we intended to replicate these studies in order to support our presumption that our tasks serve as bads, we repeated their experiment with the only modification being that their bads were replaced by our tasks.

We conducted two different treatments, one with a "strong" and one with a "neutral" frame. The instructions for the first hypothetical treatment emphasized the tasks' downsides by explicitly stating that they are unpleasant, that the sorting task is especially fiddly and that the zeros and ones task is especially exhausting. In the neutrally framed treatment these negatively connoted words were excluded from the instructions.[13] Besides that, the instructions for both hypothetical treatments did not differ. Both setups reflect the structure proposed in Brenner *et al.* (2007), where first the bad a subject is assigned to is described, while the alternative bad is not described before subjects learn about the opportunity to switch. This procedure should ensure that a subject's focus lies on her

[12] As this additional treatment should test only the robustness of our findings, in one day we conducted three sessions with 50 participants.

[13] One of the three slight changes between the wording in the treatments is the following: "You have been assigned the unpleasant task sorting" became "You have been assigned the task sorting." Instructions for the neutrally framed hypothetical treatment are provided in section 2.B, figures 2.7 and 2.8.

task and not on the alternative. Besides these modifications, we did not alter our incentivized setup.

Table 2.1 provides an overview of all treatments.

Table 2.1: An overview of the different treatments.

Treat-ment	Description	# of subjects
IP	incentivized; subjects could practice their assigned task	79
InoP	incentivized; no practice, only a questionnaire on the assigned bad	50
HStrong	hypothetical; instructions include negatively connoted words	85
HNeut	hypothetical; evaluative words are omitted	71

2.4 Experimental results

2.4.1 Incentivized setup

Among the 79 participants in the IP treatment, 18 subjects switched their task while 61 subjects stayed with their endowment. Irrespective of the assigned task, the majority of participants did not switch (see Table 2.2 and Figure 2.1). Out of 38 subjects who were endowed with confetti, only six subjects switched; out of 41 subjects who were endowed with zeros and ones, 12 switched. Note that due to the random assignment of endowments the share of subjects endowed with either of the bads does not exactly match 50%. In addition we do not know the share of subjects which prefers a certain bad. In order to reject the hypothesis of over-trading we therefore test if subjects' overall switching rate is significantly below $\min\{\alpha, 1-\alpha\}$, where α denotes the share of subjects endowed with task 1.[14] As only 23% of the subjects exchanged their tasks, we can reject over-trading at $p < 0.001$ according to a one-sided binomial test (testing against $\min\{\alpha, 1-\alpha\} = 38/79$) with each subject's decision representing an independent observation. This replicates switching rates from conventional papers on exchange asymmetries for goods. Consequently, we obtain a strong indication that the endowment effect carries over to the unpleasant tasks incorporated in our study.

The results from the InoP treatment are comparable as only nine out of 50 participants (18%) exchanged their task ($p < 0.001$, one-sided binomial test). We can pool the data as the results in both incentivized treatments do not differ

[14] Note that this test is conservative as it allows for any distribution of preferences between the two tasks. In particular, if tasks are equally spread among subjects, that is, if $\alpha = 0.5$, then exactly the preceding Hypothesis whether more than 50% of the subjects switch is tested.

Table 2.2: Results in the IP treatment

	IP	
	Sorting	**Zeros and Ones**
switch	6	12
not switch	32	29

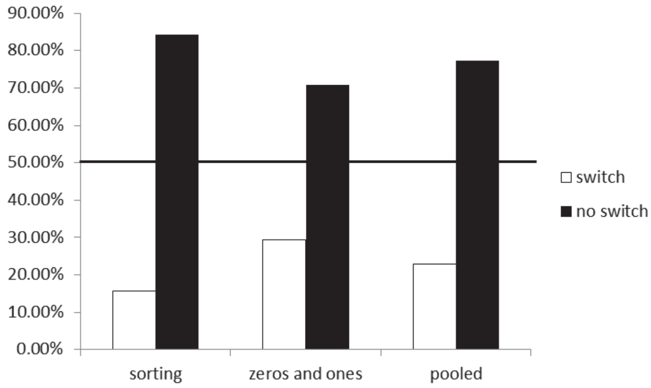

Figure 2.1: An illustration of the results in the IP treatment.

significantly ($p = 0.515$, χ^2 test). Overall, only 21% of all participants in our incentivized treatments switched. Therefore, the pooled data allows us to reject the hypothesis of over-trading at $p < 0.001$ (one-sided binomial test), too.

2.4.2 Hypothetical setup

In both hypothetical treatments, switching rates were above 50% for both tasks (see Table 2.3). In the HStrong treatment, the overall exchange rate equals 55%. It was even larger in the HNeut treatment (58%). As the results in both hypothetical treatments are not significantly different ($p = 0.758$, $\chi^2(1)$ test) we can pool the data. Altogether, significantly more than $\max\{\alpha, 1-\alpha\} = 79/156$ of the subjects switched their task ($p = 0.087$, one-sided binomial test).[15] This gives a (slight) reverse exchange asymmetry and reproduces the findings of Brenner *et al.* (2007) and Bhatia and Turan (2012).

15 Testing against an exchange rate of $\max\{\alpha, 1-\alpha\}$ with α denoting the share of subjects endowed with task 1 provides a conservative test for over-trading as it allows for any arbitrary preference distribution between the tasks.

Table 2.3: Results in the hypothetical treatments

	HStrong		HNeut	
	Sorting	**Zeros and Ones**	**Sorting**	**Zeros and Ones**
switch	24	23	20	21
not switch	20	18	15	15

2.5 Discussion

In this section, we first discuss different features of our experiment and possible objections. Then we elaborate on the discrepancy between our hypothetical and incentivized results.

2.5.1 Discussion of the incentivized experiment

In our experiment, we took two tasks as bads. Incorporating bads, i.e., items providing a disutility, is not easy in a laboratory experiment. In particular, unpleasant physical items, like annoying waste, do not serve as bads as subjects can simply ignore them. Pain yields a negative utility, but is not easily implementable.[16] We consider our tasks as bads even though subjects are monetarily rewarded for accomplishing them. Subjects always expect some form of remuneration, just for participating in a laboratory experiment. However, in other experiments run at the economics' laboratory in Düsseldorf, the tasks are not nearly as unpleasant. Thus, both tasks are worse than expected, so that according to subjects' expectations, fulfilling the assigned task is a certain discomfort and therefore a bad.

The completed questionnaires provide further evidence that our tasks serve as bads. For instance, in the IP treatment about 75% of the subjects (59 out of 79) used negatively connoted words like "stupid," "boring" or "senseless" to describe the assigned task. About 50% of the subjects (38 out of 79) even described their task as "strongly boring," "unpleasant," "laborious" or synonymously. Out of these 38 subjects, the switching rate did not exceed the overall switching rate as only nine of them (24%) switched ($p < 0.01$, one-sided binomial test). This supports our view of the tasks as bads.[17]

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[16] Pain is incorporated only in very few studies such as Berns *et al.* (2011), who investigate probability weighting in lotteries with "non-monetary adverse outcomes" (electric shocks).

[17] Further evidence that subjects strongly disliked their tasks is given by the fact that material built between the separated cubicles was partly demolished and by comments like "If the next experiment I take part in is comparably stupid, I will quit going to experimental sessions" or "I hate the tasks."

In addition, the results from the hypothetical treatments support the assumption that our tasks serve as bads. The endowment effect for goods is a robust finding both in hypothetical and incentivized studies (see, for example, Kahneman *et al.*, 1991; Horowitz and McConnell, 2002). Its entire absence in our hypothetical setup indicates that our tasks represent bads.

Furthermore, we think it is appropriate to consider tasks instead of physical endowments. First, related studies by Brenner *et al.* (2007), Bhatia and Turan (2012) and Dhar *et al.* (1999) incorporate non-physical endowments as well. Second, there is broad evidence that exchange asymmetries exist for physical and non-physical items alike (see Horowitz and McConnell, 2002; 2003).

We think that our results are driven neither by uncertainty-aversion nor by learning effects. If practicing the assigned task in the introductory phase is possible, uncertainty concerning the assigned task may be eliminated and learning may play a role. Both issues, however, are excluded in the InoP treatment.[18] [19]

In addition, we controlled for the common confounds in exchange experiments as listed by Plott and Zeiler (2007), that is, issues of relative value, of language, of transaction costs, and of the influence of public revelation. First, to avoid emotional relations the subject might draw between the endowment and the experimenter, endowments had already been placed on the tables prior to subjects being randomly assigned to them. Second, we used a neutral wording such that subjects could not apprehend staying or switching as the "better" or "correct" choice. Third, we minimized transaction costs by requiring an active decision and by exchanging endowments instantaneously for those who decided to switch. The decision to switch did not induce any delay as the experiment was started simultaneously once all the necessary material had been handed out. Fourth, the individual cubicles eliminated the influence of public revelation on decision making. Thus, we think that these confounds are not an issue in our experiment.

To keep the clear prediction by Bordalo *et al.* (2012a) of a reverse exchange asymmetry we avoided (1) training rounds for both tasks and (2) pre-test trading

[18] Uncertainty about how bad the tasks are should not play a role as we illustrated both bads carefully and incorporated two tasks that subjects should be, to some extent, familiar with, like writing numbers or doing fiddly exercises. Also, uncertainty about the probability of accomplishing the task in time should not confound our experiment as we emphasized that everybody could accomplish the task for sure (due to an allowance for extra time if necessary) and that quicker performance bore no advantage.

[19] The average time switchers needed to fulfill their task provides further indication that learning was no issue. Subjects switching from sorting to zeros and ones did not need significantly more time (27.4 minutes compared to 26.7 minutes), whereas switchers from zeros and ones to sorting needed on average 23.4 minutes, exactly as long as non-switchers needed for this task.

rounds as comparable to those in Engelmann and Hollard (2010). In the case of prior experience with both tasks, it is unclear which degree of attention a subject designates to which task when she makes her final decision. Thus, predictions by attention-based theories would become more vague if training rounds for both tasks or pre-test trading rounds were introduced.

Finally, we decided against a study on willingness-to-accept (*wta*) and willingness -to-pay (*wtp*) gaps since the presence of an endowment effect for money would create a crucial confound. Consequently, in order to decide whether the reverse exchange asymmetry for bads does or does not exist, exchange experiments are preferable to *wta*-*wtp* studies.

2.5.2 Discussion of the discrepancy between our hypothetical and the incentivized results

The results from our incentivized setup challenge the findings of hypothetical studies (Brenner *et al.*, 2007; Bhatia and Turan, 2012) which report a reverse exchange asymmetry for bads. The following mechanism may explain this difference. Assigning an agent a bad makes her feel dissatisfied with her endowment. She may intuitively wish to switch bads just to get rid of her endowment as Bordalo *et al.* (2012a) propose. A subject may base her decision to switch on this first intuition when outcomes are hypothetical.

This, however, may not reflect her actual choice when facing real consequences. In contrast to hypothetical setups, exchange experiments like ours give a subject more time to empathize. Loewenstein and Adler (1995) document an empathy gap which prevents subjects from anticipating how the endowment will make them feel. This might apply to our hypothetical experiment as well. It is only with incentives that the decision maker is truly involved in the setting and therefore has second thoughts. This involvement shifts the reference point toward the endowment. In contrast to the agent's initial desire to get rid of the bad, she does not switch after adopting her endowment as her reference point as she is loss averse. This explanation is also supported by some of the subjects' statements on the questionnaires such as "I had already prepared myself mentally to do the assigned task" or "In the beginning I thought the other task would be better, but then I did not switch because I had already adapted myself to my task." These comments indicate that the mechanism proposed by prospect theory is at work in incentivized settings.

Our study adds to the literature which documents important differences between hypothetical and incentivized studies in various fields. For example, Harrison (2006) finds that subjects respond differently to risky prospects with either real or hypothetical consequences. Vlaev's (2012) results call into question established methodologies that rely on hypothetical answers with respect to social interaction. Interestingly, in a field experiment Azar (2010) tests his theory of "relative thinking" (Azar, 2007), which shares its central prediction with salience theory of consumer choice (Bordalo *et al.*, 2013). He takes two vertically differentiated goods (where the lower-quality good is cheaper) and tests the hypothesis that a uniform increase in prices shifts demand toward the more expensive, higher-quality good. He finds support for his hypothesis exclusively in a hypothetical setup, but not in his field experiment. Similar to our paper, Azar (2010) indicates differences in incentivized and hypothetical choice situations if salience plays a major role.

2.6 Conclusion

As loss aversion-based and attention-based theories share many predictions of decision biases, we analyze a setup in which the approaches yield contradicting predictions. Loss aversion-based models hypothesize an endowment effect for bads, regardless of whether the reference point equals the status quo (Kahneman *et al.*, 1991; Samuelson and Zeckhauser, 1988) or a subject's expectations (Kőszegi and Rabin, 2006; 2007). In contrast, attention-based theories predict a reversal of the endowment effect for bads. Thus, we analyze exchange rates for bads in an incentivized laboratory experiment and find a strong endowment effect for bads. This finding supports prospect theory but contradicts attention-based theories. Therefore, we find a clear indication that the endowment effect is indeed loss aversion-based and not attention-based. Attention effects may not be strong enough to carry over to the two-stage procedure proposed in Bordalo *et al.* (2012a) in incentivized settings.

Furthermore, our results stress the robustness of the status quo bias. Our findings imply that people do not only have strong preferences in favor of the status quo if it is pleasant, but also if it is rather unpleasant. Thus, our results may indicate that people are locked in bad jobs or marriages instead of opting for other (potentially also bad) alternatives. An endowment effect for bads might also induce customer loyalty toward low-quality products which could be exploited by firms. Consequently, our finding of an endowment effect for bads may also have important practical implications.

2.A Exchange asymmetries for bads

In order to derive predictions of attention-based and loss aversion-based theories for our experimental setup, we impose the following assumptions. Each item c is uniquely given by the values it takes in two dimensions/ attributes, i.e., it can be described by a vector $c = (c_1, c_2)$ with two entries. For the bads we incorporate, the first dimension indicates how fiddly the task is and the second dimension indicates how exhausting the task is. Suppose an agent's utility function v is linear and additively separable with respect to an item's different dimensions. In particular, we assume that $v(c) := v_1(c_1) + v_2(c_2)$, where $v_i(c_i) := c_i$ for $i = 1, 2$. Let task "sorting," abbreviated by S, be given by the vector $S = (-s_1, -s_2)$ with $s_1 > s_2$ as it is more fiddly than exhausting.[20] The task "zeros and ones" (Z) is given by vector $Z = (-z_1, -z_2)$ with $z_1 < z_2$ as it is more exhausting than fiddly. We impose symmetry, that is, $z_2 = s_1$ and $z_1 = s_2$, and normalize $z_2 = s_1 = 1$ and $z_1 = s_2 = 0$. Without loss of generality, we assume that a subject is assigned task S at the first stage.

The salience mechanism

Salience and homogeneous agents

We illustrate the salience mechanism introduced in Bordalo *et al.* (2012a), according to which an item is evaluated depending on the saliency of its attributes. A local thinker (LT) – an agent who is susceptible to the salience mechanism – assigns a larger weight to an attribute the more salient it is. An item's attribute is the more salient the more it differs from the average value that attribute takes among all items within the consideration set (the set comprising all options considered by a subject). Thus, attributes which match the average within the consideration set tend to be neglected. In contrast, an attribute which differs a lot from the average tends to be overemphasized. In our setup with two attributes we call that attribute which is more salient the "salient" attribute and the other attribute the "not salient" attribute.

The weights a local thinker assigns to different attributes are distorted according to a parameter $\delta \in [0, 1)$, while $\delta = 1$ characterizes a rational decision maker. The smaller δ, the larger the bias. Parameter $\delta = 0$ indicates that the agent evaluates an item solely based on its most salient attribute. Given two attributes, the multiplicative weight on the more salient attribute is given by $\frac{2}{1+\delta}$

[20] The minus signs indicates negative utilities.

and the weight on the less salient attribute by $\frac{2\delta}{1+\delta}$.[21]

In our two-stage experiment a local thinker chooses the item which yields the higher final valuation $v^{LT}(\cdot)$. If an item is considered only at the second stage (the *trading stage*), but not before, then the item's final valuation equals its second-stage valuation $v^{LT,2}(\cdot)$. If an item is considered at both stages (during the *endowment stage* and the *trading stage*), then its final valuation equals a convex combination of its first-stage valuation $v^{LT,1}(\cdot)$ and its second-stage valuation $v^{LT,2}(\cdot)$.

With these steps, the salience mechanism predicts a reverse exchange asymmetry, that is, over-trading, for bads. Being assigned a task (suppose S) in the first stage, the subject evaluates it in comparison to her initial status quo $(0, 0)$ of not having it. Then, her consideration set consists of the two elements $S = (-1, 0)$ and $(0, 0)$. The task's value in the first dimension (fiddliness) differs from the average fiddliness within the consideration set, $-1 < -\frac{1}{2}$, while its value in the second dimension (exhaustiveness) meets the average of zero. Therefore, the fiddliness of task S is salient and overemphasized. The local thinker's valuation of task S in the endowment stage is given by $v^{LT,1}(S) = -\frac{2}{1+\delta} + \frac{2\delta}{1+\delta} \cdot 0$.

In the second stage, agents must decide whether to switch tasks. The consideration set then comprises the two tasks $S = (-1, 0)$ and $Z = (0, -1)$.[22] Here, the average value of both attributes equals $-\frac{1}{2}$. Each task has one relative upside (the attribute with value 0) and one relative downside (the attribute with value -1). The upsides of the tasks are assessed equally and so are the downsides. As Bordalo *et al.* (2012a) impose diminishing sensitivity, the tasks' valuations, however, are distorted at this stage, too.[23] Each task's upside is salient as the difference between 0 and $-\frac{1}{2}$ is perceived to be larger than the difference between -1 and $-\frac{1}{2}$. Thus, the weight on each task's upside equals $\frac{2}{1+\delta}$ and the weight on each task's downside is $\frac{2\delta}{1+\delta}$. Consequently, both tasks are evaluated at the second stage as $v^{LT,2}(S) = v^{LT,2}(Z) = \frac{2}{1+\delta} \cdot 0 - \frac{2\delta}{1+\delta}$.

The local thinker's final valuation $v^{LT}(\cdot)$ of the endowment is a convex combination of the first- and the second-stage valuations with corresponding weights

[21] Note that the following procedure mirrors the salience mechanism (Bordalo *et al.*, 2012a) with a few slight modifications which do not change its predictions; for instance, we do not normalize the sum of the weights assigned to the attributes to one.

[22] Including $(0, 0)$ in the consideration set does not substantially alter the analysis (for details, see Bordalo *et al.*, 2012a).

[23] If the assumption of diminishing sensitivity is dropped, such as in Kőszegi and Szeidl (2013), both items are valued rationally at this stage. In either case, the subsequent argumentation and the prediction of over-trading remain valid.

$\gamma \in (0,1]$ and $1-\gamma$, that is,

$$v^{LT}(S) = \gamma v^{LT,1}(S) + (1-\gamma)v^{LT,2}(S) < v^{LT,2}(S).$$

In contrast, the alternative task's final valuation equals its second-stage valuation,

$$v^{LT}(Z) = v^{LT,2}(Z) = v^{LT,2}(S) > v^{LT}(S).$$

Consequently, local thinkers are expected to switch their assigned bads. Therefore, the salience mechanism predicts a reverse exchange asymmetry for unpleasant items.

Salience and heterogeneous agents

In this section, we investigate the predictions by salience theory if a share $0 \leq p \leq 1$ of subjects anticipates at the first stage that switching endowments would become possible, while the remaining share $1-p$ does not.

How subjects evaluate different alternatives depends on the composition of their consideration set. If a subject expects the chance to exchange her assigned task S, she considers both alternatives already at the first stage, such that both the endowment and the alternative are contained in her first- and second-stage consideration sets. Then, her consideration set at the first stage equals $\{S, Z, (0,0)\}$. In this set, the upsides of S and Z and the downsides of both options are equally salient, so that $v^{LT,1}(S) = v^{LT,1}(Z)$. As in the preceding subsection, the consideration set in the second stage equals $\{S, Z\}$, so that $v^{LT,2}(S) = v^{LT,2}(Z)$. For each item $c \in \{S, Z\}$ which is considered in both stages, a local thinker's final valuation equals a convex combination of its first- and second-stage valuations, i.e., $v^{LT}(c) = \gamma v^{LT,1}(c) + (1-\gamma)v^{LT,2}(c)$ for some $\gamma \in (0,1]$. Therefore, the final valuations match, $v^{LT}(Z) = v^{LT}(S)$. Thus, the subject is indifferent between keeping and trading her endowment and switching rates can be expected to be about 50%.[24]

For the remaining share of $1-p$ subjects who do not expect the chance to trade, the alternative is not included in the first-stage consideration set. These subjects are expected to behave as delineated in the preceding subsection. Hence, salience theory predicts over-trading for all $0 \leq p < 1$, which becomes weaker for a larger p.

[24] In particular, relaxing the assumption that both attributes are weighted equally, i.e., consumers put randomly a slightly higher weight on one of the attributes, generates this prediction.

As we did not mention or indicate any opportunity to switch endowments prior to the trading stage, we suppose that p should be zero. But even if it takes a small positive value, our predictions hold qualitatively. Therefore, the prediction of over-trading is robust with respect to the assumption that some subjects anticipate the chance to exchange endowments.

Salience and stochastic consideration sets

The following setup is related to the previous subsection and yields the same results. Instead of heterogeneous agents, it incorporates stochastic consideration sets. Suppose a subject is endowed with task S. Assume further that an agent's first-stage consideration set equals $C' := \{S, Z, (0,0)\}$ with probability p', while it equals $C'' := \{S, (0,0)\}$ with probability $1-p'$. Therefore, at the first stage an agent considers the chance to switch with probability p', while she does not consider that chance with probability $1-p'$. As in the preceding subsections, the second-stage consideration set equals $\{S, Z\}$, the items' upsides are overweighted due to diminishing sensitivity and in particular $v^{LT,2}(S) = v^{LT,2}(Z)$ holds. An item's final valuation $v^{LT}(\cdot)$ is given by a convex combination of the previous stages' expected valuations if the item is considered at both stages while it equals the second stage's valuation if it is not considered at the first stage. In order to assess whether an agent decides to switch, we compare her expected final valuations of the endowment and the alternative. We denote the first-stage valuation of $c \in C'$ as $v^{LT,1}(c, C')$ and of $c \in C''$ as $v^{LT,1}(c, C'')$. Then, the agent's expected valuation $v^{LT,1}(\cdot)$ of her endowment at the first stage equals $v^{LT,1}(S) = p'\, v^{LT,1}(S, C') + (1-p')\, v^{LT,1}(S, C'')$.

We distinguish the following two cases: (1) within C', the upsides of S and Z are more salient than the downsides, or (2) within C', the options' downsides are more salient than the upsides.[25][26]

As in the first case the downside of S is overemphasized in C'', but not in C', its expected first-stage valuation $v^{LT,1}(S)$ increases in p'. As $v^{LT,2}(S)$ is independent of p', the expected final valuation $v^{LT}(S) = \gamma v^{LT,1}(S) + (1-\gamma) v^{LT,2}(S)$ increases in p', too. As Z's upside is overweighted both in C' and in $\{S, Z\}$, the expected final valuation $v^{LT}(Z) = v^{LT,1}(Z, C') = v^{LT,2}(Z)$ of alternative Z is independent of p'. For $p' < 1$, over-trading is predicted which becomes weaker for a larger p'.

25 If the upsides and the downsides are equally salient within C', computations and predictions are analogous to the two cases presented here. Salience theory predicts over-trading as long as $p' < 1$.

26 In Bordalo *et al.* (2012a), the first case applies due to additional specifications on *salience functions* (which we omit here for brevity).

In the limit case $p' = 1$, the decision maker is indifferent between switching and not switching as $v^{LT}(Z) = v^{LT}(S)$.

In the second case, the downsides of S and Z are salient in C' and in C'', such that S's final valuation is independent of p' as $v^{LT,1}(S, C') = v^{LT,1}(S, C'')$. The expected final valuation of alternative Z is given by

$$v^{LT}(Z) = p'(\gamma v^{LT,1}(Z, C') + (1-\gamma)v^{LT,2}(Z)) + (1-p')v^{LT,2}(Z).$$

As $v^{LT,2}(Z) > \gamma v^{LT,1}(Z, C') + (1-\gamma)v^{LT,2}(Z)$ for $\gamma > 0$, the expected final valuation of Z decreases in p'. Therefore, the reverse exchange asymmetry becomes weaker for a larger p'. For $p' = 1$, switching rates can be expected to be about 50% as $v^{LT}(Z) = v^{LT}(S)$.

Thus, in both scenarios (with heterogeneous agents and with heterogeneous choice sets) salience theory predicts over-trading as long as $p < 1$ ($p' < 1$, respectively).

Loss aversion

Loss aversion with a deterministic reference point (Kőszegi and Rabin, 2006)

When the reference point is given by a decision maker's expectations, loss aversion-based theories predict an endowment effect for goods and bads alike. According to Kőszegi and Rabin (2006), the utility derived from $c = (c_1, c_2)$, given reference point $r = (r_1, r_2)$, is given by

$$u(c|r) = v(c) + n(c|r),$$

where $n(c|r)$ gives the gain-loss utility relative to the reference point. Suppose that n is additively separable across dimensions, i.e., $n((c_1, c_2)|r) := n_1(c_1|r_1) + n_2(c_2|r_2)$, and suppose $n_i(c_i|r_i) := \mu(v_i(c_i) - v_i(r_i))$ for a function μ which satisfies the properties of the value function introduced in Kahneman and Tversky (1979). In particular, we assume that μ is a piecewise linear function which is defined by $\mu(x) = \eta x$ if $x > 0$ and $\mu(x) = \eta\lambda x$ if $x \leq 0$, where parameter $\eta > 0$ is a measure of the weight a decision maker assigns to the gain-loss utility and λ is a coefficient of loss aversion. Following prospect theory, losses relative to the reference point receive larger weights than gains, i.e., $\lambda > 1$. If a subject expects to carry out task S, her reference point equals $S = (-1, 0)$, while expecting to do task Z induces reference point $Z = (0, -1)$. As by assumption $v(c) = v_1(c_1) + v_2(c_2) = c_1 + c_2$, the utility derived from $c \in \{S, Z\}$ given reference point $r \in \{S, Z\}$ equals

$$u(c|r) \ = c_1 + c_2 + \mu(c_1 - r_1) + \mu(c_2 - r_2).$$

Suppose a subject is endowed with task S. If she does not exchange her endowment, we have $c = r = S$ and her utility is given by $u(S|S) = -1 + 0 + \mu(-1 + 1) + \mu(-0 + 0) = -1$. If she switches, we have $c = Z$ and $r = S$ and her utility is given by $u(Z|S) = 0 - 1 + \mu(0 + 1) + \mu(-1 + 0) = -1 + \eta(1 - \lambda)$. As we assume $\lambda > 1$ and $\eta > 0$, she does not opt for the alternative Z, but sticks to her endowment S.

Loss aversion with a stochastic reference point (Kőszegi and Rabin, 2007)

Suppose an agent expects to exchange her endowment $c \in \{S, Z\}$ for alternative c' with probability $0 \leq \tilde{p} \leq 1$, while she does not expect to do so with probability $1 - \tilde{p}$. Denote G the corresponding probability distribution on $\{c, c'\}$. Then, according to Kőszegi and Rabin (2007), the utility derived from c given the stochastic reference point G equals

$$u(c|G) = \tilde{p} \cdot u(c|c') + (1 - \tilde{p}) \cdot u(c|c),$$

while the alternative $c' \neq c$ yields

$$u(c'|G) = \tilde{p} \cdot u(c'|c') + (1 - \tilde{p}) \cdot u(c'|c).$$

Suppose $c = S$ and $c' = Z$. The decision maker exchanges her endowment if $u(Z|G) > u(S|G)$, i.e.,

$$\tilde{p}\ u(Z|Z) + (1 - \tilde{p})\ u(Z|S) > \tilde{p}\ u(S|Z) + (1 - \tilde{p})\ u(S|S).$$

As $u(Z|S) = u(S|Z) = -1 + \eta(1 - \lambda)$ and $u(Z|Z) = u(S|S) = -1$, the subject switches if $\tilde{p} > \frac{1}{2}$ and refrains from switching if $\tilde{p} < \frac{1}{2}$. For $\tilde{p} = \frac{1}{2}$ she is indifferent.

In particular,

$$\frac{\partial u(Z|G)}{\partial \tilde{p}} = -\frac{\partial u(S|G)}{\partial \tilde{p}} = -\eta(1 - \lambda) > 0.$$

We get the intuitive result that the higher the probability $\tilde{p}$, the less attractive the endowed option S and the more attractive the alternative option Z becomes.

Therefore, the larger $\tilde{p}$, the larger the predicted exchange rates. Consequently, loss aversion-based theories predict an endowment effect also if subjects expect to trade their endowment with a small probability $\tilde{p}$.

2.B Experimental procedure of the IP treatment

1) Subjects are welcomed and draw a number between one and 18 randomly which gives the number of the cubicle to sit in. The material has been set to the cubicles beforehand: cubicles 1-9 are endowed with the task "sorting" while cubicles 10-18 are endowed with the task "zeros and ones".

2) We deliver the instructions and emphasize that they are to be read for both tasks. In the end, subjects have to answer control questions on both tasks.

3) After the answers to the control questions have been checked privately by the experimenters, a questionnaire for the assigned task is handed out (see Figure 2.2) and the introductory period starts.

4) After a few minutes, the trial phase ends and questionnaires are collected. Confetti which have been sorted were remixed and paper sheets which have been filled out partly are replaced.

5) Subjects are orally informed about the chance to switch tasks: "Before the 30 minutes start, you have the option exchange your assigned task for the other task described in the instructions. You will receive a decision form in which you need to check one of two boxes. One box states that you want to stay with your assigned task while the other one indicates that you want to exchange it for the alternative task. Before the task starts, you will receive the material for the task you have chosen. The payment for the alternative task is exactly the same: fulfilling the task correctly and completely gives you €8, independent of whether you switch tasks or not. Once the 30 minutes have started, there is no further opportunity to switch tasks, but you need to finish your chosen task."

6) The decision form is handed out (see Figure 2.3).

7) The decision form is collected and each switcher is endowed with the requested task.

9) The working time begins (30 minutes).

10) After 30 minutes, the final questionnaire is handed out (see Figure 2.4).

11) Results are inspected and subjects get paid privately.

On the next pages, we provide a translation of the instructions for a subject in the IP treatment who is endowed with the task sorting. Instructions for subjects endowed with the alternative task are analogous. For the InoP treatment, instructions are similar, but the option to practice the assigned task is removed from the instructions. In figures 2.5 and 2.6, we provide pictures of the cubicles. For the hypothetical treatment HNeut, instructions are given in figures 2.7 and 2.8.

Instructions

Welcome to today's experiment. Please do not talk to other participants from now on. If you have any questions during the experiment, please raise your hand. We will answer your question privately. Please, read the instructions carefully.

Please, fill in the blanks before you read the instructions:

Your age: ______________________

Your major: ______________________

Your sex (m/ w): ______________________

By randomly drawing a number for a cubicle to be seated in, one of the following two tasks was randomly assigned to you. **Your task is ``sorting''** (see next page). **You only need to fulfill this task**.

Nevertheless, please read the instructions for both tasks. Thus, please also read the instructions for task `` zeros and ones.'' Both tasks will be paid equally. You have 30 minutes to fulfill your task. You will earn 8 Euro for correctly finishing the task. In total you can earn 12 Euro for participating in this experiment.

In the following, both tasks are described in detail.

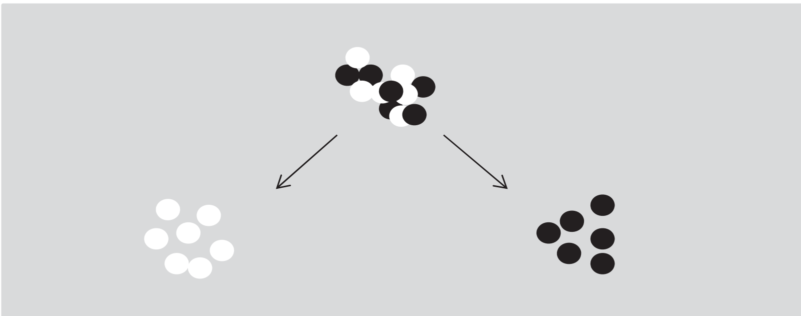
TASK 1: SORTING (Your task)

In your task you have to sort a certain amount of paper snips according to color. You receive a basket with black and white paper snips and two empty baskets. Please sort the black paper snips in one empty basket and the white ones in the other empty basket. At the end of the experiment, the baskets with the sorted material are given to the experimenter.

For this task you have 30 minutes. The amount of paper snips is calibrated such that you can easily manage this task within time given an appropriate speed. If you finish before 30 minutes are over, you will have to wait until time runs out. Therefore, you gain nothing by working very fast. If you do not manage to finish within the given time, you will get some additional minutes to finish the task.

You will only be paid if you have completed the task and have sorted the paper snips correctly! We will control both the amount and the correctness of sorting before we pay you accordingly. Therefore, please make sure you do not lose any paper snips.

Illustration of the task:



TASK 2: ZEROS AND ONES

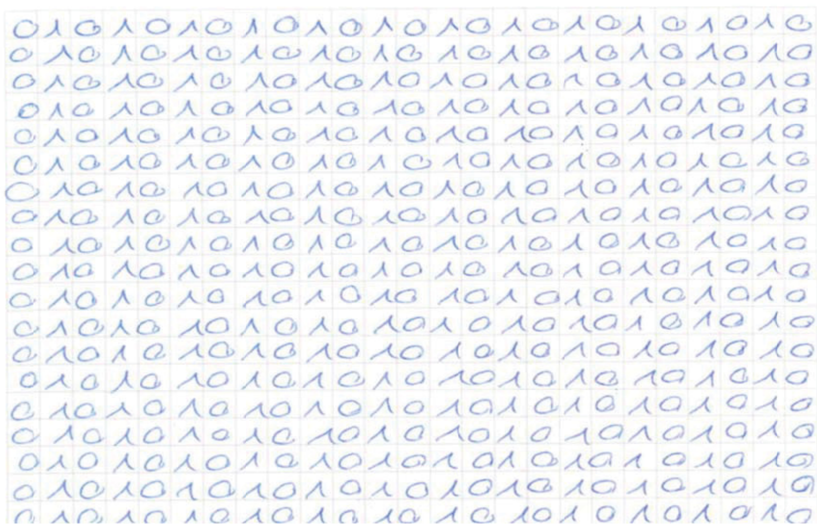
The other task requires writing ``0'' and ``1'' on one and a half sheets of checkered paper in alternating order. The first box in a row should be started with a ``0'', the second box should be filled with a ``1'', the third one with a ``0'' and so on until the end of a row. The first box of the next row should again start with a ``0'', and then it should be proceeded as in the previous row in alternating order. This is to be done for the given sheets of paper. At the end of this task every single box should contain one number. At the end of the experiment, the sheets are given to the experimenter.

For this task you will have 30 minutes. The amount of paper is calibrated such that you can easily manage this task within time, given an appropriate speed. If you finish before the 30 minutes are over, you will have to wait until time runs out. Therefore, you gain nothing by working very fast. If you do not manage to finish within the given time, you will get some additional minutes to finish the task.

It is necessary that every single box contains one number (either a zero or a one) in the correct order to get the payment. We will check the sheets before making the payment.

Illustration of the task:

HEINRICH HEINE
UNIVERSITÄT DÜSSELDORF



Procedure of the experiment

Before the actual task starts, there will be a trial period in which you can familiarize yourself with your assigned task (sorting). We will hand out an additional questionnaire for your task. Please fill out the questionnaire during this trial period. The time for the trial is not part of the 30 minutes. Thus, time does not run during the trial. The snips you have sorted during this time do not count for the amount to be sorted within the 30 minutes. Everything that has been sorted will be remixed before the actual task starts. Therefore, you cannot work in advance. For this part of the experiment (trial and questionnaire) you earn 4 Euro.

After that, you have 30 minutes for the actual task. Please carry out your task correctly. If time runs out before you finish your task, you will receive some additional minutes. If you finish earlier we ask you to wait silently in your cubicle until the 30 minutes are over. Fulfilling the task correctly gives you 8 Euro.

In total you can earn 12 Euro for participating in this experiment: 4 Euro for the trial and the questionnaire and 8 Euro for the correctly fulfilled task.

Control questions (only to make sure you read the instructions for both tasks):

Please provide short answers:

1) What needs to be done for the task SORTING?

____

2) What needs to be done for the task ZEROS AND ONES?

____

3) What happens if you are finished after 20 minutes?

____

4) Which task is yours?

____

Your task: Sorting

Please make yourself familiar with your task. Paper snips which have already been sorted during the trial phase will be remixed again afterwards. Please write three sentences about your task. What do you think about your task?

____

____

____

Figure 2.2: Questionnaire for subjects endowed with the task "sorting".

PLEASE MAKE YOUR DECISION NOW!

Your assigned task: SORTING

Your alternative task: ZEROS AND ONES

☐ I want to stay with the assigned task

☐ I want to switch to the alternative task

Payment for the alternative task is exactly the same: Finishing the task correctly gives 8 Euro, independent of whether you switch tasks or not. When the 30 minutes have started, there is no further possibility to switch tasks.

Figure 2.3: The decision form for subjects endowed with the task "sorting".

Do you have comments about the experiment?

What did you think while reading the instructions?

How did you find the trial session?

Why did you switch / not switch your task?

How long did it take you to finish the task?

Figure 2.4: Final questionnaire.

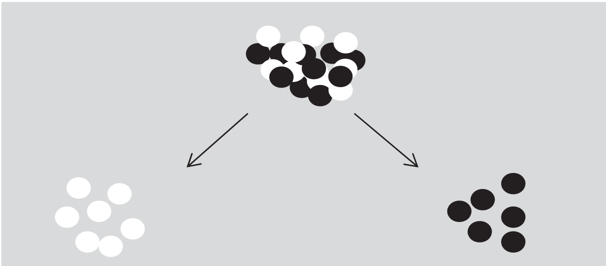
Figure 2.5: Cubicle for subjects endowed with the task "zeros and ones".

Figure 2.6: Cubicle for subjects endowed with the task “sorting”.

Instructions:

Please, imagine the following situation and answer honestly.

You participate in an economics experiment for about an hour and you will earn 12 Euro for fulfilling all requirements. Whereas you are used to doing tasks on the computer in experiments like this, here you are assigned the task **sorting**: Within 30 minutes, sort a given and exactly calibrated amount of mixed black and white paper snips according to color. If you need more than 30 minutes you will get up to 5 additional minutes until all the paper snips are sorted completely. If you finish before 30 minutes are over, you will have to wait silently at your seat until the time runs out; working fast does not bear any advantage. The following picture illustrates this task.



You must have sorted the given amount completely and correctly to receive the payment. The paper snips are small, made from low-grade paper and may stick together.

Before the start of the actual task, you surprisingly get the opportunity to exchange your task immediately for another task named **zeros and ones**: Write zeros and ones in alternating order in every box of one and a half sheets of checkered paper. This task takes approximately as much time as the first task. The conditions with respect to time and the payment are the same for both tasks. The following picture illustrates task zeros and ones.

.

Figure 2.7: Instructions for HNeut for those endowed with the task "sorting", page 1.

How would you decide in such a situation? Please mark one answer clearly! **I would…**

☐ Stay with the task **sorting**

or

☐ switch to the task **zeros and ones.**

Comments about this experiment and your decisions:

____

____

____

Figure 2.8: Instructions for HNeut for those endowed with the task “sorting”, page 2.

Declaration of Contribution

Hereby I, Katrin Köhler, declare that the chapter "Exchange Asymmetries for Bads? Experimental Evidence" is co-authored by Markus Dertwinkel-Kalt. It has been pre-published as a DICE Discussion paper (Dertwinkel-Kalt and Köhler, 2014).

My contributions to this chapter are as follows:

- I wrote parts of the Introduction
- I wrote minor parts of the model (Section 2 and Appendix A)
- I contributed to the implementation of the experiment
- I contributed to the design and wrote parts of the results
- I wrote minor parts of the Discussion
- I have contributed to the Conclusion

Signature of coauthor 1 (Markus Dertwinkel-Kalt): ______________

Chapter 3

Demand shifts through salience effects? An experimental investigation

Co-authored with Markus Dertwinkel-Kalt, Mirjam Lange and Tobias Wenzel

3.1 Introduction

This paper studies consumers' choices in markets with vertical product differentiation. Decisions between goods and services which are differentiated in price and quality are widespread. For example, in grocery or electronics stores consumers choose between various types of vertically differentiated goods on a frequent basis, e.g., manufacturer's brands versus home brands or simple cellular phones versus multifunctional smart phones. Given its ubiquity, understanding the underlying evaluation criteria yields important implications for commercial decisions like the range of products produced and for marketing purposes, as well as for related fields such as psychology and consumer decision research in economics (Azar, 2011).

Suppose a consumer has to choose from a set of goods which are characterized by the attributes *price* and *quality*. Standard theory requires that the consumer evaluates the different options separately and chooses the option which maximizes her utility. In contrast, salience theory (Bordalo *et al.*, 2013; henceforth BGS) predicts context-dependent choices according to which a consumer's attention is drawn either to a good's price or to a good's quality, depending on which attribute is more salient. BGS state that salience of an option's attribute is determined by comparing its level to the attribute's average level among all options which come to the consumer's mind.

In general, salience theory (Bordalo *et al.*, 2012a,b, 2013) states that agents overemphasize especially salient features of choices and underrate less prominent, but possibly important aspects. This assumption is supported by psychological evidence suggesting that an agent's attention is limited and therefore allocated to outstanding features (Taylor and Thompson, 1982; Kahneman, 2011). Regarding decision making under risk, salience theory provides an alternative rationale for violations of expected utility theory which have previously been explained by prospect theory (Bordalo *et al.*, 2012b). With respect to riskless decision making, it can explain many violations of rational choice in the domain of consumer choice, such as endowment (Bordalo *et al.*, 2012a) or decoy effects (Bordalo *et al.*, 2013). Thus, salience theory provides a better understanding for a broad variety of cognitive biases and puzzles via the assumption that agents' attention is limited and focused on outstanding features.

Formally, salience theory is built on two main assumptions which we will test experimentally: *ordering* and *diminishing sensitivity*. *Ordering* states that an attribute is the more salient the more it differs from the attribute's average level among all options in a given choice context. For instance, a good's price becomes more salient the further it is away from the average price. *Diminishing sensitivity*, as a core feature of human perception in general (Weber's law) and of prospect theory in particular (Kahneman and Tversky, 1979), states that by uniformly increasing the value of an attribute for all goods, the salience of this attribute is reduced. Thus, for example, a generally higher price level makes prices less salient.

The following example by BGS illustrates how purchase decisions between two vertically differentiated products may reverse if the general price level increases. Suppose a consumer intends to buy a red wine at a wine store. She has the choice between an *Australian shiraz* for \$10 and a *French syrah* for \$20, knowing that she likes the French wine better. As prices in the wine store are modest, the \$10 price difference is noticeable: the higher-quality French wine is twice as expensive as the Australian. In this context prices are salient, and the consumer opts for the cheaper Australian wine. A few weeks later she visits a restaurant where again both wines are on display. As expected, both wines are marked up by an additional amount of $40, making the price difference of $10 less prominent in the restaurant than in the store (due to diminishing sensitivity). Thus, in the restaurant the French syrah seems to be a better deal and the consumer decides to buy a bottle of this wine.

In the preceding example, the consumer's price expectations coincided with the actual prices. As expected, the price level was low in the store and high in the restaurant. Imagine that, in contrast, the consumer expected low prices or was at least unsure whether the price level would be low or high, but then faced high prices (we say that prices are *unexpectedly* high). In such non-deterministic settings, not just the differences between the available options attract the consumer's attention, but also the surprising features of the choice context. Thus, an attribute's salience also depends on how much its actual realization differs from prior expectations, that is, the reference price is not just the average price of all available options, but it is also affected by the consumer's expectations of the price level. If prices are unexpectedly high, the consumer finds prices to be salient. Therefore, she is less likely to choose a high-quality product than if prices where expectedly high. This effect is driven by *ordering*: if a consumer takes not only high, but also low price levels into consideration, the reference price is reduced, thereby rendering high prices more salient. Concerning the example above, a consumer going to a store and being surprised by restaurant prices is hypothesized not to go for the high-class wine, but for the budget option. As a consequence, at expectedly high prices Bordalo *et al.* (2013) predict that sensitivity to prices is low, while it is higher after unexpected price hikes.

In a laboratory experiment with real consumption decisions, this paper tests two central and distinctive predictions of salience theory with respect to decision making between vertically differentiated products: (1) a higher expected price level for both products shifts demand toward the more expensive, high-quality product and (2) demand for the high-quality product is larger if the price level is expectedly high than if it is unexpectedly high.

During our experiment, participants had to choose between a more expensive, fast internet connection (the high-quality product) and a cheaper, slow internet connection (the low-quality product). They were endowed with a lump sum from which the costs for their purchase were deducted.[1] We controlled for participants'

[1] There are further studies which implemented real consumption in the laboratory. For instance, internet access has also been used by Pagel and Zeppenfeld (2013) and Houser *et al.* (2010), whereas Brown *et al.* (2009) and Jimura *et al.* (2009) have incorporated beverage rewards. Sippel (1997) offered a variety of goods (snacks, juices, different media), which could be consumed.

expectations by sending out an information email a couple of days prior to the experiment. In this email the experiment was described and the prices of the two options were announced.

We compare choices in a situation where the actual price level is low (LP-treatment) with a situation where all prices are marked up by the same amount (HP-treatment). In both treatments, the announced prices in the information email were identical to the actual prices faced in the experiment. In order to test for the role of expectations, we ran an additional treatment in which subjects were unsure about the price level (UHP-treatment). In this treatment participants received an information email listing both the prices from the LP- and the HP-treatment, while they faced the high price level from the HP-treatment in the experiment.[2]

We find strong support for the predictions of salience theory. First, we detect that in the HP-treatment the share of subjects opting for the premium product is significantly larger than in the LP-treatment. Second, there is a significant difference between choices in an environment with an expectedly and an unexpectedly high price level, pointing to the importance of controlling for expectations. In particular, we find that when faced with unexpectedly high prices in the UHP-treatment, subjects are less likely to choose the high-quality product than in the HP-treatment.

Our study contributes to the literature in several ways. We test for the fundamentals of salience theory in a controlled and incentivized laboratory experiment with real consumption decisions. We focus on two aspects: on the effect of increasing the price level and the effect of price surprises on choices. This has two appeals. First, the predictions regarding our treatments differ widely across recent behavioral papers and thus allow us to assess the applicability of various approaches. While several theories can explain at most one finding, salience theory as outlined in BGS is, at least to our knowledge, the only theory that is in accordance with our two main findings in one coherent framework. We elaborate this further in Section 3.5. Second, those treatments are novel additions to the literature. As far as we know there has been no experiment that studies the effects of price surprises on choices. Other predictions by salience theory (such as decoy and compromise effects), on the contrary, have been studied and supported

[2] Ideally, a test for the role of expectations would include a treatment in which subjects hold wrong expectations such that they do not expect to find the factual prices with any positive probability. We abstain from such a treatment in order to avoid deceiving subjects. Instead of providing erroneous information ex ante, we provided a list of feasible prices, thereby expanding the set of prices the subjects consider to be possible.

extensively in the literature.

Up to now, there are only a few studies which have empirically tested novel predictions by salience theory. In a laboratory experiment, Dertwinkel-Kalt and Köhler (2014) test for the reverse endowment effect for bads as predicted by salience theory in Bordalo *et al.* (2012a). More directly related to our setup, Azar (2010) conducts a field experiment where differentiated versions of bagels (with and without cream cheese) are sold to students. Testing a model of relative thinking (Azar, 2007), the author implements two treatments with different price levels, but does not find a significant shift in demand. While Azar (2010) does not control for price expectations, we show that demand shifts from low- to high-quality goods occur only if consumers are not surprised by unexpectedly high prices. Hastings and Shapiro (2013) investigate the effect of unexpected price shifts on consumer choices in the market for gasoline. In line with salience theory, they find that an unexpected uniform price increase induces agents to shift toward cheaper, lower octane gasoline. Unlike our study, however, Hastings and Shapiro (2013) need to impose strong assumptions on the prices agents have on their mind when making a purchase decision.

The remainder of the paper is organized as follows. Section 3.2 introduces salience theory and its main predictions regarding our setup. Section 3.3 describes the experimental design and derives the hypotheses before we present our results in Section 3.4. In Section 3.5 we review alternative theories and relate them to our experimental findings. We explain how our study contributes to the literature in Section 3.6 and, finally, Section 3.7 concludes.

3.2 The model

We outline salience theory as presented in BGS. Carefully delineating the role of expectations for the predictions made by salience theory, we illustrate that salience effects can induce different choices in a high-price compared to a low-price setting. The main ingredient of the model is that decision makers do not evaluate options according to true consumption utilities, but overweigh the salient attribute of an option.

A decision maker chooses from a finite choice set $\mathfrak{C} = \{(q_k, p_k) \in \mathbb{R}^2_+ | 1 \leq k \leq N\}$ of $N > 1$ vertically differentiated products, where each good $k := (q_k, p_k)$ is described by its quality level q_k and its price p_k. In the absence of salience effects, a consumer values good k with a linear utility function which assigns equal weights to its two attributes,

$$u(k) \;=\; q_k \;-\; p_k. \tag{3.1}$$

If an agent's decision making is affected by salience, she does not maximize Equation (3.1) but overweighs the attribute which is more salient. Salience is assessed via a *salience function* $\sigma : \mathbb{R}^2 \to \mathbb{R}_+$ which is symmetric and continuous and has the following two key properties: The salience function obeys *ordering*, that is, $\sigma(x+\mu\epsilon, y-\mu\epsilon') > \sigma(x,y)$ for $\mu = sgn(x-y)$ and $\epsilon, \epsilon' \geq 0$ with $\epsilon+\epsilon' > 0$, and it exhibits *diminishing sensitivity*, that is, $\sigma(x+\epsilon, y+\epsilon) < \sigma(x,y)$ for all $\epsilon > 0$. For a salience function σ and a choice set $\mathfrak{C}$, a product k's price is more salient the larger the value $\sigma(p_k, \overline{p})$ is, with $\overline{p} := \sum_k p_k/N$. Analogously, k's quality is the more salient the larger $\sigma(q_k, \overline{q})$ is, with $\overline{q} := \sum_k q_k/N$. We say that product k's price is salient if $\sigma(p_k, \overline{p}) > \sigma(q_k, \overline{q})$ holds, its quality is salient if $\sigma(p_k, \overline{p}) < \sigma(q_k, \overline{q})$ and both are equally salient if $\sigma(p_k, \overline{p}) = \sigma(q_k, \overline{q})$.

The outlined properties of the salience function capture two essential features of sensory perception (Bordalo *et al.*, 2012b). First, according to ordering, a product's price (quality) is the more salient the more it stands out, or put differently, the more it differs from the average price $\overline{p}$ (the average quality $\overline{q}$) in $\mathfrak{C}$. Second, diminishing sensitivity implies that the saliency of a good's attribute decreases if the value of that attribute uniformly increases for all items in $\mathfrak{C}$ (Weber's law of sensory perception). For instance, a good's price becomes less salient if all prices are increased by a uniform amount.

An agent's susceptibility to salience is captured by the parameter $\delta \in [0,1]$ that denotes to which extent the relative weights on the attributes are distorted. Formally, when making her decision, the agent places the multiplicative weight $\frac{2}{1+\delta} \geq 1$ on the more salient and $\frac{2\delta}{1+\delta} \leq 1$ on the less salient attribute. The smaller δ is the more the decision weights are distorted in favor of a product's salient attribute. The limit case of a rational consumer who maximizes (3.1) is characterized by $\delta = 1$. In the following we assume that the agent is susceptible to the salience bias, thus $\delta < 1$. We denote her corresponding distorted utility function with $u^s(\cdot)$.

We investigate how changes in the price level affect choices. We start by showing that higher price levels affect the way a consumer values a product. Suppose that for product k the price is salient, that is, $\sigma(q_k, \overline{q}) < \sigma(p_k, \overline{p})$, such that

$$u^s(k) \;=\; \frac{2\delta}{1+\delta}\, q_k \;-\; \frac{2}{1+\delta}\, p_k. \tag{3.2}$$

Now assume that all prices are uniformly shifted upward by an amount $\Delta > 0$, such that the average price equals $\overline{p}+\Delta$. Due to diminishing sensitivity, product k's price becomes less salient the larger the price shift Δ is. For a sufficiently large Δ, the product's quality may eventually become salient such that $\sigma(q_k, \overline{q}) > \sigma(p_k + \Delta, \overline{p} + \Delta)$ holds. In this case, the uniform price shift Δ makes k's quality salient and the decision maker evaluates the product as

$$u^s(k^\Delta) \;=\; \frac{2}{1+\delta}\, q_k \;-\; \frac{2\delta}{1+\delta}\,(p_k + \Delta), \tag{3.3}$$

where $k^\Delta := (q_k, p_k + \Delta)$ denotes good k at the increased price level.

Expected price shifts. In the following, we illustrate how shifts in the price level can induce choice reversals. Suppose there are two vertically differentiated products $k \in \{1,2\}$ with $q_1 < q_2$ and $p_1 < p_2$. Presuming that these two products lie on a rational indifference curve with $q_k - p_k = c > 0$ for $k \in \{1,2\}$,[3] the price is salient for both goods as

$$\sigma(q_k, \overline{q}) = \sigma(p_k + c, \overline{p} + c) < \sigma(p_k, \overline{p})$$

holds, such that the low-quality good is chosen.[4] There exists a threshold markup $\Delta^* > 0$ at which prices and quality are equally salient. For any $\Delta < \Delta^*$, the price remains salient for both products such that the low-quality product is chosen, while for any $\Delta > \Delta^*$ quality is overweighted and the consumer chooses the high-quality product. In particular, we have $\Delta^* = c$. Provided that $\sigma(p_k, \overline{p}) > \sigma(q_k, \overline{q})$ and $\sigma(p_k + \Delta, \overline{p} + \Delta) < \sigma(q_k, \overline{q})$, salience theory hypothesizes that a uniform price increase Δ shifts demand toward the high-quality good. Thus, an agent's price sensitivity crucially depends on the price level.

Prediction 3.1:
Suppose there are two vertically differentiated products and the low-quality product is sold at a lower price. If the general price level is sufficiently low, the agent chooses the low-quality product. If the general price level is sufficiently high, the agent chooses the high-quality product.

Due to diminishing sensitivity fixed price differences loom the smaller the

[3] We adopt the assumption by BGS that the goods lie on a rational indifference curve merely for illustrative purposes. Whenever the salience distortion outweights the objective gap between the products, a price shift can reverse choices. Thus, the following predictions still hold if the agent strictly prefers one of the products.

[4] We ensure that the decision maker chooses one alternative by assuming that she receives a utility of $-\infty$ if she does not consume.

larger the general price level is. Therefore, subjects are more willing to pay a fixed price difference in order to get the better quality at a high than at a low price level.

Unexpected price shifts. In the previous analysis, the agent compares a product against those alternatives which are indeed available. If, however, she expects to find alternatives which are not available when she makes her consumption decision, she may evaluate each option not only within her actual choice set, $\mathfrak{C}$, but within the set comprising the actual and expected offers. We call this comprehensive set the agent's *consideration set* C. For instance, if she expects several price levels to be feasible, then her consideration set consists of the products at their actual and at their expected price level.

Consider again the two vertically differentiated products (q_1, p_1) and (q_2, p_2) with $q_1 < q_2$ and $p_1 < p_2$ and scrutinize the following three scenarios. First, the general price level is low and consumers expected it to be low, that is, for each consumer the consideration set equals the choice set (scenario LP). We denote this as $C^{LP} := \mathfrak{C}^{LP} = \{(q_1, p_1), (q_2, p_2)\}$. Second, the general price level is high and consumers expected it to be high (scenario HP) such that $C^{HP} := \mathfrak{C}^{HP} = \{(q_1, p_1 + \Delta), (q_2, p_2 + \Delta)\}$ holds for some $\Delta > 0$. Third, suppose that consumers expected both price levels to be feasible (scenario UHP). Denote the (exogenous) probability with which the agent expects the low price level $p_L \in [0, 1]$. Then, the low-quality product's expected price equals

$$p_1^e := p_L\, p_1 + (1 - p_L)(p_1 + \Delta)$$

and the high-quality product's expected price is given by

$$p_2^e := p_L\, p_2 + (1 - p_L)(p_2 + \Delta).$$

Denote $\mathfrak{C}^e := \{(q_1, p_1^e), (q_2, p_2^e)\}$. Thus, an agent's consideration set is given by

$$C^{UHP} := \mathfrak{C}^{HP} \cup \mathfrak{C}^e = \{(q_1, p_1 + \Delta), (q_2, p_2 + \Delta), (q_1, p_1^e), (q_2, p_2^e)\}.$$

Within C^{UHP}, the average price is lower than within C^{HP}, causing the high-quality product's price to be more salient within C^{UHP} than within C^{HP}. In particular, if the price of the high-quality product is salient in UHP while its quality is salient in HP, then the agent's valuation of this product is lower in UHP than in HP. This yields the prediction that consumers are less inclined to choose the high-quality product if the price level is unexpectedly high than if it is expectedly high.

Formally, the average price within C^{UHP} equals $\overline{p} + (1 - \frac{p_L}{2})\Delta$ with $\overline{p} = (p_1 + p_2)/2$. Therefore, salience of the high-quality product's price in UHP is given by $\sigma(p_2 + \Delta, \overline{p} + (1 - \frac{p_L}{2})\Delta)$ while in HP it is given by $\sigma(p_2 + \Delta, \overline{p} + \Delta)$. According to the ordering property, the high price is more salient in UHP than in HP for all $\Delta > 0$ as long as $p_L > 0$. Thus, suppose that in HP the high-quality product's quality is salient while in UHP its price is salient. Then the high-quality product is valued as

$$\begin{aligned} u^s(k^\Delta, C^{UHP}) &= \frac{2\delta}{1+\delta}\, q_k - \frac{2}{1+\delta}\,(p_k + \Delta) \\ < u^s(k^\Delta, C^{HP}) &= \frac{2}{1+\delta}\, q_k - \frac{2\delta}{1+\delta}\,(p_k + \Delta). \end{aligned}$$

Prediction 3.2:
Suppose agents have to choose between two vertically differentiated products (where the low-quality product has a lower price). Consider two scenarios. First, subjects expect high prices and are faced with coinciding high prices. Second, subjects are unsure whether the price level is high or low, but finally face high prices. In the second scenario, fewer subjects choose the high-quality product than in the first scenario.

High prices attract more attention if they are partly surprising than if they were entirely expected. That is, having low prices on one's mind renders high prices more salient. As a result, people are less willing to pay a fixed price difference for the better quality if prices are surprisingly high than if they are not.

Note that these two predictions precisely allow to test the key assumptions of salience theory. The first prediction represents a test of diminishing sensitivity. The second prediction tests jointly (a) the assumption that the consideration set (instead of the actual choice set) affects decision making and (b) the ordering property.

3.3 Experimental setup

3.3.1 Experimental design

In this section, we describe our experimental setting. We invited students to a laboratory experiment where they had to purchase either a fast or a slow internet connection; an outside option was not available (that is, participants could not opt for not using the internet at all). Internet connections were differentiated with respect to quality, given by potential download speeds: While it took around 30 seconds to fully load frequently used websites, such as Facebook or a newspaper site when using the slow internet connection, it only took around five seconds with the fast connection. Participants did not have to complete any tasks but could use the internet at their convenience for the duration of the experiment. Students received a lump sum payment for participating, however, they had to incur a cost for using the internet.

Procedures

We now describe the procedures of the experiment in more detail. First, students received a standard invitation email to our experiment via ORSEE (Greiner, 2004) and registered online. Deviating from the standard procedure, participants received an additional information email a few days prior to the experiment. This email corresponded largely to the instructions, which were later distributed during the experiment. In particular, the available speeds, the corresponding prices of the two internet connections and the lump sum payment for participation were announced.[5] This information email was used to influence the participants' expectations of the price level for internet access. We outline below how the information email and the instructions differed between the treatments.

After arriving at the laboratory, participants were randomly assigned to a separated working station equipped with a computer. All screens were switched off at this point. Subjects received the instructions which the experimenter then read aloud. Participants were informed that they had to purchase internet access which they could use at their convenience for 45 minutes. It was not allowed to use any brought items, e.g., smartphones, books or papers. Speakers were not in place and illegal downloads were prohibited during the experiment. The instructions emphasized that the experimenters could not track which pages the subjects browsed during the experiment.

[5] Chapter 3.A contains an English translation of the information email.

Table 3.1: Overview of the different treatments.

Treatment	**Description**	**Endowment**	**Prices**		**Expected**	**Consideration**
			Fast	**Slow**	**prices**	**set**
LP	low prices	12	1.50	0.50	Yes	$\mathfrak{C}^{LP}$
HP	high prices	15	4.50	3.50	Yes	$\mathfrak{C}^{HP}$
UHP	unexpected prices	15	4.50	3.50	No	$\mathfrak{C}^{HP} \cup \mathfrak{C}^{e}$

All prices in Euros.

After reading the instructions aloud and answering potential questions in private, subjects received a decision sheet and indicated their choice of either slow or fast internet. Thereafter, computers were set up according to subjects' purchase decisions. After 45 minutes the screens shut down automatically and a final questionnaire was issued to all participants. Finally, subjects received their payment privately.

Treatments and hypotheses

Within this setting we ran three different treatments and used a between-subjects approach to test the hypotheses proposed by salience theory. Table 3.1 gives an overview of the treatments which we explain below.

The first goal of the experiment was to study the effect of an expected higher price level on the consumption choices by implementing a low-price (LP) and a high-price (HP) treatment. In the low-price treatment subjects received a fixed endowment of €12, with prices equal to €0.50 for the slow internet and €1.50 for the fast internet connection. In the high-price treatment, we increased the general price level by €3, hence the prices for slow and fast internet access corresponded to €3.50 and €4.50, respectively. To rule out any income effects the endowment was adjusted likewise and amounted to €15.

In both treatments, LP and HP, all information contained in the preceding email (in particular, the listed prices) corresponded to those from the instructions distributed during the experiment. Thus, a subject in treatment LP (HP) considers only the two options at their actual prices, such that her consideration set equals $\mathfrak{C}^{LP}$ ($\mathfrak{C}^{HP}$). This allows us to test for quality choices when low and high price levels are expected. From Prediction 1 we derive the following hypothesis:

Hypothesis 3.1:
In treatment HP a larger share of subjects opt for the fast internet connection than in treatment LP.

The study's second objective was to analyze how choices are affected if participants' price expectations are not fully met. We therefore ran a third treatment in which participants were unsure whether the price level would be high or low (UHP). In the UHP-treatment, subjects received an information email prior to the experiment, stating that the prices for both internet connections might either be high or low. The email announced that the prices will be either €0.50 for slow and €1.50 for fast internet (corresponding to prices in the LP-treatment) or €3.50 for slow and €4.50 for fast internet access (corresponding to the prices from the HP-treatment) while the lump sum payment corresponded to that of treatment HP (€15). The actual prices in the experiment are equal to those in the HP-treatment.

With this procedure participants were unsure about the prices they would face in the experiment. The idea is that, when making the purchase decision, the subjects have actual and expected prices on their mind. We interpret this treatment where both high and low price levels are in the agent's consideration set as capturing the effects of unexpectedly high price levels. Thus, a subject's consideration set in treatment UHP is given by $\mathfrak{C}^{HP} \cup \mathfrak{C}^{e}$.[6] From Prediction 3.2 the following hypothesis follows:

Hypothesis 3.2:
In treatment UHP a smaller share of subjects opt for the fast internet connection than in treatment HP.[7]

Participants

Sessions were conducted between January and June 2015 at the DICE experimental laboratory at the Heinrich-Heine University Düsseldorf. In total, 169 subjects participated, 59 in the HP, 57 in the LP, and 53 in the UHP treatment.[8]

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6 We stay agnostic about the exact probability with which the low price level is expected. As we mention the low price level in the information email, however, we assume that most subjects expect the low price level to occur with *some* probability.

7 In this stylized rank-based salience model according to which an attribute is either salient or not, choices in UHP and LP should be identical if the price is salient in both treatments. This, however, is an artefact of the rank-based model. Choices in LP and UHP are not predicted to be identical in a richer model with a smooth salience specification according to which weights do not just reflect which attribute is more salient, but also how salient an attribute in fact is. A smooth specification is, for instance, proposed in footnote 9 of Bordalo *et al.* (2012b).

8 The dropout rate of students having registered, but not showing up is comparable to the dropout rate at other experiments in the same lab. Show-up rates across treatments amount to 84% in LP, 88% in HP and 77% in UHP and the average rate is 83%. The average show-up rate for other experiments conducted in the same lab is roughly 85%. Moreover, the personal characteristics of the participants also do not vary systematically

Each treatment comprised five sessions, thus adding up to 15 sessions for the three treatments. A session lasted around 60 minutes and subjects earned either €10.50 or €11.50.

3.3.2 Discussion of the experimental design

We now discuss the main features of the design and how they match the assumptions made by salience theory. Furthermore, we outline the advantages of a laboratory experiment compared to a field study.

First, the consumption alternatives in our experiment are clearly vertically differentiated. A fast internet connection is doubtlessly superior to a slow one and, at equal prices, one would expect all subjects to opt for the fast connection. Therefore, we can exactly mirror the assumption made in BGS according to which goods are two-dimensional and uniquely defined by their quality- and price-parameters. Another advantage of our implementation is that subjects in our experiment have a clear demand for the products as they are not allowed to use any devices or items during the 45-minute duration of the experiment.

Second, high-price and low-price environments typically attract different classes of consumers. For instance, consumers who buy wines at high-class restaurants and those who buy wines at cheap stores can be expected to be heterogeneous with respect to income and the appreciation of quality. We can exclude such sample biases by randomly assigning subjects to treatments.

Third and most importantly, the design of our experiment allows us to analyze the role of consideration sets and expectations. To the best of our knowledge, we are the first to investigate the subtle difference between expected and unexpected price shifts which plays an important role for the effects on consumer choice in salience theory. In the study by Hastings and Shapiro (2013), for example, the empirical results crucially depend on the definition of the consideration sets. In their two specifications, the consideration sets consisted of all price-quality-combinations which were available either during the last week or during the last four weeks. Their results are sensitive to this specification. In our LP- and HP-treatments the consideration sets are explicitly given by the choice sets while in treatment UHP the consideration set is larger as it comprises also the options at their expected prices. Thereby, we can properly control for the consideration set which is a novelty in the empirical literature.

Fourth, by adjusting the nominal income levels between treatments LP and

across treatments. This suggests that our procedures and the additional information email do not induce a selection bias in our sample.

HP, we fix the subjects' real income levels such that the choices in terms of real payoffs are identical in all three treatments: subjects could either get the high-speed internet and €10.50 or the low-speed internet and €11.50. That is, the differences between the choices that we observe can be attributed to the different frames used in the treatments. Here we have standard economic theory as the clear benchmark, which we could test against, as it cannot explain any shift of demand between the treatments.

Fifth and finally, we are able to fix the consumption location in our study. Therefore, both the high- and the low-quality product yield the same utility in all treatments, while in general high-quality products may provide a higher utility at high-class, pricy locations. Our study eliminates this as an explanation.

3.4 Results

This section presents the experimental results which are summarized in Table 3.2. We start by investigating the effects of an expectedly high price level and compare the treatments LP and HP (Hypothesis 3.1). Subsequently, we examine the impact of an unexpectedly high price level (or, more precisely, of a high price level when low prices are considered) by comparing HP and UHP (Hypothesis 3.2). Robustness checks are provided at the end of this section.

Table 3.2: Experimental results

	LP treatment Choice		**HP treatment** Choice		**UHP treatment** Choice	
Fast	16	28.1%	27	45.8%	14	26.4%
Slow	41	71.9%	32	54.2%	39	73.6%
# of participants	57		59		53	

3.4.1 Results for an expectedly high price level

We find that in treatment HP the share of subjects opting for the more expensive internet connection is significantly higher than in treatment LP. As can be seen in Table 3.2, in treatment LP 28.1% (16 out of 57 subjects) choose the fast internet connection while in treatment HP this share increases to 45.8% (27 out of 59 subjects). This effect is quite sizeable: In our setting, a €3 markup on both prices significantly raises the share of the high-quality product by roughly 20 percentage points. With a p-value of 0.025 (one-sided χ^2-test), we can reject the null hypothesis that an expectedly higher price level (weakly) decreases the share of subjects choosing the high-quality product. This is in line with Hypothesis 3.1:

Result 3.1:
With an expectedly higher price level, a larger share of subjects opt for the high-quality, more expensive internet connection.

3.4.2 Results for an unexpectedly high price level

We now contrast the effects of an expectedly and an unexpectedly high price level by comparing the outcomes in the treatments HP and UHP. In compliance with Hypothesis 3.2, a smaller share of subjects should opt for the fast internet in treatment UHP than in treatment HP. Indeed, our results suggest that subjects' choices depend on their initial expectations of the price level. In treatment HP 45.8% of the subjects (27 out of 59) opt for the fast internet connection, while in treatment UHP only 26.4% of the subjects (14 out of 53) choose the fast internet connection. In treatment UHP a significantly lower share of subjects favors the fast internet connection than in treatment HP ($p = 0.017$, one-sided χ^2-test). Hence, the null hypothesis that, compared to an expectedly high price level, an unexpectedly high price level (weakly) increases the share of subjects opting for the high-quality product can be rejected. Thus, our result accords with Hypothesis 3.2:

Result 3.2:
Compared to an expectedly high price level, a lower share of subjects opt for the fast internet connection when facing an unexpectedly high price level.

Our results suggest that expectedly and unexpectedly high price levels affect choices differently. An expectedly high price level tends to increase the share of subjects choosing the high-quality, high-price product, while an unexpectedly high price level does not. Both findings are in line with the predictions made by BGS.

3.4.3 Robustness

We assess the robustness of our results by applying a multivariate logit regression model. Logit estimation is conducted given the binary dependent variable, which equals one if a subject chose the fast internet connection and zero otherwise.[9] The regression analysis allows to control for personal characteristics that might influence subjects' decisions. The included controls are gender and field of study.[10]. Estimation results for an expectedly and an unexpectedly high price level are presented in Table 3.3.

Table 3.3: Logit regression of opting for the fast internet connection.

Parameter	**(1)**	**(2)**	**(3)**	**(4)**
High Price	0.771***	0.730**	0.771***	0.728**
	(0.326)	(0.401)	(0.320)	(0.358)
Unexpected	-	-	-0.855***	-0.782***
			(0.260)	(0.279)
Controls	no	yes	no	yes
Observations	116	111	169	163

All specifications include a constant.
Robust standard errors at the session level in parenthesis.
One-sided significance level: *: 10%, **: 5%, ***: 1%.

Specifications (1) and (2) use the choice data from the treatments LP and HP to estimate the effect of an expected uniformly higher price level. Specification (1) solely includes the dummy variable *High Price*, which is equal to one if a subject is part of the treatment group with an increased price level (HP treatment). *High Price* is positive and highly significant. Switching from LP to HP results in a 0.77 unit change in the log of the odds for choosing the fast internet. Put differently, the odds of choosing the fast internet connection are 2.2 times (120%) larger in the HP than in the LP treatment. When controlling for personal characteristics, as in specification (2), the effect is marginally reduced.Being part of the HP treatment increases the log of the odds of choosing the fast internet connection by 0.73 or rather the odds are 108% higher in the HP than in LP treatment. Both results are in line with Result 3.1.

To determine the difference between an expectedly and an unexpectedly high price level, we include the variable *Unexpected*. *Unexpected* indicates whether the information email announced both price levels (*Unexpected*=1) or the factual prices only (*Unexpected*=0). Columns (3) and (4) state the estimation results, using data from all three treatments. Again, we estimate a model with and without additional controls.[11] In both specifications the coefficients of *Unexpected*

[9] Applying OLS yields similar results. However, due to the discrete dependent variable logit is preferred to OLS.

[10] Although we have further information on age and the degree pursued (bachelor vs. master), we abstained from including them as the qualitative results do not change, but sample size is reduced due to missing observations.

[11] None of the included controls is significant in both regressions (2) and (4). The magnitude of the main treatment variables (*High Price* and *Unexpected*) does only change slightly

are negative at a high significance level. Taking part in the UHP instead of the HP treatment, leads to a -0.86 (-0.78) unit change in the log of the odds of choosing fast internet. Alternatively, the odds in UHP are 58% (54%) lower than the odds in HP.[12] These findings are consistent with Result 3.2.

3.5 Discussion of alternative theories

In this section we illustrate why standard economic theory cannot explain our findings. We also investigate the predictions of behavioral models, such as Kahneman and Tversky (1979), Kőszegi and Rabin (2006), Kőszegi and Szeidl (2013), Bushong *et al.* (2014), Azar (2007), and Cunningham (2013). We find that some of these theories can explain parts of our findings, but no model is consistent with both of our results. Thus, to the best of our knowledge, no other model (apart from BGS) can account for Result 3.1 and Result 3.2 in one coherent framework.

Standard economic theory cannot explain the different choice patterns we observe. As the feasible outcomes are identical in all three treatments (i.e., receiving €10.50 and the high-quality internet or €11.50 and the low-quality internet), standard economic theory can explain neither Result 3.1 nor Result 3.2.

Prospect theory (Kahneman and Tversky, 1979). Prospect theory hypothesizes that subjects evaluate outcomes with respect to a deterministic, exogenous reference point which typically indicates an agent's status quo. With respect to this reference point, an agent's value function satisfies the property of diminishing sensitivity and loss aversion, that is, losses are weighted disproportionally compared to gains. In our experiment, the reference point is represented by a two-dimensional vector (r_1, r_2), where r_1 gives the reference earning and r_2 gives the reference quality of the internet connection. As typically university students have access to high speed internet for free (in particular, those living on campus), a sensible reference point in our experiment is where r_1 equals the announced endowment (that is, €12 in LP and €15 in HP) and r_2 equals the high quality q_H.

Given this reference point, prospect theory can explain Result 3.1 via diminishing sensitivity. Due to diminishing sensitivity, the price difference in LP (1.50 vs. 0.50) feels larger than the same price difference in HP (4.50 vs. 3.50). Hence, choosing the high-quality product in HP is more attractive than choosing it in

across our specifications with controls - see also Table 3.3.

[12] When estimating the model only with data on the HP and UHP treatment, results are confirmed.

LP. In particular, a decision maker opting for the high-quality product in LP will also opt for the high-quality product in HP. As a consequence, prospect theory predicts that the share of subjects opting for the high-quality product is larger in HP than in LP.

Prospect theory, however, does not predict different decisions for treatments HP and UHP as the subject's status quo and therefore the reference point is not affected by the information email. Thus, prospect theory can explain Result 3.1, but not Result 3.2.

Personal equilibrium (Kőszegi and Rabin, 2006). Kőszegi and Rabin (henceforth: KR) propose a reference-dependent model according to which an agent is loss averse with respect to an endogenous reference point which is shaped by rational expectations. According to their equilibrium concept of a *personal equilibrium* (PE) expectations are consistent with actual behavior. A *preferred personal equilibrium* selects a personal equilibrium with the highest expected utility. In deterministic environments, KR prescribe choices which maximize consumption utility (see their Section III). As both options yield exactly the same outcomes in the treatments HP and LP, that is, either quality q_H and an income of €10.50 or quality q_L and an income of €11.50, the demand shift between LP and HP cannot be explained by KR.[13]

In order to apply the concept of a personal equilibrium to treatment UHP, each subject has to assign well-defined probabilities to the different price levels. Given that the probability with which the low price level is expected is sufficiently high, KR can explain why few people choose the high-quality option in UHP. This is because a subject will rationally expect to go for the low-quality in order to minimize her loss in the price-dimension. Hence, KR can be consistent with our Result 3.2. In Chapter 3.B, we provide a formal analysis for this prediction. If the subject, however, has no well-defined expectations on the occuring price levels, KR cannot be applied to treatment UHP. Further, if the high price level is expected to be distinctly more likely than the low price level, there exist further (preferred) personal equilibria (i.e., one in which subjects choose the high-quality option with probability one, and one in which subjects strictly mix) such that any choice pattern is in line with KR.

[13] For illustration, assume that both goods lie on a rational indifference curve. In a preferred personal equilibrium the agent will expect to choose one of the options with certainty and behave consistently at the second stage. Therefore, in LP and HP two preferred personal equilibria exist and Result 3.1 remains unexplained.

Focusing theory (Kőszegi and Szeidl, 2013) and relative thinking (Bushong *et al.*, 2014). Kőszegi and Szeidl (henceforth: KS) and Bushong *et al.* (henceforth: BRS) offer two closely related approaches. KS assume that a decision maker overemphasizes those attributes for which the range of choice in choice set $\mathfrak{C}$ is broad, that is, for which her options differ a lot, while she tends to neglect attributes for which the available options are rather similar. In contrast, BRS assume the opposite: a decision maker puts more weight on dimensions where the range of choice is small. More precisely, according to both approaches, an agent values an option $k = (q_k, p_k)$ as

$$u(k) \; = \; w_q \; u_q(q_k) \; - \; w_p \; u_p(p_k), \tag{3.4}$$

where for $x \in \{p, q\}$ function $u_x(\cdot)$ gives a subject's consumption utility in dimension x while weight w_x is a function of the available range in dimension x, that is, $w_q = w(\Delta_q)$ with $\Delta_q := \max_{k \in \mathfrak{C}} u_q(q_k) - \min_{k \in \mathfrak{C}} u_q(q_k)$ and $w_p = w(\Delta_p)$ with $\Delta_p := \max_{k \in \mathfrak{C}} u_p(p_k) - \min_{k \in \mathfrak{C}} u_p(p_k)$. Crucially, KS assume that $w'_x > 0$, while BRS propose that $w'_x < 0$ for $x \in \{p, q\}$.

With utilities linear in price and quality, the price ranges are identical in treatments LP and HP, $\Delta_q = \Delta_p = 4.50 - 3.50 = 1.50 - 0.50$, such that both models cannot account for differences in choices between those two treatments.

Regarding the predictions of treatment UHP it is essential to consider how announced, but not available options affect an individual's consideration set and therefore the weights w_x. KS mention such effects, but do not offer a systematic treatment how this would affect choices within their setup. BRS consider several approaches how one could consider such effects. In the following we discuss their preferred approach (see Section 4 of their paper). According to this approach a subject chooses an option before she is certain about its price (that is, for instance, after she has read the information email, but before the actual experiment).[14] Formally, she chooses between lotteries on $\mathbb{R}^K$, that is, her choice set is some $\mathfrak{F} \subset \Delta(\mathbb{R}^K)$. Following BRS the range along dimension p can then be defined by

$$\Delta_p(\mathfrak{F}) = \max_{F \in \mathfrak{F}} (E_F[u_p(p_k)]) + \frac{1}{2} S_F[u_p(p_k)]) - \min_{F \in \mathfrak{F}} (E_F[u_p(p_k)]) - \frac{1}{2} S_F[u_p(p_k)]), \tag{3.5}$$

where $E_F[u_p(p_k)]) = \int u_p(p_k) dF(p)$ denotes the decision maker's expectation of $u_p(p_k)$ under F, and $S_F[u_p(p_k)] = \int \int |u_p(p'_k) - u_p(p_k)| dF(p') dF(p)$ the average distance between two independent draws from the distribution. Let $0 < p_L \leq 1$

14 In our experiment, around 80% of the subjects indicated that they have indeed made their decision immediately after reading the information email.

be the probability with which the low price level is expected and $(1-p_L)$ the probability with which the high price level is expected. Straightforward computations show that the range of dimension price in UHP equals $\Delta_p^{UHP} = 1 + 6p_L(1 - p_L)$ which always exceeds the range along dimension price in HP, that is, $\Delta_p^{HP} = 1$. Thus, BRS predict that prices attract more attention in HP than in UHP such that subjects should be more likely to pay for the high quality in UHP. This contradicts our findings.

To sum up, both KS and BRS cannot account for our results in their original setups.[15] In particular, our experiment clearly rules out that the observed effects are driven by relative thinking as proposed in BRS.

Relative thinking (Azar, 2007). Azar's model of relative thinking hypothesizes that both the absolute and the relative price differences matter for product choices. Given vertically differentiated products, consumers are predicted to choose the higher quality product with uniformly higher prices as the relative price increase is lower for the high-quality product. Therefore, relative thinking explains Result 3.1.[16] As the predictions of relative thinking are independent of the decision maker's expectations, Azar cannot account for the difference between expected and unexpected price increases (Result 3.2).

Models closely related to Azar (2007), such as Alchian and Allen (1964) and Barzel (1976), predict a higher relative demand for high-quality products in high-price than in low-price environments. This prediction stems from the fact that the price of the premium product relative to the low-quality product is reduced by the existence of fixed costs, such as transportation costs (Alchian and Allen) or unit taxes (Barzel). As consumers take into account relative prices, these models predict that demand shifts toward higher-quality products after a price increase. Several empirical papers aimed at testing this hypothesis, with generally mixed results.[17] However, in contrast to BGS and the present investigation, none of these papers accounts for the composition of the consideration set such that they cannot explain Result 3.2.

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15 Note, however, that focusing theory can account for both results if the following two assumptions are added to the model by Kőszegi and Szeidl (2013): first, the utility function satisfies diminishing sensitivity, and second, mentally but not factually available items are admitted to the agent's choice set.

16 Azar (2010) tests this hypothesis both in a field experiment and in a hypothetical study. While the hypothetical study supports his prediction (see also Azar, 2011), the field results reject it.

17 Bertonazzi *et al.* (1983), Borcherding and Silberberg (1978), Nesbit (2007), and Sobel and Garret (1997) find evidence of a demand shift, whereas Coats *et al.* (2005) and Lawson and Raymer (2006) find no or only moderate support.

Comparisons and choice (Cunningham, 2013). Cunningham offers a behavioral theory according to which preferences depend on the current choice set and on the choice set history. His main assumption is that the appreciation for a certain choice dimension (more precisely, the marginal rate of substitution between this and every other dimension) decreases if any element in the history (or the current choice set) increases in absolute value along this dimension.

Concerning our experiment, this theory is consistent with Result 3.1. As both prices in HP are larger in absolute value, the price dimension attracts less attention in HP than in LP such that subjects are more likely to choose the high quality product in HP than in LP. Cunningham, however, does not offer an unambiguous way of how to include content of the information email into the framework. In our interpretation of the model the content of the information email would not be part of the choice set history and therefore Result 3.2 would not be predicted.[18] Thus, Cunningham can account for our first, but not for our second result.

3.6 Discussion

Our experiment and, in particular, our first two treatments HP and LP, are in the spirit of the jacket and calculator puzzle by Tversky and Kahneman (1981) and Thaler (1999). According to this puzzle, people are willing to drive across town to save \$5 on a \$15 calculator while they are not willing to drive across town to save \$5 on a \$125 jacket. Thus, people seem to value saving a fixed amount the less the higher the base price is (\$10 vs. \$120). In contrast to other studies, we exclude the outside option of not buying at all, which allows us to precisely distinguish between relative thinking and *diminishing sensitivity*. Bushong *et al.* (2014)'s model of relative thinking, for instance, can explain the puzzle only if not buying is an available option. Then, the cost saving seems large if the base price is low as it represents a larger percentage of the overall price range. On

[18] It should be noted, however, that if one is willing to assume that (i) the content of the information email forms part of the choice set history and (ii) the choice history affects decisions only through the average values observed in the entire history, then Result 3.2 is also consistent with his theory as the average price is larger in HP than in UHP. Thus, price attracts less attention in HP than in UHP and consequently subjects are more likely to choose the high quality in HP. However, this logic would also imply that individuals are less likely to choose the high-quality product in LP than in UHP as the average price is lower in LP. But this prediction is not consistent with our results as we do not observe significantly different choices between LP and UHP. It should also be noted that Assumption (ii) is criticized, for instance, by Bushong et al. (2014) in footnote 3, where they argue that this assumption can contradict relative thinking in a counter-intuitive manner.

the contrary, if the base price is high, the cost saving represents only a small percentage of the overall price range, such that the saving opportunity seems less attractive. By excluding the outside option of not buying, we held the price range constant between our treatments such that we could rule out relative thinking as the driver of our effect.

Our third and most novel treatment (UHP) extends the jacket and calculator puzzle by showing that not only the base price, but also the expectations of the base price affect price sensitivity. An agent is price-sensitive even at high base prices if she is surprised by the high price level. This treatment allows to test for two assumptions simultaneously: for *ordering* and for the effect of only *mentally available items* on decision making. Especially the test for the latter is novel as it is hard to control for a subject's consideration set outside a controlled laboratory experiment.

We test these fundamentals in a domain where salience theory's predictions are most novel. Alternative predictions by salience theory, such as decoy and compromise effects, have already been investigated in various setups in the experimental literature. For instance, Heath and Chatterjee (1995) provide a meta-analysis on decoy effects which demonstrates that adding decoys to choice sets increases the demand for brands which are similar to the decoys but reduces demand for dissimilar brands. Such decoy and compromise effects have been documented in very different domains (see, for instance, Highhouse, 1996), both in hypothetical and in incentivized experiments (Herne, 1999).

3.7 Conclusion

This study explores choices between vertically differentiated products in a laboratory experiment with real consumption decisions. We find that decision makers' responses largely depend on whether price levels are expected or not. An expectedly high price level induces more subjects to choose the high-quality product than if subjects were unsure about the actual prices. By analyzing the differential effects of expected and unexpected price hikes, we confirm two central predictions of consumer choice for vertically differentiated products made by salience theory (Bordalo *et al.*, 2013). Furthermore, we review alternative established behavioral theories and find that these theories cannot account for our findings.

Our study provides interesting insights for researchers and practitioners about the decision making of consumers. Given that salience theory predicts that expected upward price shifts can reduce consumers' price sensitivity, it yields a rationale for various observations in the retail sector. For example, our findings explain why suppliers can sustain high margins for premium products in high-price environments where quality is more likely to be overweighted while prices tend to be disregarded.[19]

Moreover, we document that consumers tend to overweight prices when price increases are unexpected. This yields important insights for marketing purposes. For instance, when a retailer is confronted with uniform cost increases (for all its products, e.g., change in quantity taxes), the retailer should not only expect its demand to drop if the change in final consumer prices is unexpected by consumers, but also to expect that demand between high- and low-quality variants will change toward lower quality.

[19] For instance, Dudenhöffer (2014) shows that premium manufacturers in the automotive industry can preserve EBIT margins for each car that are twice as high as those earned by high-volume manufacturers.

3.A Instructions and information mail

In this Appendix, we provide a translation of the information email and the experimental instructions. First, we present the information email for participants in the LP- and the UHP-treatment. In the end we provide the instructions for subjects participating in LP. The instructions for the HP- and the UHP-treatment differed only with respect to the prices for internet access and the endowment.

Information email to participants prior to the experiment (LP Treatment):

Dear participants,

please read this email carefully! It contains information about the experiment on xx/xx/2015, for which you have signed up.

This experiment is about your willingness to pay for internet access. For the duration of the experiment (45 minutes) you have to purchase either **high-speed or low-speed internet,** which you can use at your convenience – please note that it is not possible to buy no internet access at all! For participating in the experiment, you will receive a fixed payment of **12 Euro** minus the costs of the selected internet alternative.

You can use the internet at your convenience for the duration of the experiment and there are no other tasks to complete. Note that we do not store any information: the browser will reset automatically after the experiment! Neither the experimenters nor any third party can track which websites you have visited.

Restrictions: It is prohibited to use the computer loudspeakers in order not to disturb other participants, to visit illegal websites or to perform any downloads. Furthermore, you are not allowed to use any brought documents, mobile phones or other printed media or electronic devices.

High-speed internet (regular internet access via the HHU-network) is characterized as follows:

- To fully load frequently used websites, such as facebook.de, spiegel.de or bild.de it takes **on average less than 5 seconds**.

Low-speed internet (slowed down internet access) is characterized as follows:

- To fully load frequently used websites, such as facebook.de, spiegel.de or bild.de it takes **on average about 30 seconds**.

The one-time costs for the two alternatives are:

- **High-speed internet: 1.50€**
- **Low-speed internet: 0.50€**

At the beginning of the experiment you will receive a decision sheet where you have to indicate your choice for one of the two alternatives.

After you have made your decision, your computer is set up according to your choice and you can use the internet for the next 45 minutes.

After 45 minutes you will receive your payment (12 Euro minus the cost for the respective internet access you have chosen) and the experiment ends.

Figure 3.1: Information mail for the participants of treatment LP.

Information email to participants prior to the experiment (UHP Treatment):

Dear participants,

please read this email carefully! It contains information about the experiment on xx/xx/2015, for which you have signed up.

This experiment is about your willingness to pay for internet access. For the duration of the experiment (45 minutes) you have to purchase either **high-speed or low-speed internet,** which you can use at your convenience – please note that it is not possible to buy no internet access at all! For participating in the experiment, you will receive a fixed payment of **15 Euro**.

You can use the internet at your convenience for the duration of the experiment and there are no other tasks to complete. Note that we do not store any information: the browser will reset automatically after the experiment! Neither the experimenters nor any third party can track which websites you have visited.

Restrictions: It is prohibited to use the computer loudspeakers in order not to disturb other participants, to visit illegal websites or to perform any downloads. Furthermore, you are not allowed to use any brought documents, mobile phones or other printed media or electronic devices.

High-speed internet (regular internet access via the HHU-network) is characterized as follows:

- To fully load frequently used websites, such as facebook.de, spiegel.de or bild.de it takes **on average less than 5 seconds**.

Low-speed internet (slowed down internet access) is characterized as follows:

- To fully load frequently used websites, such as facebook.de, spiegel.de or bild.de it takes **on average about 30 seconds**.

The one-time costs for the two alternatives are <u>either</u>:

- **High-speed internet: 1,50€**
- **Low-speed internet: 0,50€**

<u>or</u>

- **High-speed internet: 4,50€**
- **Low-speed internet: 3,50€**

At the beginning of the experiment you will learn which of the two price levels will apply in the experiment.

You will receive a decision sheet where you have to indicate your choice for one of the two internet alternatives.

After you have made your decision, your computer is set up according to your choice and you can use the internet for the next 45 minutes.

After 45 minutes you will receive your payment (15 Euro minus the cost for the respective internet access you have chosen) and the experiment ends.

Figure 3.2: Information mail for the participants of treatment UHP.

Information on the experiment

Welcome to this experimental study. Please do not talk to other participants from now on. You are not allowed to use your own paper, mobile phones or any other printed media or electronic devices.

For the duration of the experiment (45 minutes) you have to purchase **high-speed or low-speed internet** which you can use at your convenience during the experiment – please note that it is not possible to buy no internet access at all! For participating in the experiment you will receive a fixed payment of **12 Euro** minus the costs for the selected internet alternative.

You can use the internet at your convenience during the experiment and there are no other tasks to complete. Note that we do not store any information: the browser will reset automatically after the experiment! Neither the experimenters nor any third party can track which websites you have visited.

High-speed internet (regular internet access via the HHU-network) can be described as follows:

- To fully load frequently used websites, such as facebook.de, spiegel.de or bild.de it takes **on average less than 5 seconds**.

Low-speed internet (restricted internet access) can be described as follows:

- To fully load frequently used websites, such as facebook.de, spiegel.de or bild.de it takes **on average about 30 seconds**.

After all participants read the instructions, you will receive a decision sheet where you have to indicate your choice for one of the two alternatives.

The one-time costs for the two alternatives are:

- **High-speed internet: 1.50€**
- **Low-speed internet: 0.50€**

After you have made your decision you can use the internet for the next 45 minutes. [Restrictions: you are not allowed to use the speakers of the computer in order to not disturb other participants, to visit illegal websites or to perform any downloads].

After 45 minutes you will receive your payment (12 Euro minus the cost for the chosen internet access) and the experiment ends.

If you have any questions, please do not hesitate to contact the experimenters at any time. Just raise your hand and we will answer your question privately.

After completing the experiment, please wait at your seat until you are called.

Figure 3.3: Instructions for the participants of treatment LP.

3.B Formal analysis of Kőszegi and Rabin (2006)

In order to investigate whether Kőszegi and Rabin (2006) can account for Result 3.2 we determine all personal equilibria (PE) in treatment UHP. Suppose that an agent expects to find a low price level with some exogenous probability $0 < p_L \leq 1$ and a high price level with $p_H := 1 - p_L$. Given the low price level, the decision maker expects to choose the low-quality option with probability p_s^L and the high quality option with probability $1 - p_s^L$. Given the high price level, she expects to opt for the low-quality option with probability p_s^H and for the high-quality option with probability $1 - p_s^H$. Then, the reference price level r_p equals

$$r_p(p_L) := p_L \; (0.50 \; p_s^L + 1.50 \; (1 - p_s^L)) + (1 - p_L) \; (3.50 \; p_s^H + 4.50 \; (1 - p_s^H))$$

and the reference quality level is given by

$$r_q(p_L) = q_L \left(p_L \; p_s^L + (1 - p_L) \; p_s^H\right) + q_H \left(p_L \; (1 - p_s^L) + (1 - p_L) \; (1 - p_s^H)\right).$$

A PE requires the following consistency criterion to be satisfied. Given the reference point (r_p, r_q), the decision maker finds it optimal to follow her plan at the second stage, that is, if prices are low (high) she chooses the low-quality option with probability p_s^L (p_s^H, respectively).

According to KR, the utility derived from an alternative $k = (p_k, q_k)$, given a reference point $r = (r_p, r_q)$, is given by

$$u(k|r) = v(k) + n(k|r),$$

where $n(k|r)$ denotes the gain-loss utility relative to the reference point (which is zero in a rational model). As before, the agent's consumption utility $v(k)$ is linear and equals $v(k) = q - p$. Suppose that the high- and the low-quality product lie on a rational indifference curve, thus $q_H = q_L + 1$. We assume that n is additively separable across dimensions, i.e., $n((p_k, q_k)|r) := n_p(p_k|r_p) + n_q(q_k|r_q)$, and $n_i(x|y) := \mu(v_i(x) - v_i(y))$ for a function μ which satisfies the properties of the value function introduced in Kahneman and Tversky (1979). In particular, let μ be a piecewise linear function which is defined by $\mu(x) = \eta x$ if $x > 0$ and $\mu(x) = \eta \lambda x$ if $x \leq 0$, where parameter $\eta > 0$ is a measure of the weight a decision maker assigns to the gain-loss utility and λ is a coefficient of loss aversion. Following prospect theory, losses relative to the reference point receive larger weights than gains, i.e., $\lambda > 1$. As choosing the high quality will never represent a loss in the quality dimension we have

$$n_q(q_H|r_q) = \eta\ (q_H - r_q).$$

Analogously, the low quality will never represent a gain, that is

$$n_q(q_L|r_q) = \lambda\eta(q_L - r_q).$$

Concerning prices, the low quality product's price will never represent a loss at the low price level and the high quality product's price will never represent a gain at the high price level.

In the following we discuss the case where subjects expect both scenarios with equal probability, that is, $p_L = 50\%$. We then show that the only PE involves choosing the low-quality product with probability 1.[20]

First, if there is a solution with $0 < p_s^H < 1$, then the decision maker is indifferent between opting for the high and the low quality at the second stage at high prices, that is,

$$q_L - 3.50 - n_p(3.50|r_p(p_L)) - \lambda\eta(r_q(p_L) - q_L) = q_H - 4.50 - \lambda\eta(4.50 - r_p(p_L)) + \eta(q_H - r_q(p_L))$$

or, with our specification,

$$\begin{aligned} & q_L - 3.5 - \eta\lambda(3.5 - r_p(0.5)) - \lambda\eta(r_q(0.5) - q_L) \\ =& q_H - 4.5 - \eta\lambda(4.5 - r_p(0.5)) + \eta(q_H - r_q(0.5)). \end{aligned}$$

As $q_H = q_L + 1$, this is equivalent to $r_q = q_H$, which is a contradiction as we assumed $p_s^H > 0$. Thus, it must hold that $p_s^H \in \{0, 1\}$.

Second, suppose $p_s^H = 1$. Then, it has to be (weakly) optimal to choose the high quality at the second stage, that is

$$q_L - 3.50 - \eta\lambda(3.50 - r_p) - \eta\lambda(r_q - q_L) \leq q_H - 4.50 - \eta\lambda(4.50 - r_p) + \eta(q_H - r_q)$$

or, equivalently,

$$\lambda(q_H - r_q) \leq q_H - r_q,$$

[20] Straightforward computations show that this pure strategy equilibrium exists also for arbitrary expectations of p_L. If p_L becomes sufficiently small such that the low quality option at the high price level can be perceived as a gain in the monetary dimension for some p_s^H and p_s^L, then, however, multiple equilibria exist. In that case, it is also an equilibrium to have $p_s^H = 0$ and in addition there exists also a strictly mixed equilibrium such that any choice pattern can be in line with KR.

which is a contradiction as $\lambda > 1$ and $q_H > r_q$.

Third, suppose $p_s^H = 0$ such that

$$q_L - 3.50 - \eta\lambda(3.50 - r_p) - \eta\lambda(q_L - r_q) \geq q_H - 4.50 - \eta\lambda(4.50 - r_p) + \eta(q_H - r_q)$$

has to be fulfilled. Indeed, the equivalent condition

$$\lambda(r_q + 1 - q_L) > (q_H - r_q),$$

is satisfied as the reference quality is closer to q_L than to q_H and in particular $r_q + 1 - q_L > q_H - q_L$ and $q_H - r_q < q_H - q_L$. Thus, in a personal equilibrium the decision maker will rationally expect to choose the low quality in order to minimize her loss in the price-domain.

Declaration of Contribution

Hereby I, Katrin Köhler, declare that the chapter "Demand shifts through salience effects? An experimental investigation" is co-authored by Markus Dertwinkel-Kalt, Mirjam Lange, and Tobias Wenzel.

My contributions to this chapter are as follows:

- I contributed to the development of the experimental design
- I contributed to the implementation of the experiment
- I researched parts of the related literature
- I wrote minor parts of the experimental design
- I wrote major parts of the results
- I wrote parts of the discussion

Signature of coauthor 1 (Markus Dertwinkel-Kalt): ________________

Signature of coauthor 2 (Mirjam Lange): ________________

Signature of coauthor 3 (Tobias Wenzel): ________________

Chapter 4

Wage Requests and Effort in the Gift-Exchange Game

4.1 Introduction

The gift-exchange game is one of the workhorse models in experimental labor markets and it has been used in a variety of experiments (see, for example, Fehr *et al.*, 1993; Fehr *et al.*, 1998a; Charness, 2004; Fehr *et al.*, 2009). In the standard gift-exchange game the principal decides unilaterally on the wage payment and afterwards the agent exerts effort. In its core the literature on gift exchange shows that labor markets with incomplete contracts are characterized by a positive relationship between wages and effort. This is denoted as the *fair wage-effort* relation (Akerlof, 1982; 1984). As the gift-exchange game is commonly applied, it appears to be of vital interest to investigate the robustness toward modifications which resemble a more interactive setup than the isolated payment decision of the employer in the standard version.

To examine the robustness of the gift-exchange game, the introduction of wage requests is a logical step. Notably, wage negotiations are highly prevalent and are well-known for affecting today's labor markets. For instance, many jobs are highly specialized, that is, firms often do not have predetermined wage schedules for a particular vacancy, but bargain with the potential employee for the future payment. Wage bargaining is also relevant in ongoing employee-employer relationships, i.e., workers may want to renegotiate their wages after a certain period of employment. Consequently, employees are repeatedly faced with wage negotiations. Thus, it makes sense to incorporate such an important aspect into the gift-exchange game and to study its impacts on working behavior.

Two possible consequences of wage requests could be the evocation of explicit pay expectations which may serve as a reference point for both parties in the remaining bargaining process. First, the employee may use her revealed pay expectation as a reference point when deciding on whether to accept or reject an offer and, after acceptance, when choosing an effort level.[1] For example, a wage offer (far) below the revealed pay expectation of an employee triggers disappointment and may therefore lead to a lower level of effort. Though the same wage offer is possibly perceived as less unfair and selfish when the employee did not disclose her expectations to the employer in the first instance.[2] For example, a game theoretical model by Eliaz and Spiegler (2013) suggests that the intrinsic motivation of employees shrinks when they feel they are being treated unfairly. A negative impact on the performance of policemen when the wage payment is lower than expected is also suggested in an empirical study by Mas (2006). Second, employers' decisions may also be affected by workers' wage requests, that is, they may use the requests as reference points, anticipating that workers potentially decrease their future effort when requests are not fulfilled. These examples emphasize that workers' wage requests can play an important role in employee-employer relations because they may impact crucially on wage offers and future effort levels.

To test the effects of wage requests, our experiment applies a baseline treatment (no-request treatment) which is equivalent to a standard gift-exchange game (Fehr *et al.*, 1993; Fehr *et al.*, 1998a; Charness, 2004; Fehr *et al.*, 2009) and a main treatment where employees can reveal non-binding wage requests before employers offer final wages (request treatment). In the standard gift-exchange game, the principal sets the wage payment unilaterally and the agent exerts effort afterwards. In the treatment with requests, the agent can first send a non-binding wage request to the principal before she offers the final remuneration.

The introduced treatments aim at analyzing the effects of introducing (non-binding) wage requests in a bilateral gift-exchange game similar to Fehr *et al.* (1998a), thereby testing the robustness of the gift-exchange game. The focus is mainly on the resulting effort choices as, on the one hand, if employers follow requests by increasing their wage offers, a shift toward efficiency could be

[1] This is similar to the minimum wage literature, where a minimum wage represents some exogenously given reference point which influences the decisions of agents in experimental labor markets (see, for example, Brandts and Charness, 2004; Falk *et al.*, 2006; Owens and Kagel, 2010). Since a minimum wage can be seen as a legitimate reference point which positively affects the pay expectations of workers, it influences the level of future wage payments and also has a slight impact on effort levels.

[2] This motivation is similar to Abeler *et al.* (2011) who find that expectations can significantly impact on employees' effort provision. Additionally, this topic is related to the negotiation literature, for example, Van Poucke and Buelens (2002).

achieved. On the other hand, if workers' requests are not fulfilled a disturbance of reciprocity may result. The purpose of this paper is to find out which effect predominates.

The main finding is that effort levels are significantly lower when the wage request exceeds the subsequent wage payment and that effort levels are similar in both treatments when the requested wage is paid. Moreover, the effect on effort provision additionally depends on how employers react to requests, that is, the larger the discrepancy between the request and actual payment, the more performance differs from the standard gift-exchange treatment. Interestingly, the fair wage-effort relation is preserved in the request treatment.

The paper is organized as follows. Section 4.2 summarizes the related research followed by the experimental setup in section 4.3. Section 4.4 presents behavioral hypotheses for the effort levels, and section 4.5 summarizes the data and highlights the main results. Subsequently, section 4.6 concludes and discusses the main results and insights from the experiment.

4.2 Related literature

A huge literature on experimental gift-exchange games has evolved. The literature, which investigates labor market relationships, has repeatedly shown that higher wage payments are reciprocated with higher effort levels (see Charness and Kuhn, 2011 for a summary). Fehr *et al.* (1993) were the first to experimentally test Akerlof's (1982) fair wage-effort hypothesis. After a one-sided oral auction, workers with a contract decide on an effort level that determines the final payoffs. This resulted in experimental workers responding to high wages by providing high effort. This supports the fair wage-effort hypothesis which has proven to be very stable in a variety of different setups.[3] Fehr *et al.* (1998a), for instance, find that competitive pressure only has a minor impact on reciprocity.

However, behavior may be affected when subjects in a game are allowed to communicate. A number of psychological studies have analyzed this topic (see Wubben *et al.*, 2009; Van Dijke and De Cremer, 2011). As communication is also relevant to economics, a part of the experimental communication literature is discussed below.

Several papers analyze the impact of requests on final payoffs in pure ultimatum games. Rankin (2003), for example, suggests that the non-binding requests

[3] Relatedly, there is empirical evidence that workers reciprocate high wage payments (such as bonus payments) by additional effort (Groves *et al.*, 1994; Jones and Kato, 1995; Kahn and Sherer, 1990; Engellandt and Riphahn, 2011).

of responders reduce offers, increase the rate of rejection, and decrease the average pay of responders. Possible explanations are that (i) requests crowd out pro-social behavior and/or (ii) perceivably unfair requests may decrease giving. Charness and Rabin (2005) study a similar question with a different setup. The authors use a sequential game where first movers have the opportunity to express preferences between different choices of responders. They find that responder behavior depends crucially on the preferences expressed by first movers.

The phenomenon that requests crowd out the proposers' offers is also documented in the dictator game. Rankin (2006) finds that the magnitude of the request determines whether it has a positive or negative effect on the dictator's offer. That is, up to a certain threshold amount, a request increases the offer and thereafter adversely affects giving. This is similar to a study by Andreoni and Rao (2011) who analyze a modified dictator game in which the recipient first sends a request to the dictator before the dictator makes the allocation decision.

Relatedly, Dale and Morgan (2010) analyze the effect of suggested contribution amounts on actual donations in a voluntary contribution game. They find that by and large "silence is golden." That is, asking for the socially optimal donation amount performs worst and decreases the actual contribution considerably, whereas moderate suggestions increase giving compared to the case where no suggestion is made at all. To summarize, the previously mentioned articles find that in several experimental setups requests are shown to be of significant importance. Therefore, it will be interesting to analyze the effects in a gift-exchange game.

In a way, requests have implicitly been the subject of investigation in gift-exchange games. Falk and Fehr (1999) experimentally study a double-auction where both employer and employee can make offers in the market. But, in contrast to our experiment, they do not explicitly analyze the effects of requests. Their experiment focuses instead on showing a downward rigidity of wages in competitive markets. They find that competitive pressure drives workers' requests (or bids, as they are termed in Falk and Fehr, 1999) down to the theoretically predicted minimal wage payment. In light of this experiment it is of vital interest to specifically study the impact of wage requests in a setup without competition. One might suspect that in non-competitive bilateral labor-market relationships, requests (or bids) do not converge toward the minimal wage payment as there is no need for employees to underbid each other.

The effects of communication in the gift-exchange game are explicitly investigated, for example, by Cooper and Lightle (2013) and Charness *et al.* (2013).

In Cooper and Lightle (2013) workers can send a message along with their effort decision. Usually, employees suggest that employers raise wages and offer an explanation as to how this will yield higher effort levels. They find that wages positively react to communication while the effort levels of workers remain unaffected. The crucial difference to our setup is that communication happens along with the employees' effort choices, whereas in our study communication happens prior to the actual "basic" game. Charness *et al.* (2013) investigate the effect on effort levels when the agent proposes a contract that includes a specified but non-binding effort level to the principal. The results suggest that chosen effort levels and profits are significantly higher in this case compared to when the worker's proposal does not include an effort level specification or the principal proposes the contract. In their study the party which proposes the contract (either the principal or the agent) can specify a non-binding effort level, wheareas in our study it is only the worker who can send a non-binding specification which indicates the desired wage payment. The (non-binding) effort level specification is not part of the contract in our experiment.

4.3 Experimental design and procedures

We designed a laboratory experiment using the standard gift-exchange game with a between-subjects design and we implemented two treatments. The no-request treatment, abbreviated by *NR*, is identical to Fehr *et al.*'s (1998a) "Bilateral Gift-Exchange Treatment,“ with the numbers of workers and firms being equal. The request treatment, abbreviated by *R*, is identical to the first treatment except for one aspect. In this treatment workers have the opportunity to express a non-binding wage request before the employers decide on wages. The experiment comprised five periods.

To explicitly isolate the effect of a request, we refrained from modeling competition in our experimental setup. Thus, in a session with 24 subjects, we had 12 employers and 12 employees who were randomly rematched in every period by using a stranger-matching design and whose identity was never revealed during the entire experiment. We formed two matching groups with 12 subjects each, such that each matching group comprised six employers and six employees. Subjects were rematched at the beginning of each period to avoid reputation building and strategic spillovers from repeated interaction.[4]

[4] For example, Brown *et al.* (2004) argue that low effort is penalized in repeated interactions by terminating existing relationships whenever possible. This helps to overcome the low effort problem. However, we want to exclude any effects from repeated interaction.

At the beginning of the experiment, each subject was randomly assigned the role of either an employer or an employee. The roles remained fix for the duration of the experiment.

In the *NR treatment* employees were only informed of the employers' offers. Furthermore, employers were given information about workers' exerted effort levels and both were informed of their own payoff. There was a crucial difference in the *R* treatment. Here, employers were additionally informed of workers' wage requests. That is, an employer was first informed of her worker's wage request and then decided on the wage offer. Subsequently, the wage offer was communicated to the worker. Finally, the employer also received information about her worker's effort and both were given information on their own payoffs. In both treatments all information regarding wages, efforts (*NR* and *R treatment*) and requests (*R treatment*) were not publicly revealed but were communicated only within the particular employee-employer matching pair.

Table 4.1 was common knowledge to the employees and employers. It depicts the costs of effort *m(e)* for specific effort choices *e* of employees, which could be chosen in steps of 0.1. Apparently, exerting higher effort increased the cost of the employee.

Table 4.1: Effort costs

e	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1
m(e)	0	1	2	4	6	8	10	12	15	18

Table 4.1 yields the following piecewise linear effort-cost function relevant to section 4.4

$$m(e) = \begin{cases} 10e - 1 & \text{for } 0.1 \leq e \leq 0.3 \\ 20e - 4 & \text{for } 0.3 < e \leq 0.8 \\ 30e - 12 & \text{for } 0.8 < e \leq 1. \end{cases} \tag{4.1}$$

The ***NR treatment*** consisted of two stages:

Stage 1: The employer made her wage offer in integers between [20,120] to her matched employee. Afterwards the matched employee decided whether to accept or reject the offer. If an employee had rejected an offer both the employer and the worker made zero profit.

Stage 2: Once the employee had accepted the wage offer, she had to decide on the effort level in stage 2. The effort could be chosen in the interval [0.1,1] (see Table 4.1).

The ***R treatment*** effectively consisted of three stages:
Stage 1: The employee could deliver a non-binding wage request in integers between 20 and 120 to her matched employee.
Stage 2: After observing the request, the employer made a wage offer from the interval [20,120] in integers to her matched employee, who could accept or reject the offer. Similar to the *NR treatment*, wage rejections led to zero profit for both parties.
Stage 3: Given acceptance, the employee chose an effort level between 0.1 and 1.

Following Table 4.1, employee i had to bear effort-cost $m(e_i)$, depending on which effort level she had chosen. Additionally, she incurred an opportunity cost for providing one unit of labor, denoted by c. We assume this cost to be $c = 20$, and to be constant across all employees and periods. Let w_i be the wage offered to individual i. Then, given acceptance, her one-period payoff was given by

$$\pi_i \;=\; w_i \;-\; c \;-\; m(e_i). \tag{4.2}$$

Furthermore, if one unit of labor produces v units of output, where $v = 120$ was exogenously given, employer j's one-period profit took the form

$$\pi_j \;=\; (v \;-\; w_i)\; e_i, \tag{4.3}$$

with w_i representing the final wage payment to employee i and e_i constituting matched employee i's effort choice. As in Fehr *et al.* (1993) and Fehr *et al.* (1998a), we restricted the profit of firms to be non-negative, due to evidence that behavior is influenced by loss aversion (see Kahneman and Tversky, 1979; Tversky and Kahneman, 1991).[5]

Although subjects' reciprocal behavior may be crowded out by ignored requests, observing effort choices exceeding e_{min} still gives rise to behavioral concerns in labor market relationships. To eliminate deterioration in any desired way, we avoided the use of terms like fairness, cooperation or reciprocity in the instructions and subjects were only informed on v, c, the effort-cost function and were informed that all subjects knew these parameters.

The sessions were conducted at the DICE laboratory at the University of Düsseldorf in December 2012, and January and February 2013. Subjects were recruited via ORSEE (Greiner, 2004) and the experiment was programmed in

[5] Note, the experiment is not interested in motives like loss aversion on the side of the employer, therefore the setup excludes this possibility.

z-Tree (Fischbacher, 2007). In total we ran six sessions: three *NR treatment* and three *R treatment*. In each session 24 subjects participated. Thus, a total of 144 participants took part in the experiment.

The instructions were framed in labor-market terms and subjects earned "Experimental Currency Units" (ECU) which were converted into € and were paid to the participants privately at the end of the experiment. The payoffs from each period were accumulated and determined the participant's final payment. The conversion rate of ECU into Euro was 4:1. The experiment lasted approximately 35 minutes and subjects earned on average €6.85.

4.4 Behavioral predictions

This section provides the behavioral predictions for the effort choices of workers in both treatments based on the reciprocity model of Falk and Fischbacher (2006). We do not describe the model in detail but only outline the basic predictions this theory yields for employees' effort choices in our setup.[6] Specifically, this section outlines how the effort levels of employees can be expected to differ for a given wage payment with the option of stating a request compared to when this is not possible.

The only equilibrium standard theory predicts is $e^* = e_{min}$, $w^* = w_{min}$ for both of the treatments described above. In this setup $e_{min} = 0.1$ is the minimal possible effort a worker can exert and $w_{min} = 20$ is the lowest possible wage an employer can pay. However, numerous studies provide robust evidence of wage payments and effort choices being above the minimum level. Using a modified utility function, Falk and Fischbacher's (2006) theory can account for these experimental results. Basically, this utility, given by U_i, can be described as:

$$U_i = \pi_i + \rho_i \cdot \varphi_j \cdot \sigma_i. \tag{4.4}$$

The first term represents the material payoff of, say, worker i according to equation (4.2). The second term captures the *reciprocity utility* of player i. This summand comprises a constant, individual reciprocity parameter $\rho_i \geq 0$, a kindness term φ_j and the reciprocation term σ_i. The kindness term φ_j captures the perceived kindness of player $j \neq i$. That is, the kindness of player j is c.p. perceived to be higher the more she offers to player i.[7] In general, if $\varphi_j > 0$ player j

6 Online Appendix 3 of Falk and Fischbacher (2006) provides propositions and proofs for a more general gift-exchange setup.

7 For simplicity, we assume that the players act fully intentionally in our setup (see online

is perceived to act kindly, while if $\varphi_j < 0$, player j is perceived to act unkindly. The reciprocation term σ_i expresses the response of player i to the experienced kindness of the other player. If player i rewards the kindness of player j, $\sigma_i > 0$, while a punishing action of i implies $\sigma_i < 0$. Thus, given that ρ_i is non-zero, if player $j \neq i$ is perceived to act unkindly, player i will choose a punishing action as this increases her utility U_i.

Based on Falk and Fischbacher (2006), the one-period utility of a worker i in our setup without requests, given by $\widetilde{U}_i$, is expressed by

$$\begin{aligned}\widetilde{U}_i &= \pi_i \\ &+ \rho_i \underbrace{(w_i - m(e_i'') - 20 - (120 - w_i)e_i'')}_{\varphi_j}\underbrace{((120 - w_i)e_i - (120 - w_i)e_i'')}_{\sigma_i},\end{aligned} \tag{4.5}$$

with e_i'' describing the second-order belief of worker i, that is, worker i's belief of employer j's belief about which effort level i will choose.[8] The first part of the product in the *reciprocity utility* describes the kindness of employer j, which is, c.p., higher the more she offers to worker i. This is given by the expression $w_i - m(e_i'') - 20$ and represents worker i's belief as to her expected payoff if employer j chooses w_i and expects i to choose e_j' (which is the first-order belief of the employer regarding the effort level the worker will choose). To determine the perceived kindness of an action of principal j, worker i compares this expression with her belief as to what employer j wants to keep for herself, $(120 - w_i)e_i''$. Thus, if $(120 - w_i)e_i'' > w_i - m(e_i'') - 20$ it follows that $\varphi_j < 0$, while $\varphi_j > 0$ if $(120 - w_i)e_i'' < w_i - m(e_i'') - 20$.

The second part of the product represents the reciprocation term σ_i and expresses the influence on player j's payoff from the action i chooses. This is given by the change of employer j's payoff from $(120 - w_i)e_i''$ – worker i's belief about employer j's belief about her payoff – to $(120 - w_i)e_i$ which is what j actually receives. Thus, $\sigma_i < 0$ implies $(120 - w_i)e_i < (120 - w_i)e_i''$ and characterizes a punishing action of worker i.

The predictions for workers' effort choices in the *NR treatment* are obtained by differentiating equation (4.5) with respect to e_i and then by equating e_i'' with e_i. The results are as follows and conform with findings from other experiments.

Appendix 3 of Falk and Fischbacher, 2006).

8 According to Falk and Fischbacher (2006), the Nash equilibrium in a psychological game (Geanakoplos *et al.*, 1989) requires all beliefs to be in line with actual behavior. Thus, the model assumes consistent beliefs, i.e., e_i'' (the second-order belief of i) = e_j' (j's first-order belief about the action i will choose) = e_i such that, e_i'' is equated with e_i after differentiating equation (4.5) with respect to e_i.

For $\rho_i = 0$ the model predicts $e^* = e_{min}$ as the standard model. However, the interesting implications of the model arise for $\rho_i > 0$. In this case the model predicts the optimal effort choices of employees to be (we suppress the indices in the following expressions for expositional reasons)

$$e^* = \begin{cases} \max\left(0.1, \frac{a\cdot(w-19)-10}{a\cdot(130-w)}\right) & \text{for } w_{min} \leq w \leq w_1 \\ \frac{a\cdot(w-16)-20}{a\cdot(140-w)} & \text{for } w_1 < w \leq w_2 \\ \min\left(1, \frac{a\cdot(w-8)-30}{a\cdot(150-w)}\right) & \text{for } w_2 < w \leq w_3, \end{cases} \tag{4.6}$$

with

$$\begin{aligned} a &= \rho(120-w) > 0 \\ w_1 &= 82.3077 - \frac{10\sqrt{\rho(2401\rho-13)}}{13\rho} \\ w_2 &= w_2 = 95.5556 - \frac{10\sqrt{\rho(484\rho-9)}}{9\rho} \\ w_3 &= 99.5 - \frac{\sqrt{\rho(1681\rho-60)}}{2\rho}. \end{aligned}$$

The nominators of the effort levels in (4.6) are positive and increasing in the wage while the denominators are positive and decreasing in the wage. Thus, effort increases in the wage payment. This suggests that workers provide $e > e_{min}$ for wages $w > \frac{149}{2} - \frac{91}{100}\sqrt{2500 - \frac{11}{\rho}}$ with increasing effort for higher wage payments (the fair wage-effort relation). Accordingly, the firm's best response is to pay wages above this cut-off level. The effort levels from equation (4.6) constitute the benchmark against which the predictions for the effort levels in R will be compared.

When a worker can state a non-binding request in the first instance, she incorporates this wage request and the difference to what she actually receives in her reciprocity utility. This changes the perceived kindness of player j's action and thus influences player i's effort decision. More precisely, this changes the weights on the expressions in φ_j. In particular, we assume that for a given wage the perceived kindness of player j is lower (higher) compared to the no-request case when the worker requested more (less) than what she actually gets. This strategy is based on intention-based models like Rabin (1993) and Dufwenberg and Kirchsteiger (2004) where the responses to an action may differ according to how it is interpreted as being fair.

Formally, the objective function for this treatment, represented by $\widetilde{U}_i^r$, can be given by

$$\begin{aligned}\widetilde{U}_i^r &= \pi_i \\ &+ \rho_i \underbrace{\left(\epsilon(d)(w_i - m(e_i'') - 20) - (2-\epsilon(d))(120-w_i)e_i''\right)}_{\varphi_j} \underbrace{\left((120-w_i)e_i - (120-w_i)e_i''\right)}_{\sigma_i}. \end{aligned} \tag{4.7}$$

$\epsilon(d) = \frac{1}{100}d + 1 \in [0,2]$ depends on the difference between the wage the agent actually receives and what she requested, which is given by the parameter d above.[9] It determines the weight attached to each part in the perceived kindness term. More precisely, $\delta\epsilon/\delta d > 0$. If a wage request is met $d = 0$, while $d > 0$ if the actual wage exceeds the wage request and $d < 0$ if the wage payment is lower than the request. For $d = 0$, the weight on each term in the perceived kindness of player j is one, as in equation (4.5). For $d < 0$, the weight on what the agent believes the principal wants to keep is inflated and the weight on what she believes the principal wants her to get decreases.[10] The reverse would apply for $d > 0$.

The predictions for workers' effort decisions in the *R treatment* with $\rho_i > 0$ are obtained as above by differentiating equation (4.7) with respect to e_i and afterwards by equating e_i'' with e_i. The results are

$$e^* = \begin{cases} \max\left(0.1, \frac{\epsilon(d)\cdot a\cdot(w-19)-10}{\frac{a(d(w-110))}{100}+a\cdot(130-w)}\right) & \text{for } w_{min} \le w \le w_a \\ \frac{\epsilon(d)\cdot a\cdot(w-16)-20}{\frac{a(d(w-100))}{100}+a\cdot(140-w)} & \text{for } w_a < w \le w_b \\ \min\left(1, \frac{\epsilon(d)\cdot a\cdot(w-8)-30}{\frac{a(d(w-90))}{100}+a\cdot(150-w)}\right) & \text{for } w_b < w \le w_c, \end{cases} \tag{4.8}$$

with

$$\begin{aligned} w_a &= \frac{10\left(-\sqrt{\rho(2401\rho(d+100)^2 - 100(7d+1300))} - 5\rho(7d+2140)\right)}{\rho(7d+1300)} \\ w_b &= \frac{\rho(86000-100d) - 20\sqrt{\rho(121\rho(d+100)^2 - 25d - 22500)}}{\rho(d+900)} \\ w_c &= \frac{\rho(19900-41d) - \sqrt{\rho(1681\rho(d+100)^2 - 600000)}}{2000\rho}. \end{aligned}$$

For all three cases the sign and the size of d determine whether effort is higher,

---

9 $\epsilon(d) = \frac{1}{100}d + 1$ ensures the sum of weights on the expressions in φ_j is two and is thus equal in both treatments.

10 See, for example, Levy *et al.* (2001) who argue that the rejection sensitivity of subjects can distort the perception of the behavior of others.

equal or lower with requests than without requests. Suppose for a given wage w, in the first case, in both treatments, we compare how the optimal effort in R differs from the optimal effort in NR according to euqations (4.6) and (4.8). Then $\frac{a\cdot(w-19)-10}{a\cdot(130-w)} > \frac{\epsilon(d)\cdot a\cdot(w-19)-10}{\frac{a(d(w-110))}{100}+a\cdot(130-w)}$ if $d<0$. This follows from the nominator being smaller and the denominator being larger with $d<0$ than without requests. The reverse holds true for $d>0$. Thus, optimal effort is c.p. (weakly) lower when $d<0$ compared to the case where the employee could not state a request. Instead, if $d>0$, optimal effort is c.p. (weakly) higher than the optimal effort without the possibility of stating a request. For $d=0$ effort levels in both treatments should not differ. Figure 4.1 illustrates the difference between both treatments

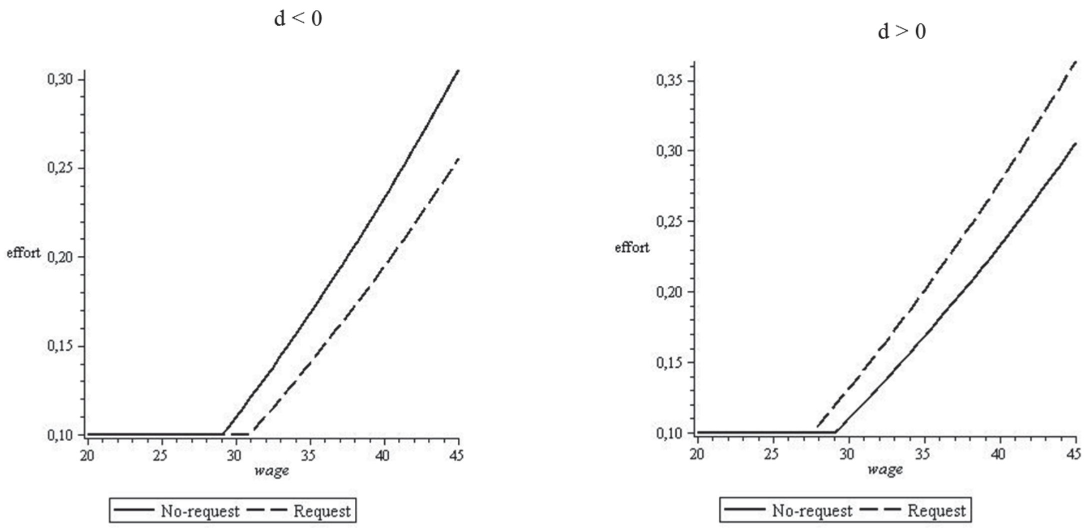

Figure 4.1: Comparison of effort choices for both treatments for $d<0$ and $d>0$ for given ρ and d ($\rho=2$, $d=-10$ and $d=10$).

when $d<0$ (left panel) and when $d>0$ (right panel) for a given sector of wage payments. The graph and the results in (4.6) and (4.8) suggest that for a given wage payment $\frac{149}{2}-\frac{91}{100}\sqrt{2500-\frac{11}{\rho}} < w < \frac{\rho(19900-41d)-\sqrt{\rho(1681\rho(d+100)^2-6000)}}{200\rho}$, the exerted effort in R is lower than in NR when $d<0$; analogously, if $d>0$, the performance level should be higher compared to the no-request treatment for a given wage $\frac{20\left(4100+29d-5\sqrt{\frac{25\rho(d+100)^2-9d-1100}{\rho}}\right)}{9d+1100} < w < \frac{199}{2}-\frac{1}{2}\sqrt{1681-\frac{60}{\rho}}$.

Thus, the first hypothesis we want to test is

Hypothesis 4.1:

(a) Workers provide (weakly) less effort when the request exceeds the actual wage payment than without the option of stating requests.

(b) Workers provide the same effort when the actual wage coincides with the

request.
(c) Workers provide (weakly) more effort when the actual wage payment exceeds the requested wage than without the option of stating requests.

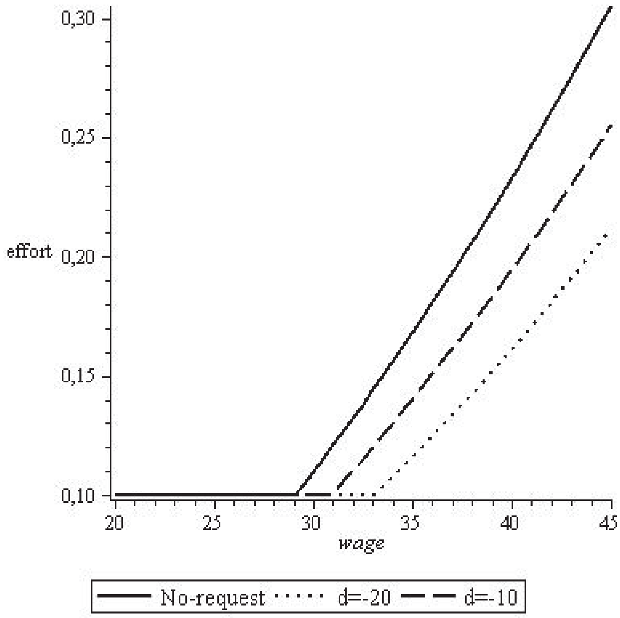

Figure 4.2: Comparison of effort choices for both treatments when $d < 0$ for given ρ and d ($\rho = 2$, $d = -10$, and $d = -20$).

According to equation (4.8) effort levels in the request treatment differ more from those in the no-request treatment the larger the discrepancy between the actual wage payment and the worker's wage request. Figure 4.2 outlines this for $d < 0$, for a given value of ρ and for a given sector of wage payments. The result for the case when $d > 0$ holds analogously, that is, effort is higher the larger $d > 0$. According to this, the second hypothesis we test for is

Hypothesis 4.2:
Effort levels in R differ more from NR for a given wage the larger the discrepancy between the requested and the received wage.

4.5 Data and results

The following subsections discuss the main results. First, we describe the evidence on the wage requests and the wage payments to give some intuition for the subsequent results. The main focus is on the second part, where we test for the specified hypotheses. When testing the directed hypotheses from section 4.4, we indicate this by reporting *one-sided p-values*. Otherwise, without indication, we report *two-sided p-values*. Each non-parametric test below is based on one matching group as one independent observation. First, we provide summary statistics for both treatments with the most relevant parameters in this study. Table 4.2

Table 4.2: Average values for the *request* and *no-request* treatment

	NR treatment	*R treatment*
wage request	-	90.29
wage offer	62	62.5
effort	0.34	0.29

outlines that the average request in the *R treatment* is larger than the average wage offer in both the *NR* and the *R treatment* and that the wage payments are similar for both treatments. Average effort levels are lower when employees are given the opportunity to state a request.

4.5.1 Requests and wages

Figure 4.3 depicts both the wage payments for both treatments and wage requests in the *R treatment* over the course of the game. The data for the request treat-

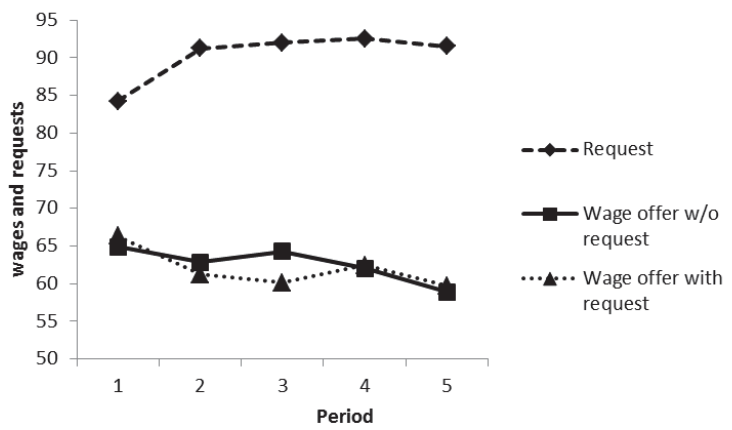

Figure 4.3: Wage payments in both treatments and wage requests over time.

ment uncover that requests are lowest in the first period and increasing steadily for the subsequent periods. This increase is statistically significant (sign test on Spearman's rank correlation between request and period, $p = 0.031$). Workers may have tried to increase the remuneration by exerting pressure on the employers' payment decisions. Employers, however, do not react upon increasing wage requests as we cannot reject that the payments in the request treatment are constant over time (sign test on Spearman's rank correlation between wage payment in *R* and period, $p > 0.600$). At the individual level, some employers exhibit a positive correlation between wage offers and requests and some reveal a negative correlation. Thus, there is no observable pattern at the aggregate level (Pearson's correlation coefficient ρ <-0.01, $p = 0.998$).[11] Furthermore, average wage offers are not significantly different in *R* compared to *NR* (Wilcoxon rank-sum test, $p > 0.600$).

Zooming in on the *R treatment*, Table 4.3 summarizes how often demanded wages are undercut, met or overbid. As can be seen, wage offers are below wage requests in most instances. Accordingly, the average effort level in this case is lowest compared to the other cases.[12] This result is also in line with the argumentation by Charness and Dufwenberg (2006) that non-binding communication by agents does not necessarily enhance efficiency, motivation, and behavior. Farrell and Rabin (1996) also stress that there is no guarantee efficiency will be enhanced by cheap talk. Especially when subjects have opposing equilibrium preferences, possible gains from coordination may be wasted due to bargaining problems. As our results suggest, we cannot reject that efficiency in the *R* is the same as in the *NR* treatment (Wilcoxon rank-sum test, $p > 0.200$).

Table 4.3: Wage requests, wage offers, and corresponding effort levels in the *R treatment*

	Frequency	*Average effort level*
wage offer < wage request	84%	0.27
wage offer = wage request	10.5%	0.38
wage offer > wage request	5.5%	0.36

4.5.2 Effort

Figure 4.4 shows the trendline of the average effort level for each treatment. Although the graph suggests that effort in the no-request treatment decreases slightly over time, a sign test on Spearman's correlation between effort in *NR*

[11] This is similar to results from Khalmetski *et al.* (2013). In particular, the correlation coefficient is insignificant for each matching group except for one.

[12] Note that due to a low number of observations and one subject choosing the lowest possible effort multiple times when the wage offer was above the wage request, effort levels in this case may be biased by this outlier. Excluding this subject increases the average effort level to 0.51.

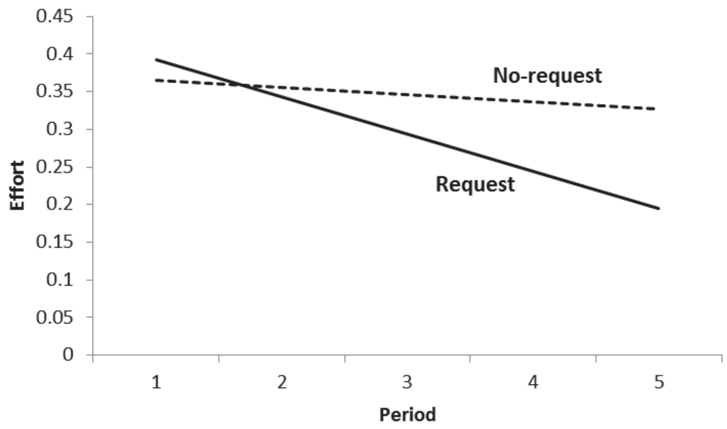

Figure 4.4: Trendlines of average effort levels in both treatments.

and period reveals that the hypothesis of effort levels being equal across periods cannot be rejected at any conventional statistical significance level ($p = 0.687$). This result is also in line with findings by Fehr *et al.* (1993) and Fehr *et al.* (1998a) who report constant effort levels over all experimental periods.

Comparing the trendlines between both treatments, it is obvious that the reduction of effort over periods is recognizably larger in the *R* than in the *NR treatment*. The decrease in effort over periods in *R* is statistically significant. This is evident from a sign test on Spearman's correlation between effort in *R* and period, which clearly indicates that effort is not constant over time with $p = 0.031$.

Besides time, effort levels may also be influenced by how the principal reacts to a stated request. Thus, it is reasonable to investigate the cases from Table 4.3 separately. Figure 4.5 depicts the average effort levels for the no-request treatment and compares it to the effort levels in the request treatment when (a) the wage request exceeds the wage payment, and (b) when the wage payment is higher than or equal to what was requested.[13] The tendency of effort levels appears to coincide with the hypothesized directions outlined above: The effort level decreases when the requested wage is not paid by the employer while it increases when the employer pays the requested wage or even more.

First, we start by investigating the relationship between effort in the no-request treatment and the request treatment when employers undercut the request, which happens in most of the cases (see Table 4.3). Effort levels are significantly lower with undercut requests compared to the treatment without requests

[13] We pool the data of these two categories for illustrative purposes. However, they are analyzed separately below.

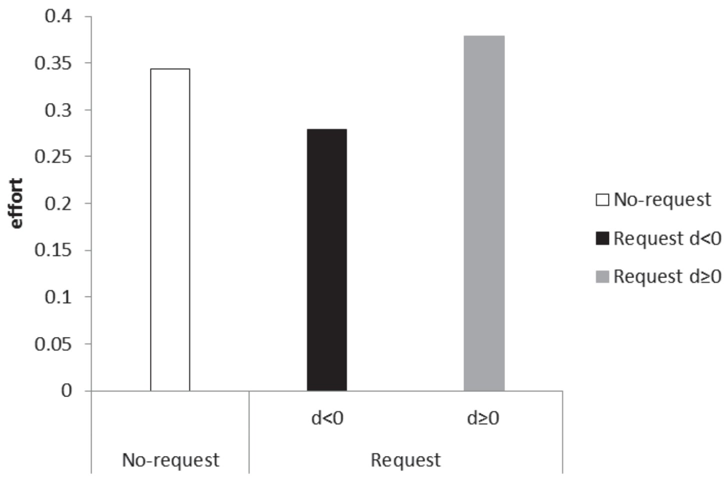

Figure 4.5: Average effort levels in the *NR treatment* and in the *R treatment* conditioned on employers' reactions.

(one-sided Wilcoxon rank-sum test, p =0.054). Thus, subjects seem to take into account the difference between their wage request and what they actually receive when making their decisions. According to equation (4.7) this decreases the perceived kindness of the employer. Consequently, the exerted effort levels are lower than in the no-request treatment.

As outlined in section 4.4, when $d = 0$, effort levels in both treatments should not be different. We cannot reject the null hypothesis that the effort level in the request treatment coincides with the effort level in the no-request treatment with a $p > 0.400$ from a Wilcoxon rank-sum test.

The tendency for the instances when a wage request is overbid seems to conform to the predictions from section 4.4, the difference to the no-request treatment is, however, not significant (one-sided Wilcoxon rank-sum, p >0.350). Although the data suggest that the intuitive prediction above is true, the lack of observations may be one reason why no final conclusion for this case can be reached. Thus, we can reject the null hypothesis that there is a (weakly) positive impact on effort levels in R when $d < 0$ compared to NR which supports Hypothesis 4.1(a). We cannot reject the null hypothesis that there is no difference in effort levels between both treatments for $d = 0$ and $d > 0$, which yields support for Hypothesis 4.1(b) but contradicts Hypothesis 4.1(c).[14]

Result 4.1:

When the wage payment is lower than the wage request, workers provide signif-

[14] However, the prediction for $d > 0$ holds if the subject who chose the lowest possible effort each time is excluded from the data set. The effort level for $d > 0$ is then significantly higher than in the no-request treatment (one-sided Wilcoxon rank-sum test, p=0.017).

icantly less effort compared to the case when they have no possibility to state a wage request. The difference between both treatments is not significant when the wage request is met or when the request is overbid.

To analyze Hypothesis 4.2, we conduct a one-sided sign test for Spearman's correlation between exerted effort and the difference between the actual and requested wage. We can reject the null hypothesis that there is a (weakly) negative correlation ($p = 0.016$). Therefore, effort increases with a larger difference. This applies to both cases, when the difference is negative as well as when the difference is positive. That is, effort is lower for $d = -30$ than for $d = -10$; accordingly, effort is lower for $d = 10$ than for $d = 30$. From this result, we conclude in line with Figure 4.2 and Hypothesis 4.2:

Result 4.2:
Effort in R varies more from NR the more the actual wage payment differs from the preceding wage request.

Additionally, as figures 4.1 and 4.2 suggest, the fair wage-effort relation (Akerlof, 1982; 1984) should hold for both treatments. Thus, Figure 4.6 shows the correlation between exerted effort and the received remuneration for both treatments. In the *NR treatment* a sign test for Spearman's correlation between

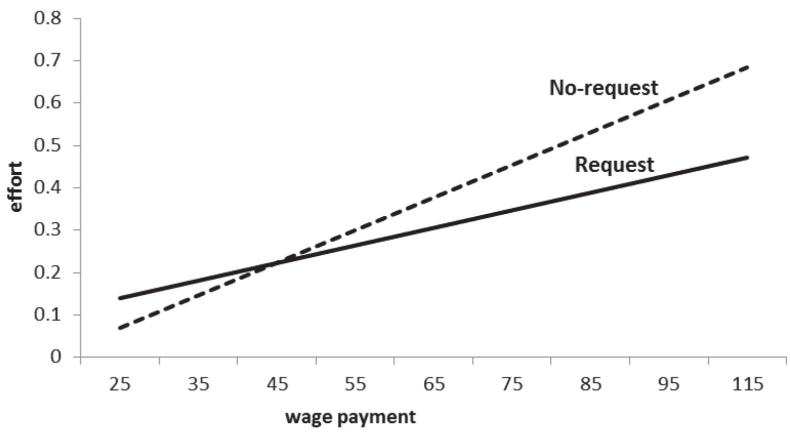

Figure 4.6: The fair wage-effort relation for both treatments.

wage payment and effort rejects the null hypothesis that there is no relationship ($p = 0.031$). This also holds for the *R treatment*: The correlation between exerted effort and received remuneration is positive and significant (sign test, $p = 0.031$). Although the graph suggests that the degree of reciprocation is smoothed in the *R treatment*, there is no significant difference between both treatments (Kolmogorov-Smirnov test, $p = 0.343$). We summarize,

Result 4.3:
The fair wage-effort relation holds in both treatments.

4.6 Discussion and concluding remarks

This experiment analyzes the effects of (non-binding) wage requests of employees in a modified gift-exchange game and therefore provides a robustness check of one of the workhorse models in experimental labor markets. It suggests that modifying a standard gift-exchange game by allowing employees to reveal requests before employers decide on their wage payments does impact on employees' effort decisions.

The main result is that effort levels decrease significantly when the actual wage payment is below a wage request and that effort levels are similar in both treatments when the employee gets the payment she requested. On the aggregate, the effect of diminishing reciprocity predominates efficiency effects, as most of the time actual wage payments are below the wage requests. This supports findings by Charness and Dufwenberg (2006) and Farrell and Rabin (1996). Moreover, effort in R differs more from effort in NR the larger the discrepancy between the request and the wage payment.

Although effort levels are lower in the *R treatment*, there is still a positive, linear relationship between effort and wage payment. This supports the fair wage-effort hypothesis which has proven to be stable in a bulk of papers. Thus, one may draw the conclusion that the phenomenon of the fair wage-effort relation is rather robust, although there seems to be some sensitivity of single parameters to the experimental setup and the explicit structure of the game. Introducing a request stage in the first instance suggests a lower degree of reciprocation by employees.[15]

The experiment applies a rather simple construct to study how reciprocity is affected by introducing a simple bargaining structure into the standard gift-exchange game. As this study focuses on the the prime effects of employees requesting a certain payment, there are several aspects left for future research. One interesting aspect which would provide further insights into wage bargaining would be to elicit beliefs of subjects. This would be one way to provide information on how subjects behave in wage negotiations and how strategically they place their requests and offers.

15 Note that these results are similar to Andreoni and Rao's (2011) finding that selfishness of agents predominates and that pro-social behavior relies on social cues.

4.A Instructions

The following pages provide the translated versions of the instructions for the *NR treatment* and the *R treatment*. First, we provide the instructions for subjects participating in the treatment without requests. Subsequently, the instructions for the treatment with requests are outlined.

General information

NOW THE EXPERIMENT HAS STARTED WE KINDLY REQUEST THAT
YOU REFRAIN FROM TALKING TO THE OTHER PARTICIPANTS.

You are taking part in an experimental study. Your earnings during the experiment are calibrated in ECU (Experimental Currency Unit). At the end, ECU will be converted into €. You will receive this amount of money in addition to the show-up fee. The conversion rate is

100 ECU = €2.00

Your earnings are paid to you privately at the end of the experiment.

All 24 subjects will be assigned to one of two groups by a random mechanism: 12 will be employees and 12 will be employers. Before the experiment starts you will be randomly assigned the role of either an employee or an employer. You will keep your assigned role for the duration of the experiment. Every employer is randomly matched with one employee in each period.
This experiment is about the labor market and consists of two stages:

Stage 1: In the first stage, the employer will offer a wage to his matched employee. The employee can decide whether to accept the offer and to work accordingly or reject the offer. In case of acceptance, the second stage follows.

Stage 2: Now the employee will decide after a fixed schedule how much effort she wants to provide for the offered wage.

Overall, the experiment consists of five periods. Your total earnings for participating in the experiment is the sum of all your earnings over the five periods plus a credit balance of 200ECU, which corresponds to the show-up fee of €4.

Please note: There are 12 employers and 12 employees who are newly re-matched in each period.

Instructions for the *NR treatment*

Detailed information about the labor market

1. At the beginning of each period, the employer can offer a wage to her matched employee. **This offer should not be smaller than 20ECU or above 120ECU**. No other employee besides the one matched in a given period and no other employer will receive information about the offered wage.

2. The employee can decide whether to accept and choose an effort level she wants to provide, or to reject an offer. In case of acceptance, the employee will incur some commuting costs of 20ECU.

3. If the offered wage is accepted, the employee will need to decide on how much effort he wants to provide. Neither another employee nor another employer, besides the one matched in a given period, will receive information about the chosen effort level.

4. If the offered wage is rejected, the employee will be unemployed in the respective period and will therefore receive no income and the matched employer will make zero profit in this period.

How to calculate the income of an employee in one period

1. If the employee rejects the wage offer of her employer, she will earn nothing in the respective period.

2. If the employee accepts the wage offer of her employer, the employee will receive the offered wage payment. However, the costs of the chosen effort level as well as the commuting costs of 20ECU have to be subtracted from the wage payment to get the income of a worker in one period.

3. The effort level is chosen by selecting a number between 0.1 and 1.0 from the below-mentioned table. Thereby, 0.1 is the smallest possible effort level an employee can choose; 0.2 is a somewhat higher effort, etc., and 1.0 is the highest possible effort one can select.

4. The higher the chosen effort level of an employee the better it is for the employer (more information on that below). The employer's profit is higher the higher the selected effort level of the employee.

5. The higher the chosen effort level of an employee, the higher the costs she has to bear. You can gather information on the costs for respective effort choices from the table below which lists all the possible effort levels with the corresponding cost.

6. If the employee accepts a wage offer, her income can be calculated in ECU as follows.

Instructions for the *NR treatment*

worker's income = wage - effort cost - commuting cost

Table with possible effort choices (e) and the corresponding cost (m(e))

e	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1
m(e)	0	1	2	4	6	8	10	12	15	18

How to calculate the profit of an employer in one period

1. The employer will receive 120 tokens in every period which she can use for paying the employee's wage. If the employer offers a wage of 120ECU, there are no tokens left for her. In general, there are

120 tokens - wage

tokens left for the employer.

2. How are the remaining tokens converted into ECU? The amount of tokens left is multiplied by the chosen effort level of the matched employee such that

Employer's profit = tokens left x effort choice

3. If the employee rejects the wage offer, the employer will earn zero profit in this period, i.e., she does not earn money from the tokens she has been given. Furthermore, tokens can only be used for the period for which they are given. Unused tokens do not accumulate and do not deliver any income for the employer.

Please note: The income and profits of all employees and all employers are calculated by the same rule in every period. Each employer receives 120 tokens to be used for wage payments and the table of effort choices and corresponding costs is the same for all employees. Thus, every employer can calculate the income of her matched worker and vice versa.

Instructions for the *NR treatment*

Let us do some exercises:

1. Assume the employer who has been given 120 tokens offers a wage of 110 ECU to her matched employee.

A. The employee rejects the offer! What are the earnings for both the employee and employer in ECU?

Worker = ___________ECU

Employer = _________ECU

B. The employee accepts and chooses an effort level of 0.5. What are the earnings for both the employee and employer in ECU?

Worker = ___________ECU

Employer = _________ECU

2. Assume the employer who has been given 120 tokens offers a wage of 30 ECU to her matched employee.

A. The employee rejects the offer! What are the earnings for both the employee and employer in ECU?

Worker = ___________ECU

Employer = _________ECU

B. The employee accepts and chooses an effort level of 0.6. What are the earnings for both the employee and employer in ECU?

Worker = ___________ECU

Employer = _________ECU

Instructions for the *NR treatment*

General information

NOW THE EXPERIMENT HAS STARTED WE KINDLY REQUEST THAT
YOU REFRAIN FROM TALKING TO THE OTHER PARTICIPANTS.

You are taking part in an experimental study. Your earnings during the experiment are calibrated in ECU (Experimental Currency Unit). At the end, ECU will be converted into €. You will receive this amount of money in addition to the show-up fee. The conversion rate is

100 ECU = €2.00

Your earnings will be paid to you privately at the end of the experiment.

All 24 subjects will be assigned to one of two groups by a random mechanism: 12 will be employees and 12 will be employers. Before the experiment starts you will be randomly assigned the role of either an employee or an employer. You will keep your assigned role for the duration of the experiment. Every employer is randomly matched with one employee in each period.
This experiment is about the labor market and consists of three stages:

Stage 1: The employee can send a non-binding wage request to her matched employer.
Stage 2: The employer offers a wage to his matched employee. The employee can decide whether to accept the offer and to work accordingly or reject the offer. In case of acceptance, the third stage follows.
Stage 3: Now the employee will decide after a fixed schedule how much effort she wants to provide for the offered wage.

Overall, the experiment consists of five periods. Your total earnings for participating in the experiment is the sum of all your earnings over the five periods plus a credit balance of 200ECU which corresponds to the show-up fee of €4.

Please note: There are 12 employers and 12 employees who are newly re-matched in each period.

Instructions for the *R treatment*

Detailed information about the labor market

1. At the beginning of each period, the employee can make a non-binding wage request to her matched employer. The wage request should not be lower than 20ECU or above 120ECU. No other employer besides the one matched in a given period and no other employee will receive information about the wage request.

2. Subsequently, the employer can offer a wage to her matched employee. This offer should not be lower than 20ECU or 120ECU. Additionally, this ultimate wage offer can be lower, higher than or equal to the requested wage. No other employee besides the one matched in a given period and no other employer will receive information about the offered wage.

3. The employee can decide whether to accept and choose an effort level she wants to provide, or to reject an offer. In case of acceptance, the employee will incur some commuting costs of 20ECU.

4. If the offered wage is accepted, the employee will need to decide how much effort he wants to provide. Neither another employee nor another employer, besides the one matched in a given period, will receive information about the chosen effort level.

5. If the offered wage is rejected, the employee will be unemployed in the respective period and will therefore receive no income and the matched employer will make zero profit in this period.

How to calculate the income of an employee in one period

1. If the employee rejects the wage offer of her employer, she will earn nothing in the respective period.

2. If the employee accepts the wage offer of her employer, the employee will receive the offered wage payment. However, the costs of the chosen effort level as well as the commuting costs of 20ECU have to be subtracted from the wage payment to get the income of a worker in one period.

3. The effort level is chosen by selecting a number between 0.1 and 1.0 from the below-mentioned table. Thereby, 0.1 is the smallest possible effort level an employee can decide on; 0.2 is a somewhat higher effort, etc., and 1.0 is the highest possible effort one can select.

4. The higher the chosen effort level of an employee the better it is for the employer (more information on that below). The employer's profit is higher the higher the selected effort level of the employee.

Instructions for the *R treatment*

5. The higher the chosen effort level of an employee, the higher the costs she has to bear. You can gather information on the costs for respective effort choices from the table below which lists all the possible effort levels with the corresponding cost.

6. If the employee accepts a wage offer, her income can be calculated in ECU as follows.

worker's income = wage - effort cost - commuting cost

Table with possible effort choices (e) and the corresponding cost (m(e))

e	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1
m(e)	0	1	2	4	6	8	10	12	15	18

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1. The employer will receive 120 tokens in every period which she can use for paying the employee's wage. If the employer offers a wage of 120ECU, there are no tokens left for her. In general, there are

120 tokens - wage

tokens left for the employer.

2. How are the remaining tokens converted into ECU? The amount of tokens left is multiplied by the chosen effort level of the matched employee such that

Employer's profit = tokens left x effort choice

3. If the employee rejects the wage offer, the employer will earn zero profit in this period, i.e., she does not earn money from the tokens she has been given. Furthermore, tokens can only be used for the period for which they are given. Unused tokens do not accumulate and do not deliver any income for the employer.

Please note: The incomes and profits of all employees and all employers are calculated by the same rule in every period. Each employer will receive 120 tokens to be used for wage payments and the table of effort choices and corresponding costs is the same for all employees. Thus, every employer can calculate the income of her matched worker and vice versa.

Instructions for the *R treatment*

Let us do some exercises:

1. Assume the employer who has been given 120 tokens offers a wage of 110 ECU to her matched employee.

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Worker = ___________ECU

Employer = _________ECU

B. The employee accepts and chooses an effort level of 0.5. What are the earnings for both the employee and employer in ECU?

Worker = ___________ECU

Employer = _________ECU

2. Assume the employer who has been given 120 tokens offers a wage of 30 ECU to her matched employee.

A. The employee rejects the offer! What are the earnings for both the employee and employer in ECU?

Worker = ___________ECU

Employer = _________ECU

B. The employee accepts and chooses an effort level of 0.6. What are the earnings for both the employee and employer in ECU?

Worker = ___________ECU

Employer = _________ECU

Instructions for the *R treatment*

Chapter 5

Worker Participation and the Efficiency of Remuneration Policies: Experimental Evidence

Co-authored with Beatrice Pagel and Holger Rau

5.1 Introduction

Worker motivation and reciprocity are at the heart of labor market relations. The positive correlation of wages and effort was highlighted by Akerlof (1984) and Akerlof and Yellen (1990). There is extensive experimental evidence supporting their so-called "fair wage-effort" hypothesis (e.g., Fehr *et al.*, 1993; Fehr *et al.*, 1998b).

However, in labor markets, it is likely that worker motivation is not exclusively maintained by wages. The classical gift-exchange relationship may be exacerbated in many cases. For instance, in the presence of agreed wages it may be difficult for employers to signal kind behavior. Moreover, minimum wages may complicate the signaling of fair behavior by wage payments. Nevertheless, workers in these environments commonly perform well.

What else enhances worker motivation and reciprocity? A common view is that both are positively affected when worker interests are represented toward their employers, i.e., when workers are given a "voice" in their companies.

Voice can be acquired by employees in labor unions or works councils. These institutions provide workers with a platform to negotiate their wages and working conditions. While wage levels frequently rise when unions are active (Menezes-Filho, 1997; Menezes-Filho and Van Reenen, 2003), institutional voice may also have productivity-enhancing effects (Freeman and Medoff 1979, 1984). Works councils represent institutions with similar characteristics which play an active role in co-determination. Here, the right to speak is realized by "worker participation," describing a concept where employees are involved in organizational decision-making within their companies. Many papers report empirical evidence that works councils may be powerful channels to facilitate communication between workers and management (FitzRoy and Kraft 1987, 2005; Frick, 1996).

Understanding the behavioral effects of voice in the sense of worker participation may be helpful for the success of labor policies. If workers positively respond to participation in organizational decisions, labor market policies such as minimum wages may benefit from this practice. Put differently, when employers accept workers' requests it may enhance reciprocity under worker participation.

This paper experimentally analyzes the effects of worker participation for the success of minimum remuneration policies. It focuses on a situation where workers bargain in an employee-employer negotiation for the introduction of a minimum remuneration requirement. We do not intend to model the actual practice and functioning of labor unions and works councils. Instead, our focus lies on the analysis of the behavioral effects of voice through worker participation on subjects' reciprocal behavior.

Following Freeman and Medoff (1979, 1984) and the empirical evidence on works councils, we hypothesize that minimum remuneration policies are more effective when workers have participation rights. That is, workers show a higher performance when they are able to enforce the labor-market policy.

To test this, we present a stylized real-effort experiment where three workers are employed by an employer. In the main treatment workers can enforce this requirement in a bargaining process with their employer. In our control setting workers have no decision power and the requirement is imposed exogenously.

Our setup is most closely related to Charness *et al.* (2012) who show that "hidden advantages in delegation" exist in a gift-exchange setting.[1] Charness *et al.* (2012) modify the gift-exchange setup allowing principals to delegate the wage choice to the employees. Their major finding is that worker participation increases reciprocity, i.e., employees exert more effort when having the right to

[1] Falk and Kosfeld (2006) show in a paper on monitoring that "hidden costs of control" exist. Put differently, revoking the freedom of employees may backfire, i.e., employees exert lower effort when principals specify minimum effort levels.

set their wages. Jeworrek and Mertins (2014) confirm this finding in the field. A similar feature of our setup is that workers have voice in remuneration decisions. In contrast to the aforementioned studies, employers do not have the choice to delegate the wage setting. Instead, employees in our experiment *always* have the right to speak at the bargaining stage. Here, they negotiate on the introduction of a minimum remuneration requirement.[2]

The efficiency-enhancing effect of voice has also been shown in other labor market experiments. Corgnet and Hernán González (2013) report in a principal-agent setting that agents increase their productivity when their demand is met by the principal. Mellizo *et al.* (2014) analyze subjects' voting decisions on a payment scheme in a real-effort study without employers. The paper concludes that voting increases subjects' performance.

In a wider context, voice effects are analyzed in studies which do not focus on labor market settings. The idea that voting rights may increase subjects' commitment to policies is also motivated by experimental findings on endogenous institutions. This literature shows that cooperation increases in public-good games (Kosfeld *et al.*, 2009; Sutter *et al.*, 2010; Markussen *et al.*, 2014), and prisoner's dilemmas (Dal Bó *et al.*, 2010) when participants have voting rights. In ultimatum games it is found that voice increases the acceptance of proposals when proposers can send messages (Andersson *et al.*, 2010) or responders can state requests (Ong *et al.*, 2012). Kleine *et al.* (2014) report that dictator giving is higher when dictators may state their concerns.

Another related strand of literature concerns experiments on the impact of minimum wages. These papers focus on minimum wages, but do not compare the efficiency of implementation methods. Brandts and Charness (2004) find that minimum wages may attenuate subjects' reciprocity in a gift-exchange game, i.e., agents exert less effort. Owens and Kagel (2010) study a gift-exchange game and find that minimum wages lead to significantly higher wages. However, employees only moderately increase their effort. Other studies abstract from effort choices and highlight that minimum wages may work as reference points. Falk *et al.* (2006) show that minimum wages increase employees' reservation wages and thus lead to higher wage payments. Dittrich *et al.* (2011) extend Falk *et al.* (2006)

[2] Few experiments analyze wage bargaining in groups. Kocher *et al.* (2012) focus on voting decisions among union members without employers. They find that productive workers ignore employment of low productivity workers. Instead, we focus on the effects of bargaining between workers and *employers*. Gose and Sadrieh (2014) focus on a modified gift-exchange game with multiple employees. Workers in this setup are given collective action, i.e., they may reject employers' uniform wage offers.

to a setting where workers have bargaining power.[3] The study finds that wage payments significantly increase in minimum wages.

Our study combines several features of these approaches. First, it builds on the evidence that worker participation and endogenous institutions may increase efficiency (Charness *et al.*, 2012; Sutter *et al.*, 2010). Second, it tests whether this may balance out the detrimental effects of minimum wages on reciprocity (Brandts and Charness, 2004). Put together, we analyze the success of a minimum remuneration requirement when workers participate in their enforcement.

The data find meaningful support for the hypothesis that worker participation may enhance the success of labor policies. We show that worker effort is higher after they successfully enforce minimum remuneration requirements. In the bargaining treatment, the majority of workers (77%) increase productivity, whereas this is only true for 55% in the exogenous case. The fair wage-effort relation becomes less important after the enforcement of remuneration requirements. In this case, workers exert high effort even under low remuneration. By contrast, employers have to overbid exogenous minimum remuneration requirements to induce high effort. Our findings suggest that worker participation may be a promising tool to maintain reciprocity.

The remainder of the paper is organized as follows: The experimental design is introduced in section 5.2. Section 5.3 derives the hypotheses and section 5.4 presents the results. Section 5.5 concludes.

5.2 Experimental design and procedures

Our framework is a two-stage game where a principal (employer) is matched with three agents (employees or workers). We apply a fixed-matching design with fixed roles which is repeated for eight periods. Each period consists of a payoff-distribution stage and a working stage. First we introduce the timing of the game. Then we present the treatments.

5.2.1 Timing

Stage 1: Payoff-Distribution

In the first stage, a dictator game (Forsythe *et al.*, 1994) is played: The employer decides on the percental distribution of the firm revenue between her and the

[3] Similar to Falk *et al.* (2006), Dittrich *et al.* (2011) abstract from effort choices. The wage determination in their paper follows an alternating-offers bargaining game similar to Rubinstein (1982).

three workers. Workers then receive information on the split dictated by the employer.[4] The split can be chosen between 0% and 100% in increments of 10 percentage points. We apply this choice set to simplify the procedure. The fraction allocated to the employees will be *equally* distributed between them. For instance, if the employer allocates 40% of the revenue to herself and 60% to the employees, each employee will receive exactly 20% of the generated revenue. Splits which are not divisible by three are rounded to the first decimal place. For example, if an employer allocates 50% to the employees, each worker receives $50\%/3 = 16.66\% \approx 16.7\%$.

Stage 2: Working Stage

After employers have decided on a distribution of revenues, workers are informed of the allocated share and have the possibility to generate the firm revenue by performing a real-effort task (Benndorf *et al.*, 2014). The task corresponds to an encryption task where letters have to be encoded to numbers (see section 5.A).

In each of the eight periods workers are given five minutes to perform the task. The firm payoff (revenue) increases by €0.10 for each correctly solved puzzle. In the meantime, employers have the possibility to surf the internet.

During the five-minute time period employees may also make use of an outside option (surf the internet). On-the-job leisure activities constitute an important part of the workplace and may help to attenuate participation in experiments Lei *et al.* (2001). Real-effort tasks may become focal in experiments when no alternatives are present. Thus, adding a desirable outside option sets up trade offs between work effort and leisure (Corgnet *et al.*, 2014).

In our experiment workers can always decide on the allocation of the time (0–5 minutes) they want to spend on exerting effort or surfing the internet. While surfing the internet, workers cannot perform the task. However, surfing the internet still yields a payoff of €0.01 for each 10 seconds spent on the internet. Paying subjects for using the outside option has been successfully applied in experimental economics (see Mohnen *et al.*, 2008), as it ensures that subjects have significant opportunity cost when working on the real-effort task. The outside payoff is not

[4] The revenue is generated by the workers in the following working stage. The remuneration mechanism implies that workers can increase profits by exerting more effort. We opted for this approach because it minimizes the cases where employees exert no effort. Note that this commonly occurs in standard gift-exchange games (Fehr *et al.*, 1993; Fehr *et al.*, 1998b). Shirking in our setup results in a payoff of zero if no employee exerts effort. We are aware that free-riding incentives still exist. An employee may exert no effort and speculate that at least one employee will exert effort. Our incentive mechanism resembles a revenue-sharing scheme which aims to motivate cooperation (e.g., Weitzman, 1985, FitzRoy and Kraft, 1986).

shared with the other members of a firm. Workers can switch between the task and the outside option any number of times.

After five minutes when a period is finished, all members of a firm are informed of the total number of correctly solved tasks. Neither the employer nor the workers learn how many puzzles were solved by any individual worker. The employer and employees are also informed of the total firm revenue, the employer's profit, and the resulting individual worker profits. The payoff each worker receives from using the outside option is not communicated to the employer or fellow employees.

The employer's profit in period t ($\pi_{e,t}$) is calculated as follows:

$$\begin{aligned} \pi_{e,t} &= A \cdot \sum_i x_{i,t}(100 - s_t), \\ & \text{with } s_t \in \{0, 10, 20, 30, 40, 50, 60, 70, 80, 90, 100\}, \\ & \text{and } t \in \{1, ..., 8\}, \text{ and } i \in \{1, 2, 3\}. \end{aligned} \quad (5.1)$$

A refers to the remuneration for each correctly solved problem. We set $A =$ €0.10. $\sum_i x_{i,t}$ is the total number of correctly solved tasks of all three employees in period t where $x_{i,t}$ is the number of correctly solved tasks of worker $i \in \{1, 2, 3\}$ in the current period t. The expression $A \cdot \sum_i x_{i,t}$ represents the corporate profit of the firm. The term in brackets of equation (5.1) is the share of the joint revenue kept by the employer. Finally, s_t represents the current share of revenue which the employer allocates to the workers in period t.

An individual worker i's payoff in period t ($\pi_{w_i,t}$) corresponds to the share of revenue she receives plus the amount of money she has generated in the working stage by using the outside option ($\pi_{o_i,t}$):

$$\pi_{w_i,t} = \frac{s_t \cdot A \cdot \sum_i x_{i,t}}{3} + \pi_{o_i,t} \text{ for } i \in \{1, 2, 3\} \text{ and } t \in \{1, ..., 8\}. \quad (5.2)$$

5.2.2 Treatments

We apply a within-subjects design with eight periods. The setting consists of two parts with four periods each. Before the experiment begins, subjects are provided with the instructions explaining the first part of the experiment (periods 1–4). Subjects also know that a second part will follow but they do not yet have information on the procedures of the second part. Furthermore, subjects are informed that they will receive new instructions after part one is finished. In periods 1–4, they take part in the payoff distribution and working stages as described above.

In periods 5–8, we apply two different treatments which correspond to institutional changes (Fehr and Gächter, 2000). We follow the literature on endogenous institutions (e.g., Kosfeld *et al.*, 2009; Sutter *et al.*, 2010) where subjects have voting rights on the implementation of institutions. These papers compare the voting settings to treatments where institutions are introduced exogenously.

In our experiment, we focus on the effects of the endogenous vs. exogenous introduction of minimum remuneration requirements on subjects' effort. In our main treatment subjects take part in a bargaining process on the implementation of a minimum-remuneration institution. In the control treatment the institution is exogenously introduced.

Endogenous Minimum Share of Revenue (MSR)

Our main treatment studies the impact of worker participation on the efficiency of a minimum remuneration requirement. In the treatment, workers participate in a one-time bargaining process with their employer over the introduction of such a minimum remuneration requirement. When a requirement is successfully enforced, the employer is required to pay a minimum share of revenue (MSR) in the subsequent periods. We call this treatment: *endogenous Minimum Share of Revenue (MSR)*.

The treatment works as follows: After workers have completed the first part of the experiment they receive new instructions and are informed of the bargaining stage. This stage *only* occurs prior to the start of period 5. Here, the three employees jointly bargain with the employer over the level of an MSR. The bargaining process is similar to the framework of the *reverse ultimatum game* introduced by Gneezy *et al.* (2003).[5]

The following procedural rules apply: First of all, workers need to agree on an MSR level they want to request from the employer. To reach an agreement, the three employees individually and simultaneously decide on a request level (r_i) between zero and 100 in increments of 10 percentage points. It follows that $r_i \in \{0, 10, 20, 30, 40, 50, 60, 70, 80, 90, 100\}$.

Employees are given a grid with three rows encompassing request levels between 0% and 100%. Each row corresponds to the choice set of one of the three

[5] In Gneezy *et al.* (2003) the proposer makes an offer to the responder who can accept or reject it. Following a rejection, the proposer has to make another offer. The main difference in our experiment is that the workers submit the offer (the request) and the employer decides whether to accept or to reject the request. Further differences are that subjects bargain over a percental split of a firm revenue and we are not interested in the impact of a time restriction on the bargaining process.

workers. The grid is depicted below. It presents workers' MSR choice set in the bargaining stage. Each employee is allocated a unique name (employee 1, 2, and 3). The workers are informed of their names and have to enter the desired MSR level.

Chosen minimum wage[6] by the employees:

	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
employee 1							**X**				
employee 2											
employee 3							**X**				

You are employee 2. Please enter your minimum-wage request: 60

In the given example, employees 1 and 3 have already entered a request level of 60% and employee 2 is currently entering a request level of 60%. Employees cannot change their selection once the decision has been entered. To determine workers' joint MSR request, an *unanimity rule* is applied. If at least one of the three workers selects a different request level, no agreement is reached. In this case, all entries are deleted and the choice process restarts. In total, the workers are given 90 seconds to reach an agreement. If they fail, a *majority rule* selects the choice of the MSR request which was chosen most often. In case of a tie, a random draw selects one of these requests. This case never occurred in our experiments. Once an agreement has been reached, the chosen MSR request is sent to the employer.

The employer observes the request and has to decide whether to accept or reject it. If the employer accepts the workers' claim, the bargaining stage ends. In this case the accepted request level will be implemented as the MSR for periods 5–8. However, if the request is rejected, the employees are informed and have to send a new request. In what follows, new request levels are determined with the same procedure as described above. However, from then on the requests have to be below the rejected request (see Gneezy *et al.*, 2003). In this case, agents are shown a new computer screen with a shortened grid of possible request levels between 0 and $r_{rej} - 10$, with r_{rej} being the previously rejected MSR request level. The bargaining process is repeated for as long as both parties do not reach an agreement. It also ends when employers reject a request level of 10% or when employees request a level of zero. In these cases, no MSR is introduced.

When an MSR is enforced, the employer has to allocate at least this percentage to the agents in each of the following periods, but she is free to allocate more. In

6 In the experiment we chose the wording "minimum wage" to simplify the understanding for the subjects.

periods 5–8 employers' choice set (s_t) can be described as:

$$\begin{aligned} &MSR \leq s_t \leq 100 \text{ with } MSR \in \{0, 10, 20, 30, 40, 50, 60, 70, 80, 90, 100\}, \\ &\text{and } s_t \in \{0, 10, 20, 30, 40, 50, 60, 70, 80, 90, 100\}, \text{ and } t \in \{5, ..., 8\} \end{aligned} \tag{5.3}$$

For the case of $MSR = 0$, employers are not required to pay a positive minimum share of remuneration. After the bargaining stage the experiment proceeds with periods 5–8. The timing is exactly the same as before the bargaining stage.

Exogenous Minimum Share of Revenue (MSR)

Our control treatment aims to disentangle the effect of worker participation on the efficiency of a minimum remuneration requirement. The situation in periods 1–4 is exactly the same as in *endogenous MSR*.

A crucial difference is that the MSR for periods 5–8 is *not* enforced by the workers. Instead, we exogenously introduce it after the end of period 4. Before period 5 starts, all subjects are informed of the exact level of the MSR which will be introduced. In the control treatment, we apply the same levels of MSRs which were enforced by the workers in *endogenous MSR*. In periods 5–8, employers are required to allocate a share of revenue which is at least as high as the MSR.

5.2.3 Procedures

Subjects in both treatments receive written instructions before the beginning of period 1. They learn that the experiment consists of two parts and the second part will start after period 4, but they do not receive information about the content (and length) of the second part.

After subjects have processed periods 1–4 they receive a new set of instructions. In *endogenous MSR* subjects are informed of the bargaining stage and that an MSR may be enforced. By contrast, in the control treatment workers and employers are informed that the MSR is exogenously introduced.

All treatments were programmed with z-Tree (Fischbacher, 2007). In total, 144 subjects participated in the experiment, i.e., we had 64 subjects in *endogenous MSR* and 80 subjects in *exogenous MSR*. Subjects were from various fields and were recruited with ORSEE (Greiner, 2004). Each session lasted for approximately 70 minutes. Subjects earned on average €16.26 including a show-up fee of €4.

5.3 Hypotheses

In this section we outline our hypotheses. We start with the worker remuneration before and after the introduction of an MSR. In a next step, we focus on the impact of endogenous/exogenous MSRs on worker effort.

Falk *et al.* (2006) and Owens and Kagel (2010) find that employers increase their wage payments in the presence of minimum payment requirements. Following Falk *et al.* (2006) the MSR requirement in our experiment should lead to "spillover" effects. Put differently, employers are not only forced to pay a higher remuneration, they also anticipate that employees expect a higher compensation. Thus, remuneration payments will significantly increase in periods 5–8 of both treatments.

Hypothesis 5.1:
(a) Employers increase the allocated share of revenue under an endogenous MSR.
(b) Employers increase the allocated share of revenue under an exogenous MSR.

When employers increase the share of allocated revenues, exerting effort becomes more profitable. Moreover, the fair wage-effort relation predicts that effort should increase in wages (e.g., Fehr *et al.*, 1993). As a consequence, workers should increase their performances in periods 5–8 of both treatments.

Hypothesis 5.2:
(a) Workers increase their effort after the introduction of an endogenous MSR.
(b) Workers increase their effort after the introduction of an exogenous MSR.

Experiments have shown that workers may perceive minimum wages as reference points (Falk *et al.*, 2006; Brandts and Charness, 2004). There is evidence that reciprocity may be mitigated when a minimum wage is exogenously introduced (Brandts and Charness, 2004). By contrast, the literature on worker participation emphasizes that the right to speak may significantly increase performance (Corgnet and Hernán González, 2013; Mellizo *et al.*, 2014).

Similar evidence is reported by the literature on endogenous institutions, which finds that voting enhances subjects' commitment to policies (e.g., Kosfeld *et al.*, 2009). Additional support is given by the *responsibility-alleviation* effect which predicts that agents bearing the responsibility for an outcome behave more pro-socially (Charness, 2000).

Moreover, delegating wage choices to workers may substantially increase their performances (Charness *et al.*, 2012; Jeworrek and Mertins, 2014). Hence, we hypothesize that MSRs may maintain reciprocity when they are enforced by workers. As a consequence, we expect that endogenous MSRs are more effective, leading to a more pronounced performance increase.

Hypothesis 5.3:
The effort increase will be more pronounced after the introduction of an endogenous MSR as compared to the exogenous case.

5.4 Results

In this section we present our results. First, the analysis focuses on the remuneration of the workers. Second, we report our main findings of the impact of worker participation on the success of minimum remuneration policies. Then we study work incentives and reciprocity. When using non-parametric tests, we always report two-sided *p-values*.

Table 5.1: Summary statistics.

	Part 1	**Part 2**	
		endogenous MSR	**exogenous MSR**
Allocated share of revenue (in%)	54.6	63.4	66.5
Individual effort	19.2	21.5	20.1
Workers' payoff (in €)	4.6	5.7	5.7
Employers' payoff (in €)	9.5	9.3	7.6
number of subjects	144	64	80
number of independent observations	36	16	20

Table 5.1 presents summary statistics on the results of our experiment. The table reports the means of the first part (periods 1–4) and the second part (periods 5–8) of the experiment, conditioned on the treatments. We find that the average share of revenue allocated to the workers increases under endogenous and exogenous MSRs. In more detail, the average remuneration is higher under exogenous MSRs (66.5%) as compared to endogenous MSRs (63.4%). Introducing MSRs stimulates exerted effort in both treatments. Note that the mean performance is higher in the bargaining treatment (21.5) than in the exogenous treatment (20.1). In part two, we find that the increases of remuneration and effort yield higher payoffs for principals and agents. A conspicuous finding is that employers' profit is clearly higher under endogenous MSRs (€9.3) as compared to the exogenous case (€7.6).

5.4.1 Worker remuneration

We start our analysis by focusing on the outcome of the bargaining stage. Table 5.2 overviews the number of different MSR levels which were enforced in the endogenous treatment. It also depicts the number of the MSR levels we exogenously introduced. To increase power we additionally included observations from a session on exogenous MSRs which we ran before we collected the endogenous data.[7]

Table 5.2: Number of endogenously/exogenously introduced MSR levels.

	MSR 40%	MSR 50%	MSR 60%	MSR 70%	Total
endogenously introduced	3	1	6	6	16
exogenously introduced	4	4	6	6	20

Remarkably, all firms managed to enforce an MSR of 40% or higher in the endogenous treatment. In most cases MSRs of 60% or 70% were established. By contrast, low MSRs of 40% and 50% were only rarely observed. A closer look at the data reveals that employers on average reject two MSR requests before they accept employees claims.

Table 5.3 presents random-effects panel regressions studying the impact of endogenous/exogenous MSRs on the allocated share of revenue. We analyze two regressions for the endogenous treatment (models 1 and 2) and for the exogenous treatment (models 3 and 4). In models 1 and 3, *MSR present* is a dummy variable testing the impact of MSRs on paid remuneration. Models 2 and 4 add control variables. Here, *MSR level* controls for the level of the MSR, it is zero in periods 1–4 and attains values between 40 and 70 in periods 5–8. Furthermore, we implement *female employer*, a dummy which is positive for female employer and *period* as further control variables. The regressions estimate Huber-White (robust) standard errors.

Model 1 highlights that endogenous MSRs generally increase employees' compensation. The coefficient of *MSR present* is positive and significant. Model 2 demonstrates that this is triggered by the level of the MSR. We find that the *MSR level* has a significant positive impact on remuneration. None of the control variables is significant. Summarizing, we find support for Hypothesis 5.1(a).

Focusing on exogenous MSRs, model 3 emphasizes that *MSR present* is highly significant with a positive sign. We therefore confirm Hypothesis 5.1(b). Moreover, model 4 once again reveals that higher levels of the MSR yield a significant

[7] Therefore, the data is not perfectly balanced for MSRs of 40 and 50. The results do not change if we exclude this data.

Table 5.3: Random effects GLS panel regressions on the average allocated share of revenue.

allocated share of revenue	endogenous MSR (1)	endogenous MSR (2)	exogenous MSR (3)	exogenous MSR (4)
MSR present	6.875**	-15.281	13.500***	-34.049***
	(2.773)	(11.266)	(3.327)	(11.311)
MSR level		0.386**		0.715***
		(0.177)		(0.177)
female employer		-4.446		-5.535
		(4.239)		(4.426)
period		-0.188		1.700***
		(0.816)		(0.572)
constant	56.563***	59.254***	53.000***	51.518***
	(3.239)	(3.552)	(3.348)	(5.014)
Observations	128	128	160	160
Number of Subjects	16	16	20	20

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

higher remuneration. We find that *female employer* is insignificant. Interestingly, *period* is highly significant and the coefficient is positive. This demonstrates that learning plays an important role in the treatment with exogenous MSRs. Thus, employers generally increase the remuneration payments over time.

Remarkably, exogenous MSRs apparently lead to a more pronounced increase of the allocated share of revenue. The exogenous case (model 3) reveals that the coefficient of *MSR present* is almost twice as high (13.500) as compared to endogenous MSRs (6.875; see model 1). A similar pattern occurs when focusing on the MSR levels. Here, regression 4 finds that the level of exogenous MSRs has a more pronounced impact in contrast to the endogenous case. The coefficient of the exogenous *MSR level* is more than twice as high (0.716) compared to endogenous *MSR levels* (0.354; see regression 2). Employers paying a higher compensation in the exogenous treatment could be a first indication that gift-exchange may become exacerbated under minimum remuneration requirements.

Result 5.1:
(a) The revenue share allocated to workers increases under endogenous and exogenous MSRs.
(b) The increase is clearly more pronounced when the MSR was exogenously introduced.

5.4.2 Worker performance

Our data reveals that the different levels of MSRs have no diverse effects on workers' performance in both treatments. The Spearman's rank correlation coefficients between the *level of MSR* and effort are insignificant, indicating no correlation between the MSRs and workers' performance (endogen: $\rho = -0.027,\ p = 0.922$; exogen: $\rho = 0.064,\ p = 0.789$). Hence, we merge the effort data under different MSRs (periods 5–8) in both treatments for the subsequent analyses.

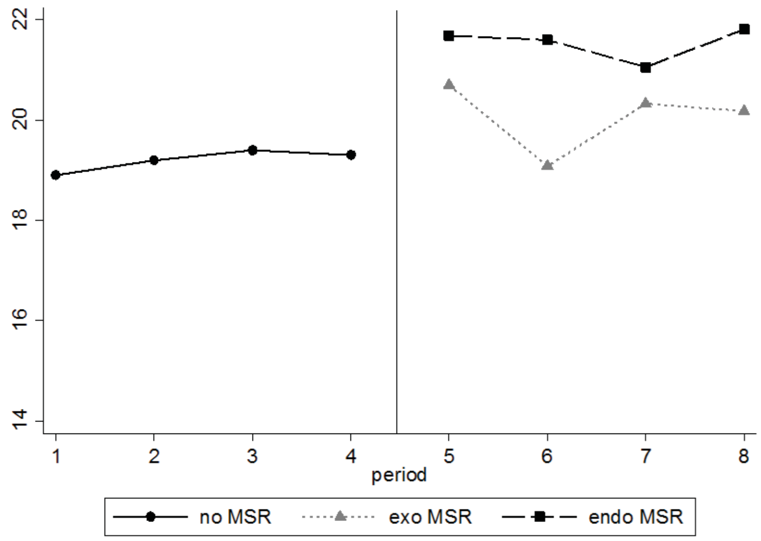


Figure 5.1: Effort development over time, before and after the introduction of an MSR.

Figure 5.1 presents subjects' average effort over time before and after the introduction of MSRs. In the absence of an MSR (periods 1–4), we observe an average performance of 19.22. We find that workers' effort significantly increases to 21.54 (periods 5–8) after they enforced an MSR (Wilcoxon Matched-Pairs test, $p = 0.019$). This supports Hypothesis 5.2(a). By contrast, employees' performance insignificantly increases to 20.08 when MSRs were exogenously imposed (Wilcoxon Matched-Pairs test, $p = 0.654$). Hence, we reject Hypothesis 5.2(b).

The previous results reveal that the performance increase is higher when MSRs are enforced by worker participation. To investigate whether endogenous MSRs are more effective than exogenous MSRs in more detail, we analyze the percentage of workers who increase their performance in periods 5–8. Figure 5.2 displays the fraction of workers who increased or who decreased or did not change their performance (decrease/no change).

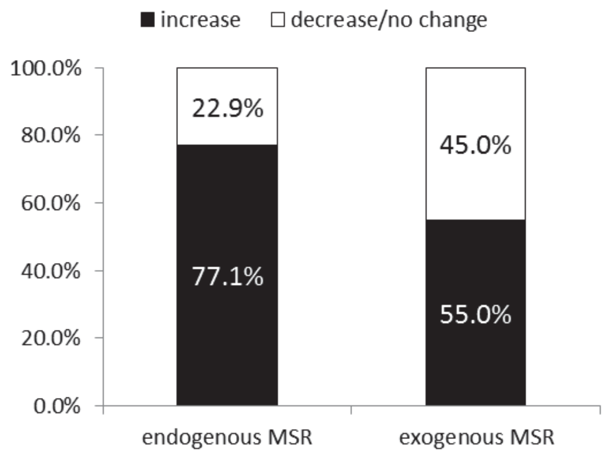


Figure 5.2: Fraction of subjects who increased/decreased or showed no change in performance.

In the treatment with worker participation, we find that the vast majority of workers (77.1%) enhances the performance after the enforcement of MSRs. This holds only for 55% of the workers in *exogenous MSR*. A χ^2-test emphasizes that significantly more employees increase their effort in *endogenous MSR* ($\chi^2(1) = 5.703,\ p = 0.017$). Summarizing, our findings demonstrate that MSRs only significantly increase performance when employees have worker participation. Moreover, a significantly higher fraction of workers increases effort in the treatment where MSRs were enforced. Hence, our data support Hypothesis 5.3.

Result 5.2:
(a) Workers significantly increase their performance after the enforcement of an MSR.
(b) Endogenous MSR are more effective than exogenous MSRs.

The results highlight that MSRs are particularly effective when enforced by employees. Hence, we confirm the positive effect of worker participation on performance (Charness *et al.*, 2012; Jeworrek and Mertins, 2014).

The data are also in line with the literature on endogenous institutions (e.g., Kosfeld *et al.*, 2009; Sutter *et al.*, 2010) and the *responsibility-alleviation* effect (Charness, 2000). Thus, the results extend these findings and emphasize that worker participation may reinforce reciprocity under minimum remuneration policies.

5.4.3 Work incentives and reciprocity

In this section we analyze the drivers of the previous results in more detail. More specifically, we investigate whether the acceptance of wage requests stimulated the maintenance of reciprocity in the treatment with worker participation. Therefore, the analysis focuses on the exerted effort conditioned on the allocated share of revenue under endogenous/exogenous MSRs. Figure 5.3 depicts this relation.[8]

It can be seen that under exogenous MSRs (grey line) workers' average effort is sharply increasing in the level of the allocated share of revenue. Thus, remuneration payments obviously work as signaling device. This supports the importance of remuneration payments as an "instrument" to trigger performance under exogenous MSRs. By contrast, the curve is much flatter under endogenous MSRs (black line). The finding that employees constantly exert high effort, emphasizes that worker motivation and reciprocity is high after they enforced an MSR. Interestingly, workers exert high effort even when the remuneration is low. Hence, paying high remuneration to motivate workers obviously becomes less important under endogenous MSRs. By contrast, the presence of low exogenous MSRs triggers low effort when employers pay a remuneration similar to the MSRs (see the remunerations of 40%-50%). In these cases employees obviously show negative reciprocity. Thus, it is interesting to analyze, whether employers under exogenous MSRs anticipate that increasing the remuneration payments is of importance to maintain reciprocity.

To account for this we focus on the cases, where employers overbid the minimum remuneration requirements. These data are presented in Figure 5.4. The bars display the frequency of the cases where employers overbid endogenous/exogenous MSRs in periods 5–8. The diagram is conditioned on the different levels of MSRs.

[8] We present the categories where we only had very few observations in a merged way. This holds for a remuneration of 40% and 50% and for the cases where employers allocated a share of revenue of at least 80%.

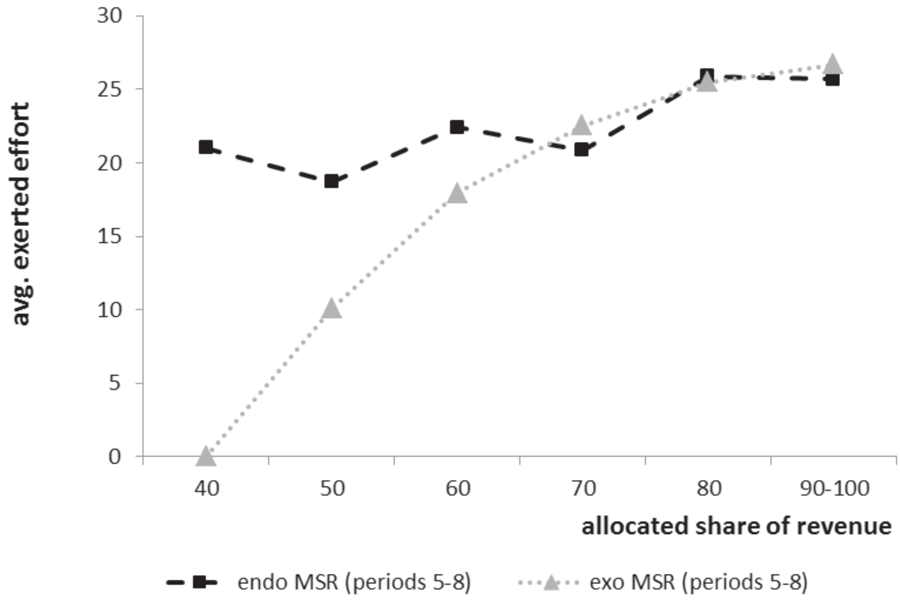


Figure 5.3: The relation between remuneration payments and effort under MSRs.

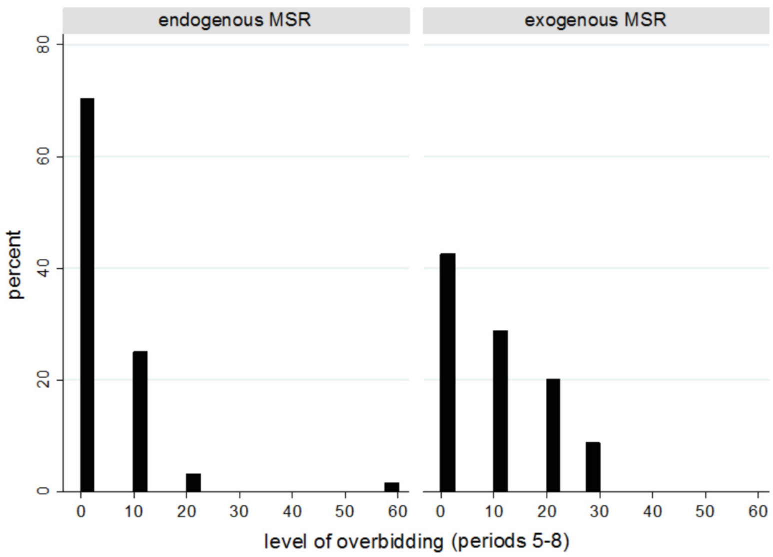


Figure 5.4: Level of overbidding under endogenous/exogenous MSRs.

Overall we identify in *exogenous MSR* common cases (58%) where employers overbid the MSR. By contrast, under endogenous MSRs, employers less often overbid the MSR (30%)(Wilcoxon rank-sum test, $p = 0.053$). A conspicuous pattern is that employers more frequently overbid all kinds of exogenous MSRs (40%, 50%, and 60%) as compared to the endogenous counterparts. The only exception are MSRs of 70%. This once more emphasizes the importance of excess remuneration payments to signal kind behavior when MSRs are exogenous.

We run random-effects panel regressions on the relation between the allocated share of revenue and exerted effort under MSRs. Table 5.4 presents two models which focus on the data after the introduction of endogenous/exogenous MSRs. The dependent variable is the effort exerted by individual workers. Both regression models control for the *allocated share of revenue* which is the percentage of the firm revenue offered to an individual worker. We also include control variables: *female worker*, a dummy variable which is positive for female workers, whereas *period* focuses on time dynamics. The regressions estimate Huber-White (robust) standard errors. The regressions analyze the data of periods 5–8.

Table 5.4: Random effects GLS panel regressions on average individual effort.

	periods 5–8	
individual effort	(1) endogenous MSR	(2) exogenous MSR
allocated share of revenue	0.416**	1.578***
	(0.188)	(0.256)
female worker	-0.960	1.667
	(1.732)	(1.652)
period	0.122	-0.503
	(0.350)	(0.411)
constant	12.451**	-12.263**
	(5.351)	(6.050)
Observations	192	240
Number of Subjects	48	60

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Regressions 1 and 2 show that a higher compensation significantly increases effort under both types of MSRs. A conspicuous result is that the coefficient of *allocated share of revenue* is more than three times higher under exogenous MSRs (1.578) ($p < 0.01$) than under endogenous MSRs (0.416) ($p < 0.05$). This supports the pattern observed in Figure 5.3, i.e., paying high remuneration to motivate workers is of less importance under endogenous MSRs. Hence, workers are less sensitive to remuneration payments after the enforcement of minimum remuneration requirements. We do not find evidence for learning, i.e., *period* is insginficant in both models.

To quantify the effect of worker reciprocity, we calculate the ratio of exerted effort per allocated share of revenue (*epsr*). We define: *epsr = exerted effort/allocated share of revenue.* The *epsr* is derived by applying the share of revenue which is allocated to an individual worker.

In the absence of an MSR, we find that workers' average *epsr* is 1.11. The exogenous introduction of an MSR leads to a significant decrease to 0.89 (Wilcoxon Matched-Pairs test, $p = 0.007$). This demonstrates once more that the introduction of exogenous MSRs comes at the cost of decreased reciprocity. By contrast, the *epsr* does not significantly change (1.05) after the endogenous introduction of an MSR (Wilcoxon Matched-Pairs test, $p = 0.836$). Thus, the results emphasize that workers' willingness to exert effort is not mitigated under endogenous MSRs. This may explain why workers' performance is higher under worker participation where they could enforce an MSR.

Result 5.3:
Workers' performance becomes less responsive to remuneration payments after they enforced an MSR.

5.4.4 Payoffs

The performance section has revealed that productivity increases more pronounced under endogenous MSRs. However, employers pay higher wages when MSRs were exogenously introduced. Hence, it will be interesting to investigate whether employers in turn achieve higher payoffs when employees are granted worker participation.

In the absence of MSRs workers achieve an average payoff of €4.6. The introduction of MSRs lead to significant increases of workers' payoffs. More precisely, employees earn significantly more under endogenous MSRs (€5.7) (Wilcoxon Matched-Pairs test, $p < 0.001$) and exogenous MSRs (€5.7) (Wilcoxon Matched-Pairs test, $p < 0.001$).

Focusing on employers, it turns out that the introduction of an exogenous MSR significant lowers employers' payoff by 20% from €9.5 down to €7.6 (Wilcoxon Matched-Pairs test, $p = 0.005$). By contrast, employers earn a similar amount after the introduction of an endogenous MSR. In this case, their payoff insignificantly decreases by 2% down to €9.3 (Wilcoxon Matched-Pairs test, $p = 0.196$). Interestingly, we find that employers earn significantly more when MSRs were enforced compared to the exogenous case (Mann-Whitney test, $p = 0.065$). Hence, our data suggests that enforced MSRs may also have less detrimental effects for employers. The reason is that employees behave reciprocal when employers accepted their minimum remuneration request. As a consequence, workers even exert high effort when employers do not overbid the minimum wage requirement.

5.5 Conclusion

We investigated the role of worker participation for the efficiency of minimum remuneration requirements. A special focus was the analysis whether participating in collective bargaining reinforces reciprocity under minimum remuneration requirements. Although MSRs generally increase effort, they are particularly efficient when workers enforce them. This supports the findings on the positive effects of worker participation in the lab (Charness *et al.* 2012; Corgnet and Hernán González 2013) and the field (Jeworrek and Mertins 2014). Our paper adds to these findings, as it highlights that labor market policies may be more successful when achieved by collective bargaining.

So far, the literature has demonstrated that the introduction of minimum wages may come at the cost of reduced reciprocity. The reason is that the fair wage-effort relation may become impaired in the presence of minimum wages. In this case, employers may have to pay a wage premium to signal kind behavior maintaining worker reciprocity (Brandts and Charness, 2004).

Our results demonstrate that worker participation is an "instrument" which may substitute the payment of wage premiums after the introduction of minimum wage requirements. The findings in the bargaining treatment show that performance less strongly depends on the remuneration payments by the employers after workers enforced an MSR. In this case workers generally exert higher effort, even if employers do not clearly increase remuneration payments above the required minimum level. This suggests that employers' acceptance of MSR requests seems to work as a positive signaling device to employees. In return workers exert high effort independently of the remuneration level. This holds although employers on average rejected the first two MSR requests. Obviously, employees care less about the level of the MSR, but rather on the fact that the employer ultimately said "yes". By contrast, under exogenous MSRs there exists a positive and significant relation between compensation levels and the exerted effort of workers. Apparently, the exogenous MSR becomes a reference point for the employees when it was automatically introduced. As a consequence, workers shift their reservation remuneration and expect a higher compensation. Employers realize this and start to overbid the MSR to induce worker motivation from the employees' side. This is in line with the findings of Falk *et al.* (2006) on the "spillover" effects of minimum wages.

The findings of this paper may have interesting implications for the design of labor market institutions. First, although stylized in nature, our bargaining setting may represent workers in an employee organization negotiating with their employer. The results suggest that works councils or labor unions may serve as important intermediators. They not only defend employees' rights, but also give institutional voice to workers, which may enhance work motivation. Second, the data provide insights for the analysis of behavioral voice effects in labor unions (Freeman and Medoff 1979, 1984) when labor policies can be enforced.

We are aware that we present findings of a lab experiment which does not resemble complex labor institutions such as unions. Nonetheless, we believe that these insights may help to better understand the behavioral patterns of work motivation of union members. Thinking of statutory minimum wages, our results suggest that institutional voice may have promising effects on the efficiency of these policies.

5.A The real-effort task

In the task of Benndorf et al. (2014) subjects are asked to encode random combinations of three letters into numbers (see below). Each letter in the first row "word" has to be encrypted in a three-digit number. The "allocation table" of the task presents subjects the correct allocation of the letters and the corresponding three-digit numbers. The table always displays all 26 capital letters of the Latin alphabet.[9] The workers have to type in the correct three-digit numbers of each letter in the "code" row below the letter.

word:	**Z**	**N**	**T**

code:	113	154	

Allocation table:

Table 5.5: Example of a problem in the real-effort task.

B	T	R	S	U	Z	F	N	C	Y	V	X	H	Y	K
384	118	201	543	386	113	980	154	745	265	432	262	110	960	245

After all three letters are encoded the workers can press a submit button and are informed whether they correctly solved the puzzle. Subjects are also provided with information on the total number of correctly solved puzzles. The task furthermore mitigates learning behavior of subjects by applying a double-randomization mechanism. Whenever a subject enters a correct solution, the word to be encrypted changes. At the same time, the mapping from letters to numbers and the positions of the letters in the table are randomly rearranged. When subjects enter a wrong answer they are informed by the computer program. Here, the number allocations and the locations of the letters will not be shuffled until subjects make a correct input. After the end of five minutes the real-effort task automatically stops and inputs are not possible anymore.

5.B Instructions

In the following we present the instructions which refer to Part I of the experiment (periods 1–4). The instructions for *endogenous MSR* and *exogenous MSR* are

[9] For reasons of space only 15 allocations are presented in the example of Table 5.5.

identical in this phase of the experiment. Afterwards, we report the instructions for Part II (periods 5–8) for both treatments separately. First, we outline the instructions for *endogenous MSR*. Then, we present the instructions for *exogenous MSR*.

Instructions: PART 1

Welcome to today's experiment. Please do not talk to others from now on. In today's experiment you have the opportunity to earn money depending on your and the other participants' behavior. You will receive your remuneration cash in the end of the experiment. For participating in the experiment you receive a show-up fee of

4 Euro

General procedure of the experiment

Today's experiment consists of two parts. Part 1 comprises **four rounds**. The experiment starts only after all participants read and understood the instructions. The experiment stops automatically after round four and the participants receive a new set of instructions for part 2. The experiment proceeds only after all participants read and understood the new set of instructions.

You will randomly be assigned the role of either an employer or an employee. You keep this role for the **whole** experiment.

The employers and employees act as firms. One firm comprises 1 employer and 3 employees. The composition of firms is identical for the whole experiment. Moreover, the identities of all subjects of a firm will never be revealed. Each participant learns her assigned role in the beginning of the experiment.

Procedure of the rounds

Each round consists of exactly **three** subsequent **stages:**

- The employer decides in the first stage.
- The three employees act in stage two.
- Finally, the employer and the three employees are informed on the results.

Summarizing, each round comprises the following three stages:

1.) The employer decides about the ***Payoff-distribution*** between her and the three employees.
2.) The employees ***work on stage 2*** and generate the firm's revenue.
3.) ***Information on the earnings.***

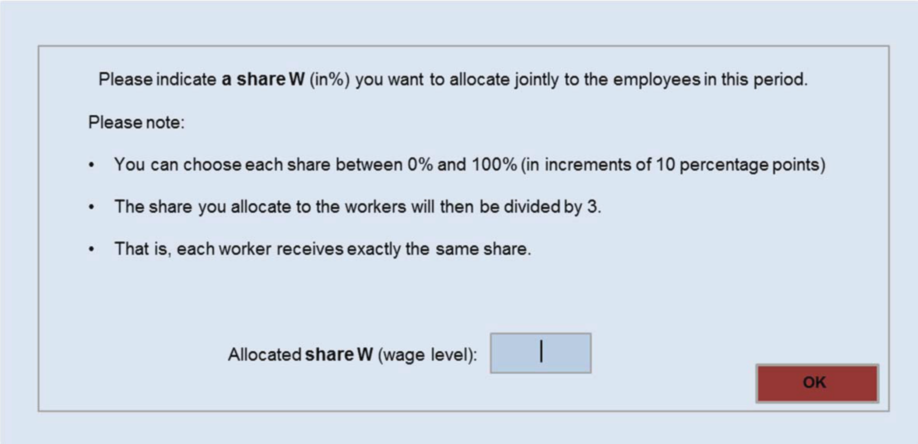
1. stage: Payoff-distribution

The employer decides about a percentage split of the firm revenue between her (*share E*) and the three employees (how the firm revenue is generated will be explained in more detail below). The share which the three workers jointly receive (*share W*) will be split equally among them. If the employer chooses a *share W*

Instructions for Part I

which is not divisible by three, it will be rounded to the first digit. The *share W* has to be chosen between **0%** and **100%** in increments of 10 percentage points. Thus, there are 11 possible splits available.

Please, also see the following screenshot:



Example:

- The employer chooses a *share W* of **X%** of the firm's revenue as remuneration.
- Accordingly, each worker earns **(X/3)%** as individual payment.
- Furthermore, the employer receives *share E* **100 - X%** of the firm's revenue.

<u>2. stage: Working phase</u>

Each worker is informed on the percentage split of the revenue between the employees (*share W*) and the employer (*share E*). Furthermore, all workers are informed on the resulting individual payments (*share W*/3).

Subsequently, in each round the employees get **5 minutes** to do a real-effort task or to press a free-time button. Pressing the free-time button opens an Internet-Explorer tab and the employee can use the internet. During this time she earns money depending in how much time she spent on the internet (more on this later). While surfing in the internet a subject **cannot** work on the real-effort task.

<u>Revenue generation</u>

- The employees can increase the firm revenue by working on the real-effort task (this task will be explained in detail below). Each correctly solved task adds **10 Cents** to the firm's revenue.

Instructions for Part I

- A worker **does not increase** the firm revenue as long as she has activated the free-time button and is using the internet.

➢ The overall firm revenue at the end of each round can be defined as follows:

Firm revenue = [(correctly solved tasks of worker 1 + correctly solved tasks of worker 2 + correctly solved tasks of worker 3)] x **10 Cents**

Earnings with activated free-time button:

With an activated free-time button, the employee receives a payment which will not be shared with the other employees and with the employer. In the end of a round, an employee receives this payment on top of her earnings from the percentage split of the firm's revenue.

The remuneration from using the internet is as follows:

- While having activated the free-time button and using the internet, the employee automatically receives an individual payment of **1 Cent for each 10 seconds.** This payment will only be accredited for completed time intervals. For example, activating the free-time button and using the internet for 60 seconds gives an additional payment (earnings internet) of **6 x 1 Cent = 6 Cent.**

➢ The earnings from using the internet is defined as:

Earnings internet =

Number of completed time-intervals (10 Sek.) x **1 Cent**

Employer:

During stage 2, an Internet-Explorer tab opens automatically for the employer. Thus, she can use the internet during this stage. However, the employer does not get any additional payment from using the internet. The tab closes automatically after 5 minutes at the end of stage 2.

3. stage: Information on earnings

After 5 minutes, the members of a firm are informed on the firm's revenue and the resulting payments.

Instructions for Part I

- The **employer's earnings** result from**:**

Employer's payoff =   **Firm revenue** x *share E* in %

- For the individual **worker's earnings** it follows that**:**

payoff worker 1 =   (**Firm revenue** x *share W* in %) / 3 + earnings internet of worker 1
payoff worker 2 =   (**Firm revenue** x *share W* in %) / 3 + earnings internet of worker 2
payoff worker 3 =   (**Firm revenue** x *share W* in %) / 3 + earnings internet of worker 3

The employer receives the following information

- Sum of correctly solved tasks (of all three employees)
- Generated firm revenue
- Employer's payoff

- Payoff of worker 1 (the earnings internet of worker 1 not included)
- Payoff of worker 2 (the earnings internet of worker 2 not included)
- Payoff of worker 3 (the earnings internet of worker 3 not included)

Each worker receives the following information

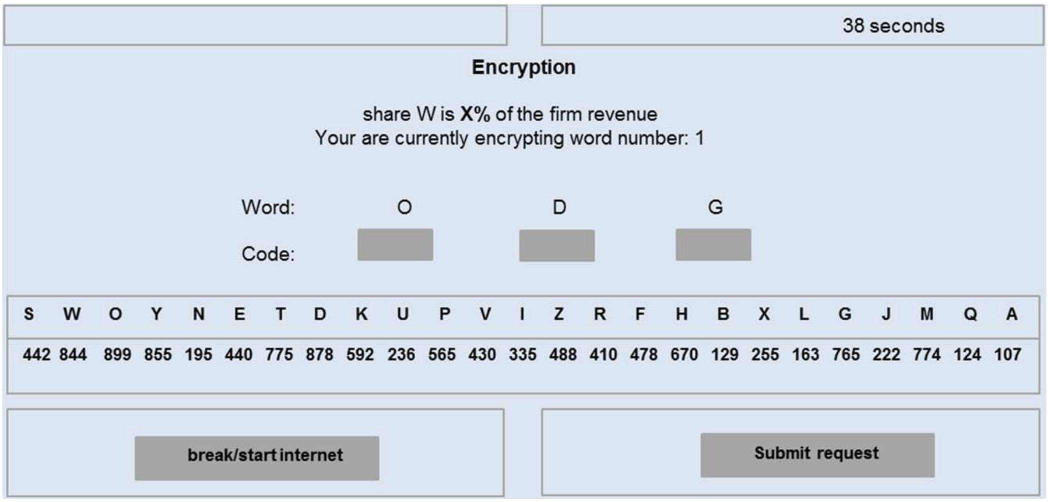
- Sum of correctly solved tasks (of all three employees)
- Generated firm revenue
- Own payoff (**including** her earnings from the internet)
- Own payoff from real-effort task
- Own payoff from using the internet
- Payoff of other workers (the earnings internet of those workers not included)

Instructions for Part I

Information on the real-effort task

1.) How the real-effort task works

For the real-effort task, **words** have to be encrypted in numbers. Each word consists of **three capital letters** each of which has to be encrypted with a number. The encryption is given by a table below the word to be encrypted. Please, also see the screenshot below.



In this example the participant is currently encrypting word number 1 (see centered field: above). Here, the three capital letters: **"O", "D" and "G"** have to be encoded. The solution follows immediately from the table:

- For "O" applies: 899
- For "D" applies: 878
- For "G" applies: 765

To make an input please click on the grey box below the first capital letter.

Furthermore, you will receive the following information:

- „*share W* is X% of the firm revenue" = allocated share to the workers in the corresponding period.
- "You currently encrypt word number" = current word to encrypt.
- "Remaining time [sec]" = remaining time in the current period.

Instructions for Part I

Important hints:

- Please note that after having entered the three-digit number you can easily switch to the next grey box by using the **tabulator key** on your keyboard.

In the following picture you can see the position of the tabulator key on your keyboard:

- The input of the numbers can be performed faster by using the numpad (on the right) of your keyboard.

In the following picture you can see the position of the numpad on your keyboard:

If all 3 numbers have been entered, please click the "OK"

- The computer then checks whether **<u>all</u>** capital letters haven been encoded correctly. Only then the word is counted as correctly solved. Thereafter a new word (again consisting of three capital letters) is randomly drawn.

- Furthermore, a new encryption table is randomly generated in two steps:

    1) The computer program randomly selects in the table a new set of three-digit numbers to be used for the encoding of the capital letters.
    2) Additionally, the computer program shuffles the position of the capital letters in the table. Please note that the program always uses <u>all</u> 26 capital letters of the German alphabet.

Please note that if a new word appears, you have to click with your mouse on the first of the three blue boxes. Otherwise, no input is possible!

- The computer will mark (in red font) wrong inputs after pressing the "OK" button.

After 5 minutes, the possibility to work on the task stops automatically. Then, you cannot enter any new input.

2.) How the free-time button and the internet usage work:

During the working phase, the workers are free to choose how much time they spend for working on the real-effort task and how much time they want to spend for using the internet.

The time of stage 2 runs from the beginning of stage 2 on. There is no time-out when using the internet.

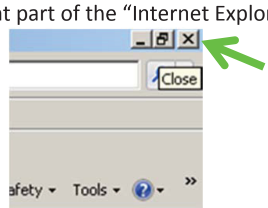
Use of the internet (for employees):

On the screen there is button called **"break/start internet"**. By pushing this button the internet access can be activated. Activating the internet by pushing the button locks the input fields from the real-effort task and an "Internet Explorer" window opens automatically.

The Browser opens at full screen. While the internet is activated, a timer in the background records the time used for surfing in the internet. You will earn **1 Cent** automatically for every **10 seconds** spent on the web. This amount will be added to your earnings from the allocated *share W* (see above).

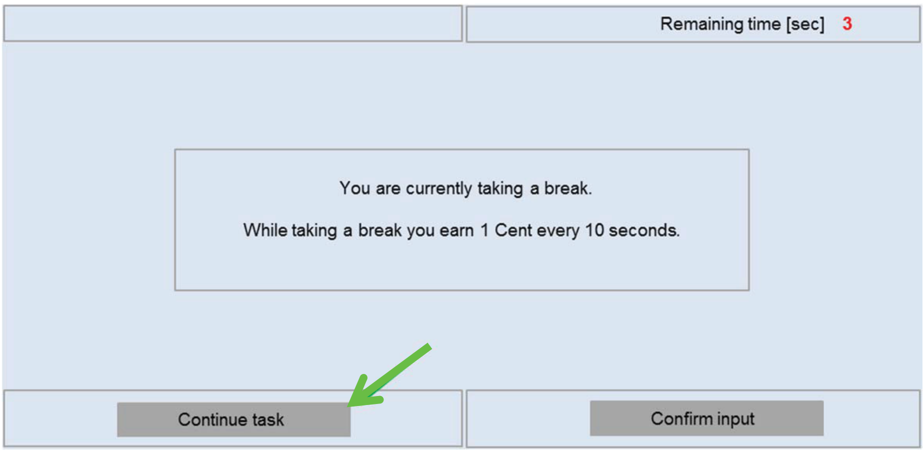
Stop using the internet:

After time ran out on stage 2, the automatic remuneration from using the internet stops. The window closes automatically. During the remaining time on stage 2 you can also switch back to the real-effort task by clicking the "window-close" button in the upper right part of the "Internet Explorer" window (see picture)



Doing so redirects you to the real-effort task. You can continue the task by clicking the button **"continue task"**. (see screenshot below)

Instructions for Part I



Please notice:

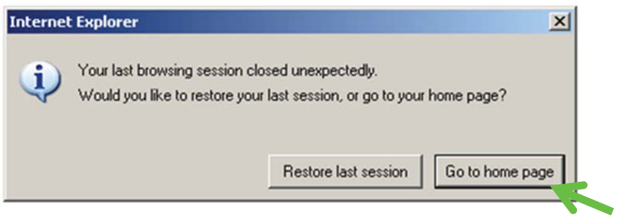
- Alternatively, workers can also switch back to the screen above with the keyboard combination **„Alt-TAB"**
- Workers can switch between the task and the internet any number of times.
- If you want to return to the internet after switching back to the task, you need to click on the **"break/start internet"** button again.
- The employer will not receive any information on the time employees spent on the internet.

Use of the internet (for employers):

As soon as stage 2 starts, the employer can click on the button "start Browser". An "Internet Explorer" window opens automatically and the employer can use the internet during the five minutes. After five minutes the window closes automatically.

Important notice for both employer and employee:

If you receive the following warning when starting the „Internet Explorer"



You will only need to click on the „Go to home page“ button to start the Browser.

If you have any questions during the experiment, please raise your hand. We will answer your question in private.

Please, answer the following control questions. Raise your hand when you completed the answers. The experiment will be started after all subjects answered the questions correctly.

Before the actual experiment starts you will see a hypothetical question on the screen. Please, answer this question. You will not receive a payment for this question and it will not have any consequences for the subsequent experiment. Nevertheless, please answer this question honestly. After that, the actual experiment starts.

Control questions

Please, imagine the following:

The employer allocated a *share W* of 20% of the firm revenue to the workers. The employees solve 10 tasks in total

a.) Determine the firm revenue: ___________

b.) What is the percentage share of the firm revenue for the employer (*share E*)? ___________

c.) What is the overall share allocated to the employees? ___________

d.) What is the share for an individual worker (fraction)? ___________

Assume now, that a worker used the internet for 60 seconds.

a.) How much does the worker earn for the time he spent on the internet? __________

Instructions for Part I

Instructions (Part II)

The second part of the experiment also comprises **4 rounds**.

The following 4 rounds consist of the 3 stages you already learned from Part I of the experiment. Before rounds 5-8 will start, there is a **onetime change** compared to Part I:

A negotiation over the introduction of a **minimum wage** will take place.

A **minimum wage** would guarantee the employees a **minimum share W** (i.e. the split the workers receive *jointly*) for rounds 5-8. The employer would be bound to allocate at least this minimum share and could not offer a share lower than the minimum share.

In the negotiation stage the 3 employees of a firm bargain collectively with their employer over a **minimum share**.

Please note: The negotiation takes place **only once** and **only before round 5** starts.

Procedure of the negotiation

The negotiation consists of two stages:

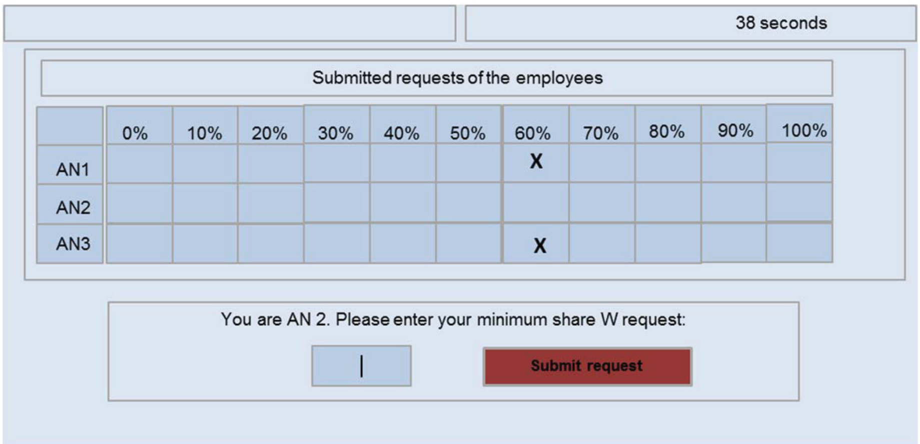
Bargaining stage 1:

The employees have to agree on a common minimum share W-request before it is sent to the employer. Each employee can suggest minimum share between **0%** and **100%** in increments of 10 percentage points.

In what follows the procedure of how to submit suggestions is described.

Please see the corresponding screenshot.

Instructions for the treatment *endogenous MSR* in Part II



Please note that all three employees in bargaining stage 1 see this screenshot simultaneously and decide simultaneously.

Each employee is first allocated a neutral number (AN1, AN2 or AN3) and is informed about that number in the lower input box.

The upper box represents the table where employees can enter their suggestion on a minimum share-request. The grid encompasses all possible requests (from 0% to 100%). Already submitted suggestions of the employees are marked with an X. In the example above, AN1 and AN3 already submitted a request of 60%.

Submitting a suggestion for a request:

- Minimum share requests (0%-100%) can be entered in the text box to the left of the button “submit request“.
- To submit, the button “submit request” needs to be pushed.
- After submitting a request, it is marked in the row of the corresponding employee.

Please note again:
The requested **minimum share** is the minimum share the **three employees receive jointly** (**share W**) from the employer (on stage 1 in rounds 5-8).

Instructions for the treatment *endogenous MSR* in Part II

How to achieve an agreement?

On bargaining stage 1 (see above), the three workers of a firm decide on a common minimum share W-request. They are provided **at most 90 seconds** to agree upon this request (we come back to that below). The remaining time can be checked in the upper right corner (see screenshot above).

The minimum share request will only be sent to the employer if all **three** employees agreed on **the same** request. The computer compares the requests only after all employees submitted their requirement.

- If only one request differs from the others, no agreement is reached. The marks remain on the screen for 3 seconds and are deleted subsequently. New requests can be submitted now.

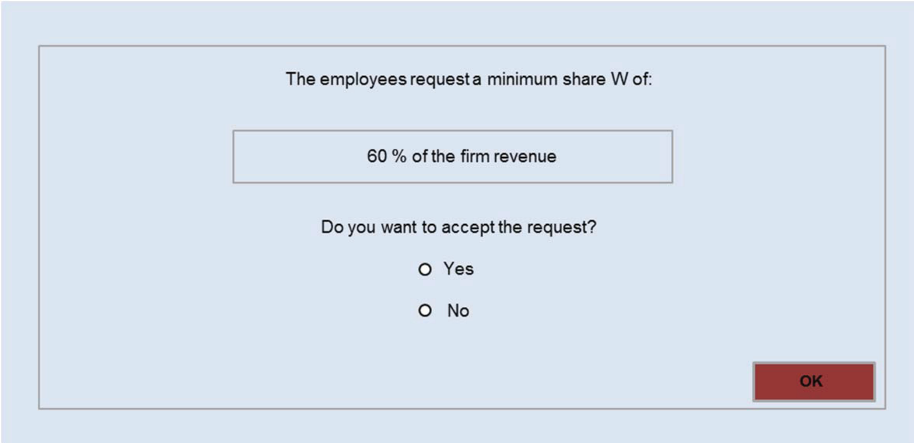
Therefore, consider your decision carefully.

- This procedure is repeated until **unanimity** is reached or **after 90 seconds without an agreement**.
- If **unanimity** is reached bargaining stage 1 stops and the employees are informed on the request which will be submitted to the employer.
- If **no unanimity is reached after 90 seconds**, the request which was chosen most of the time is automatically selected as the request which is to be sent to the employer (the request is chosen from all the suggested requests during the 90 seconds). In the case of a tie, one request will be selected randomly.

Bargaining stage 2:

At this stage the employer receives the minimum share W-request of the employees. She has to decide whether to accept or to reject the wage request. Please see the following screenshot:

Instructions for the treatment *endogenous MSR* in Part II



The employer decides on the acceptance of the request (see screenshot)

- By clicking "yes" the negotiation ends and the request will be implemented as minimum share W in the subsequent four rounds.
- Marking "no" restarts bargaining stage 1. The employees then have to decide on a minimum share W-request again.

Bargaining stage 1: Restart

Bargaining stage 1 changes slightly if it restarts. The change concerns the minimum share W-requests the employees can choose. After a restart the requests have to be **lower** than the previously rejected one.

The employees are shown the same screen as above with the only difference being the shortened grid of shares in the table. For example, if the employer rejects a request of 60%, the workers can only submit a new request between 0% and 50%.

The same conditions (as described above) apply to the unification process.

The new request will be submitted to the employer and she again decides on whether to accept or to reject.

- The **latest request** will be implemented as minimum share W if the employer accepts it.
- If the employer rejects it, the employees have to decide again on a new request, which again has to be lower than the previously rejected one and so on.

The negotiation ends:

Instructions for the treatment *endogenous MSR* in Part II

1.) If the employer accepts a request. The accepted request will be implemented as minimum share W in rounds 5-8.

Or:

2.) If the employer rejects a minimum share W request of 10%. In this case, there will be no minimum share W.

Or:

3.) If the employees request a minimum share W of 0%.

Procedure of rounds 5-8

- The employer and the workers are informed whether a minimum share W is implemented and if so also on the size before round 5 starts.
- An implemented minimum share W guarantees the workers **at least this share of the firm revenue** in stage 1.

After the negotiation the 3 stages from Part I follow.

Please raise your hand if you have any questions!

Instructions for the treatment *endogenous MSR* in Part II

Instructions (Part II)

The second part of the experiment also comprises **4 rounds**.

The following 4 rounds consist of the 3 stages you already learned from Part I of the experiment. Before rounds 5-8 will start, there is a **onetime change** compared to Part I:

A **minimum wage** will be implemented.

This **minimum wage** would guarantee the employees a **minimum share W** (i.e. the split the workers receive *jointly*) for rounds 5-8. The employer would be bound to allocate at least this minimum share and could not offer a share lower than the minimum share.

For rounds 5-8

A **minimum share W**

of: **40%**

applies.

The procedure of Part II of the experiment is as in Part I. It again consists of 3 stages in each round:

First, the employer decides about the percentage split she allocates to the three employees jointly. Then, the workers can generate the firm's revenue by exerting a real-effort task while they also have the possibility to stop working and using the internet instead. The employers can use the internet during the working stage. After the working stage the members of a firm (the employer and the three workers) are informed on the results of the current round. The experiment ends after rounds 5-8.

The procedure is as follows (and conforms with Part I):

1.) The employer decides on the ***payoff-distribution*** (bound to allocate at least the minimum share W)
2.) The employees ***work on stage 2*** and generate the firm revenue.
3.) ***Information on the earnings.***

Instructions for the treatment *exogenous MSR* in Part II

Declaration of Contribution

Hereby I, Katrin Köhler, declare that the chapter "Worker Participation and the Efficiency of Remuneration Policies: Experimental Evidence" is co-authored by Beatrice Pagel and Holger Rau.

My contributions to this chapter are as follows:

- I contributed to the development of the experimental idea and the experimental design
- I wrote parts of the introduction
- I researched parts of the related literature
- I wrote major parts of the experimental design
- I wrote parts of the behavioral hypotheses
- I contributed to the results
- I wrote parts of the discussion

Signature of coauthor 1 (Beatrice Pagel-Groba): B. Pagel-Groba

Signature of coauthor 2 (Holger Rau): Holger Rau

Chapter 6

Résumé

This thesis presents four papers analyzing two topics in behavioral economics. The first part of the thesis is concerned with consumer choice and the second part elaborates on experimental labor markets.

Chapter 2 investigates an experimental setup in which two theoretical approaches, which otherwise share many predictions of decision biases, yield contradicting predictions. Loss aversion-based models hypothesize an endowment effect for bads, i.e., items which yield a negative utility. In contrast, attention-based theories predict a reversal of the endowment effect for bads. Thus, we analyze exchange rates for unpleasant alternatives in an incentivized laboratory experiment and find a strong endowment effect for bads. This finding supports prospect theory but contradicts attention-based theories. Therefore, we find a clear indication that the endowment effect is indeed loss aversion-based and not attention-based. Attention effects may not be strong enough to offset loss aversion in an incentivized trading situation.

Chapter 3 explores choices between vertically differentiated products in an experiment with real consumption decisions. We find that decision makers' responses largely depend on whether price levels are expected or not. A high price level induces more subjects to choose the high-quality product when the prices were expectedly high than if subjects were unsure about the actual price level. By analyzing the differential effects of expected and unexpected price increases, we confirm two central predictions of consumer choice for vertically differentiated products made by salience theory (Bordalo *et al.*, 2013). Our study provides interesting insights for researchers and practitioners about the decision making of consumers. For example, our findings explain why suppliers can sustain high margins for premium products in high-price environments where quality is more likely to be overweighted while prices tend to be disregarded.

Chapters 4 and 5 deal with behavioral consequences of communication in experimental labor markets. While the study in chapter 4 introduces the opportunity for agents to reveal non-binding wage requests, chapter 5 provides agents with "voice" by implementing a negotiation framework to bargain with the principal on a minimum payment requirement. Both studies show that communication can significantly affect the experimental results.

Chapter 4 analyzes the effects of (non-binding) requests of employees in a modified gift-exchange game and therefore provides a robustness check of one of the workhorse models in experimental labor markets. The experiment applies a rather simple construct to study how reciprocity is affected by introducing a simple bargaining structure into the standard gift-exchange game. It suggests that modifying a standard gift-exchange game by allowing employees to reveal requests before employers decide on their wage payments affects employees' effort decisions. The main result is that effort levels decrease significantly when a wage request exceeds the actual wage payment and that this deterrence is stronger the more the wage payment differs from the request. Therefore, on the aggregate, the effect of diminishing reciprocity predominates efficiency effects, as wage requests exceed the actual wage payments most of the time.

Chapter 5 investigates the role of worker participation for the efficiency of minimum remuneration requirements. Although these policies generally increase effort, they are particularly efficient when workers enforce them. Thus, the study highlights that labor market policies may be more successful when achieved by collective bargaining. While the fair wage-effort relation explicitly holds in the treatment with exogenously introduced minimum remuneration requirements, this relation becomes less important in the bargaining treatment. In this case workers generally exert higher effort, even if employers do not clearly increase remuneration payments above the required minimum level. This suggests that employers' acceptance of minimum remuneration requests seems to work as a positive signaling device to employees. In return workers show high reciprocity independently of the remuneration level. The findings of this paper may have interesting implications for the design of labor market institutions. We believe that these insights may help to better understand the behavioral patterns of work motivation of union members.

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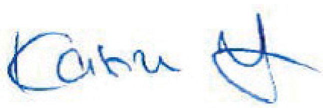
Appendix

Ich erkläre hiermit an Eides Statt, daß ich die vorliegende Arbeit ohne Hilfe Dritter und ohne Benutzung anderer als der angegebenen Hilfsmittel angefertigt habe; die aus fremden Quellen direkt oder indirekt übernommenen Gedanken sind als solche kenntlich gemacht.

Die Arbeit wurde bisher in gleicher oder ähnlicher Form keiner anderen Prüfungsbehörde vorgelegt und auch noch nicht veröffentlicht.



Düsseldorf, 29.März 2016 Katrin Köhler