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Markus Dertwinkel-Kalt, M.Sc.
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Rektorin der Heinrich-Heine-Universität Düsseldorf:
Univ.-Prof. Dr. Anja Steinbeck

Dekan der Wirtschaftswissenschaftlichen Fakultät:
Univ.-Prof. Dr. Justus Haucap

Gutachter:

- 1. Univ.-Prof. Dr. Hans-Theo Normann**
- 2. Univ.-Prof. Dr. Christian Wey**

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Chapter 1

Introduction

This dissertation deals with two distinct areas within economics: behavioral economics and industrial organization. While in the phase of my dissertation I have written several papers on both issues, I decided to include only such papers in the dissertation which are in the advanced referee process or already published. The first two chapters present experimental tests and applications of a new behavioral theory, that is, *salience theory*. The subsequent chapters introduce two theoretical models in industrial organization.

Salience theory (Bordalo, Gennaioli and Shleifer, 2012a,b) represents a novel behavioral theory which involves the concept of limited attention in order to explain puzzles of individual decision making. At its core, it assumes that agents overemphasize features which stand out in a certain context. This mechanism allows us to explain a wide range of cognitive biases relevant to decision theory, such as the Allais paradox, preference reversals and decoy effects. In order to investigate to which degree this theory explains actual human decision making and in how far it yields useful predictions, experimental tests and applications to practical problems are necessary. Therefore, the next chapter presents a laboratory test of salience theory, while the subsequent chapter applies salience to the domain of health policy.

Chapter 2, revised and resubmitted to *European Economic Review*, deals with a laboratory experiment which tests salience theory against theories of loss aversion. Loss aversion represents the predominant concept within behavioral economics according to which agents evaluate gains and losses relative to a reference point, thereby overweighting losses as opposed to gains. Without assuming loss aversion, salience theory can explain the same puzzles as loss aversion-based the-

ories can in many instances. Thus, investigating these well-known decision biases does not allow us to distinguish between the validity of the two classes of models. Therefore, we conduct an experiment for which salience theory and loss aversion yield opposing predictions. In particular, our study provides the first incentivized test of exchange asymmetries for unpleasant items, so-called *bads*. Exchange asymmetries for goods are well known as the *endowment effect*. This effect denotes the observation that a majority of people sticks to goods they are endowed with and refrains from exchanging them. Provided that it is not an experimental artefact, it is of particular importance as it may induce many trade inefficiencies. The endowment effect is a puzzle for rational choice theory as the valuation of an item should be independent from the status of ownership. While loss aversion predicts an endowment effect for goods and bads, salience theory predicts an endowment effect for goods, but a reverse endowment effect (that is, a particularly high willingness to switch) for bads. We observe a strong endowment effect for bads which implies that salience effects are dominated by loss aversion in our experiment. Therefore, our results suggest that a unified behavioral theory of individual decision making should explicitly incorporate the concept of loss aversion.

Chapter 3, accepted for publication in *Forum for Health Economics & Policy*, applies the salience mechanism to consumer policy. In health economics, there is a current debate on how consumers could be led to healthier diets. Suppose a market with healthy and unhealthy food products. Higher taxes on unhealthy food have the disadvantage of dead-weight losses, such that a government may think of alternative actions. If a government intends to encourage healthier diets without harming consumers by raising taxes, it could initiate information campaigns which either promote the healthiness of one product or which demote the unhealthiness of the alternatives. According to our approach, both campaigns work, while it is more efficient to proclaim the unhealthiness of one product in order to present it as a “bad.” Given that consumers are more susceptible towards information on familiar goods, more consumers will switch toward healthier diets through the campaign which focuses on unhealthy products. Our findings are applicable to advertisement in general. In particular, our results imply that comparative advertisement is particularly efficient for entrant firms into established markets.

The following two chapters present two models on industrial economics which

analyze the theoretical implications of two frequently used policy instruments, that are, structural merger remedies and price discrimination bans. In a nutshell, Chapter 4 develops formal arguments for the efficiency of merger remedies under a consumer surplus standard while Chapter 5 challenges the conventional critique on discriminatory input pricing in the presence of buyer power, arguing why nondiscriminatory pricing may harm competition through a foreclosure of less efficient firms.

Chapter 4, accepted for publication in *Journal of Law, Economics, & Organization*, analyzes welfare effects of structural remedies on merger activity in a Cournot oligopoly when the antitrust agency applies a consumer surplus standard according to which only such mergers are approved which do not increase the market price. Remedies are increasingly applied by antitrust agencies in the US and the EU to clear merger proposals which are otherwise subject to serious anticompetitive concerns. Structural divestitures of a merged entity represent the most common form of merger remedies. They are offered by the merging parties to effectively protect competition and to remove any competition concern the antitrust authority may have. We derive conditions such that otherwise price-increasing mergers become approvable and externality free (that is, no externalities are exerted on outsider firms and consumers) by the use of remedial divestitures. If one of these conditions holds, the consumer surplus standard ensures that only such mergers are implemented which strictly raise social welfare. As an analogous efficiency result does not hold if a social welfare standard is applied, our results speak in favor of the consumer surplus standard. If the merging parties can extract the entire surplus from the sale of the structural remedy, then the consumer surplus standard ensures that the merged entity selects a buyer firm which is optimal from a social welfare perspective. As the current legislation in the US and the EU follows a consumer standard and favors remedies for which the merged firm has the entire asset-selling power, our results support the legal practice in the US and the EU with respect to structural merger remedies.¹

¹In the companion paper, Dertwinkel-Kalt and Wey (2015) analyze how remedies in merger control affect information acquisition by an antitrust agency which is imperfectly informed about a proposed merger's type. This study qualifies our positive view on merger remedies as allowing for remedies introduces an "intermediate" option into the antitrust agency's set which can frustrate the agency's incentive to acquire information. This finding, however, depends on the institutional environment. While this holds for an inquisitorial enforcement system, Dertwinkel-Kalt and Wey (2015) show that in an adversarial system information acquisition incentives are not per se lower when remedies are feasible.

Chapter 5, published in *Economics Letters*, re-examines the view that a ban on price discrimination in input markets is particularly desirable in the presence of buyer power. Buyer power of one downstream firm may enforce lower uniform input prices for all firms which may be passed to consumers, such that final goods' prices decrease. Therefore, in the presence of buyer power, uniform pricing may be desirable from the consumers' point of view. This result, however, crucially depends on an inverse relationship between downstream firms' profits and the uniform input price. If downstream firms have different input-efficiencies, that is, some firms have a lower conversion rate of input goods to output goods than others, the results may turn over. Buyer power may induce downstream firms to enforce a particularly high uniform input price which harms more inefficient rival firms overproportionally. First, we derive conditions such that a higher input price benefits a subset of relatively efficient downstream firms. Second, we show in which setups consumers are better off if discriminatory pricing is feasible.²

²While the present study assumes that in equilibrium the powerful downstream firm's outside option binds, the companion study (Dertwinkel-Kalt, Haucap and Wey, 2015a) drops this assumption and presents examples in which this constellation arises endogenously. Such examples are not straightforward as the upstream firm may rather want to refrain from supplying the powerful buyer than to make him accept the offer.

Chapter 2

Exchange Asymmetries for Bads? Experimental Evidence

Co-authored by Katrin Köhler

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, Knetsch and Thaler (1990; 1991) and many subsequent studies.

In apparent contrast to our results, Brenner, Rottenstreich, Sood and Bilgin (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, Gennaioli and Shleifer (2012a) propose, an agent imme-

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

diately 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, 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 3 introduces the experimental design, before we present the results in Section 4. In Section 5, we discuss the crucial features of our setup and the discrepancy between the hypothetical and the incentivized results. Finally, Section 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 a downside in a different attribute. 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 Appendix A.

2.2.1 Reverse Endowment Effect According to Attention-based Theories

Attention-based theories in general and Bordalo *et al.* (2012a) and Bhatia and Golman (2013) in particular predict a reverse endowment effect for bads. First,

²We 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.

we introduce the corresponding mechanism by Bordalo *et al.* (2012a). Second, we sketch how focusing theory (Kőszegi and Szeidl, 2013) can similarly explain the reverse endowment effect.

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. Thus, at the first stage, the endowment’s downside is 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 a reverse endowment effect for bads, that is, a switching rate above 50% (for details, see Appendix A).

The reverse endowment effect 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 a reversal of the endowment effect.

Therefore, attention-based theories yield the following hypothesis.

Hypothesis: *The probability of switching an endowed bad is at least 50%.⁴*

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

⁴Attention-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.

2.2.2 Endowment Effect 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 dimension 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 Appendix 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, our Hypothesis stands in contrast to loss aversion-based theories.

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

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

2.2.3 Related Literature on Exchange Asymmetries for Bads

Experimental evidence in favor of the reverse endowment effect 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.

Further studies provide indicative support for a reverse endowment effect for bads. Psychological studies, for example Lerner, Small and Loewenstein (2004), find that negative emotions induced in a pre-test situation eliminate or even reverse the endowment effect for goods, although the pre-test situation 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 endowment effect.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.

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

⁸There are a few studies which incorporate goods with one negative aspect (such as Dhar and Sherman, 1996; Dhar, Nowlis and Sherman, 1999; Antonides, Dhar and Goedhart, 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.

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 Appendix 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}

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

⁹The 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 hold as long as one task is more fiddly than the alternative, while the alternative is more exhaustive.

¹⁰To 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 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.

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 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 allotted 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 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.

¹¹This 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.

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

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 Appendix B, Figures 2.5 and 2.6) 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 task and not on the alternative. Besides these modifications, we did not alter our incentivized setup.

Table 1 provides an overview of all treatments.

Treatment	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

Table 2.1: *An overview of the different treatments.*

¹³One 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 Appendix B, Figures 2.5 and 2.6.

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. As only 23% of the subjects exchanged their tasks, we can reject our Hypothesis at $p < 0.001$ according to a one-sided binomial test with each subject's decision representing an independent observation. This replicates switching rates from conventional papers on exchange asymmetries for goods. Kahneman *et al.* (1991), for example, review the literature on exchange experiments and state that the proportion of trades was always less than half of the expected volume, i.e., less than 25%. Consequently, we obtain a strong indication that the endowment effect carries over to the unpleasant tasks incorporated in our study.

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

Table 2.2: Results in the IP treatment

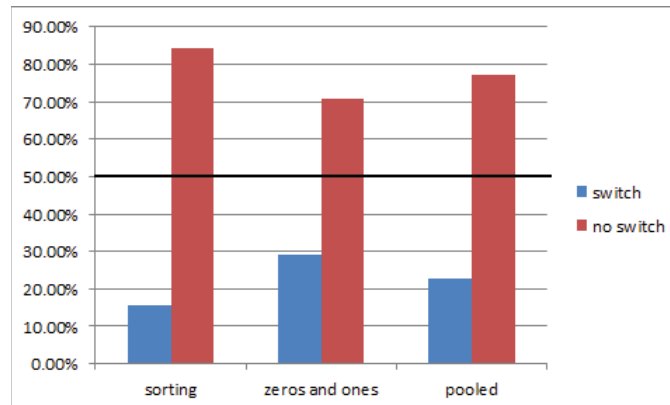


Figure 2.1: An illustration of the results in the IP treatment.

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 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 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 ($p = 0.758$, χ^2 test) we can pool the data. Altogether, significantly more than 50% of the subjects switched their task ($p = 0.064$, one-sided binomial test). This gives a (slight) reverse endowment effect and reproduces the findings of Brenner *et al.* (2007) and Bhatia and Turan (2012).

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

Table 2.3: Results in the hypothetical treatments

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.¹⁴ 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 ($p < 0.001$, one-sided binomial test). This supports our view of the tasks as bads.¹⁵

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

¹⁴Pain is incorporated only in very few studies such as Berns, Capra, Moore and Noussair (2011), who investigate probability weighting in lotteries with “non-monetary adverse outcomes” (electric shocks).

¹⁵Further 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.”

may play a role. Both issues, however, are excluded in the InoP treatment.^{16,17}

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 endowment effect we avoided (1) training rounds for both tasks and (2) pre-test trading 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 endowment effect for bads does or does not exist, exchange experiments are preferable to *wta-wtp* studies.

¹⁶Uncertainty 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.

¹⁷The 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.

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 endowment effect 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, Azar (2010) tests his theory of "relative thinking" (Azar, 2007) in a field experiment, which shares its central prediction with salience theory of consumer choice (Bordalo, Gennaioli and Shleifer, 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) hints at fundamental 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.

Appendix A: Predictions 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.¹⁸ 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 Saliency Mechanism

Saliency and homogeneous agents

We illustrate the saliency 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 presented 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 which is "not salient."

The weights a local thinker assigns to different attributes are distorted according to a parameter $\delta \in [0, 1]$. The smaller δ , the larger the bias. Parameter $\delta = 0$ indicates that the agent evaluates an item solely based on its most salient attribute.¹⁹ Given two attributes, the multiplicative weight on the more salient attribute is given by $\frac{2}{1+\delta}$ and the weight on the less salient attribute by $\frac{2\delta}{1+\delta}$.²⁰

In our two-stage experiment a local thinker chooses the item which yields

¹⁸The minus signs indicates negative utilities.

¹⁹Parameter $\delta = 1$ (which we excluded) would give a rational decision maker.

²⁰Note that the following procedure mirrors the saliency 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.

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 endowment effect 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 $Z = (0, -1)$.²¹ 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.²² 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 $\gamma \in (0, 1]$ and $1 - \gamma$, that is,

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

²¹Including $(0, 0)$ in the consideration set does not substantially alter the analysis (for details, see Bordalo *et al.*, 2012a).

²²If the assumption of diminishing sensitivity is dropped, such as in Köszegi and Szeidl (2013), both items are valued rationally at this stage. In either case, the subsequent argumentation and the prediction of the reverse endowment effect remain valid.

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 endowment effect 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%.²³

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 a reverse endowment effect for all $0 \leq p < 1$, which becomes weaker for a larger p .

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

²³In 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.

takes a small positive value, our predictions hold qualitatively. Therefore, the prediction of a reverse endowment effect is robust with respect to the assumption that some subjects anticipate the chance to exchange endowments.

Saliency 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.^{24,25}

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 $p' < 1$, a reverse endowment effect is predicted which becomes weaker

²⁴If the upsides and the downsides are equally salient within C' , computations and predictions are analogous to the two cases presented here. Saliency theory predicts a reverse endowment effect as long as $p' < 1$.

²⁵In Bordalo *et al.* (2012a), the first case applies due to additional specifications on *saliency functions* (which we omit here for brevity).

for a larger p' . 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 endowment effect 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 a reverse endowment effect 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 $\tilde{p}$.

Appendix B: 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. For the hypothetical treatment HNeut, instructions are given in Figures 2.5 and 2.6.

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.

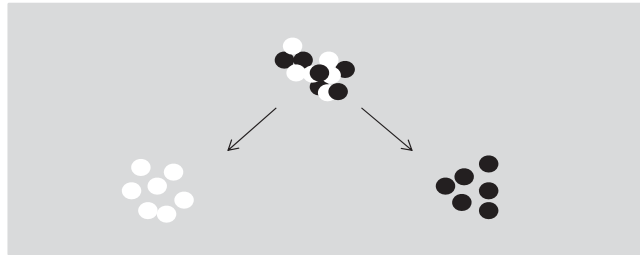
In the following, both tasks are described in detail.

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:



Procedure of the experiment

Before the actual task starts, there is 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 this questionnaire during this period. The time for the trial does not count for the 30 minutes. Thus, time does not run during the trial. What is sorted by you during this time does also 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. In case time runs out before you finish your task, you will receive some additional minutes. If you finish earlier we ask you to wait silently at 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, Sorting.

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 the task or not. When the 30 minutes have started, there is no further possibility to switch the task.

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?

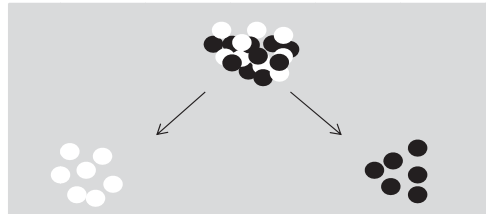
How long did it take you to finish the task?

Figure 2.4: Final questionnaire.

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 need to 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 switch tasks immediately against 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 2.5: 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 2.6: Hypothetical instructions for those endowed with the task “sorting”, page 2.

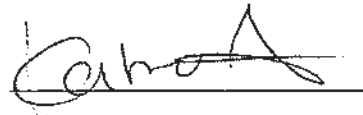
Declaration of Contribution

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

My contributions to this chapter are as follows:

- I have developed the experimental setup
- I have contributed to the implementation of the experiment
- I have written major parts of the Introduction
- I have written major parts of the Model (Section 2 and Appendix A)
- I have contributed to the Design and to the Results
- I have written major parts of the Discussion (Section 5)
- I have contributed to the Conclusion

Signature of coauthor 1 (Katrin Köhler):

A handwritten signature in black ink, appearing to read 'Katrin Köhler', written over a horizontal line.

Chapter 3

Salience and Health Campaigns

3.1 Introduction

One major issue within health politics is the question how consumers can be enticed into healthier diets. As the World Health Organization recommends consumption of five portions fruit or vegetable a day, countries like the US and the UK launched the “5-a-day” campaign and the national public health initiative “Fruits & Veggies - More Matters.” These campaigns have in common that they promote the consumption of healthy food products.¹ Healthy nutrition, however, does not only mean the consumption of healthy food products. It also includes abstaining from junk food and those products which contain a lot of sugar due to their various detrimental health effects.² Typically, governments could impose higher taxes on unhealthy food in order to change people’s nutrition. While such taxes may fail to change people’s consumption decisions, in addition they

¹For assessments of the campaign’s effects see for example Havas, Heimendinger, Damron, Nicklas, Cowan, Beresford, Sorensen, Buller, Bishop, Baranowski and Reynolds (1995), Baranowski and Stables (2000), Perry, Bishop, Taylor, Murray, Mays, Dudovitz, Smyth and Story (1998).

²For example, the Bulletin of the World Health Organization from August 28, 2003 states that “Populations with high sugar consumption are at increased risk of chronic disease” and the New York Times asks “Is sugar toxic?” (April 13, 2011). Recently, a broad debate about the significant negative effects of sweet food was initiated in Germany, supported by title stories by Der Spiegel (36/2012), BILD am Sonntag (8th July 2012) and other important newspapers and magazines. Overall costs of unhealthy nutrition like obesity and overweight are huge. For evidence, see for example the Nutrition Report 2004 by the German Nutrition Society; “The Economic Costs of Overweight, Obesity and Physical Inactivity Among California Adults - 2006” by the California Center for Public Health Advocacy; or Colagiuri, Lee, Colagiuri, Magliano, Shaw, Zimmet and Caterson (2010) for an estimation of obesity’s overall costs in Australia.

cause dead-weight losses. Therefore, information campaigns might be an appealing alternative. As empirical studies have found, information campaigns can “successfully change [...] dietary behavior” (see Snyder, 2007). Chetty, Looney and Kroft (2009) have shown the impact of the saliency of information on decision making and found that consumers underreact to taxes that are not salient, while salient tax reminders may have substantial effects on consumption decisions. Thus, by making information more salient, information campaigns might improve the quality of people’s nutrition.

Within the theoretical framework of salience (Bordalo *et al.*, 2012a,b), we analyze the effect of two information campaigns which are designed to shift consumers’ demand between heterogeneous goods. We consider a market with two products, one of which is “healthy” while the other one is “unhealthy.” In order to shift demand toward the healthier product, the government can choose between a *promotion* campaign of the healthy product (similar to the “5-a-day” program) and a *demotion* campaign of the unhealthy alternative. According to Bordalo *et al.* (2012a)’s salience mechanism, people overrate whatever aspect is especially pronounced, whereas they tend to neglect less salient ones. Various information campaigns for certain goods may emphasize different features and therefore induce different valuations of the available items. In particular, a consumer’s consumption decision may be reversed through governmental information campaigns. An information campaign which highlights a good’s upsides may increase its overall evaluation as it shifts the consumer’s attention toward the advantage and away from the good’s disadvantage. Similarly, an information campaign which stresses a good’s downside may lower its perceived value as the consumer’s attention is focused on the disadvantage. This campaign may induce consumers to value the unhealthy product as a “bad,” i.e., as a product providing a disutility consumers would like to refrain from.

Several studies have analyzed the effect of health campaigns on consumption behavior, such as Hamilton and Snyder (2002), Evans, Uhrig, Davis and McCormack (2009), Randolph and Viswanath (2004) and Hornik (2002). Furthermore, there is a broad literature on “social marketing,” see Lefebvre and Flora (1988), Grier and Bryant (2005), Smedley and Syme (2001) and Glanz, Rimer and Viswanath (2008). However, empirical results on the effectiveness of promoting and demoting health campaigns are very heterogeneous (see Capacci, Mazzocchi, Shankar, Macias, Verbeke, Pérez-Cueto, Koziół-Kozakowska, Piórecka,

Niedzwiedzka, D’Addesa, Saba, Turrini, Aschemann-Witzel, Bech-Larsen, Strand, Smillie, Wills and Traill, 2012). Another strand of research has compared gain- and loss-framed health messages. Gain-framed messages emphasize the gains resulting from a certain behavior, such that they are related to the promotion campaigns in our approach. In contrast, loss-framed messages stress the potential losses resulting from specific actions, such that they are related to our demotion campaign. Empirical findings on gain- and loss-framing are mixed, too. For instance, a meta-analysis by Gallagher and Updegraff (2012) has analyzed the impact of gain- and loss-framed messages on preventory actions. According to this study, gain-framed messages are significantly more effective for domains such as smoking, but not for nutrition (the objective of the present paper). Pakpour, Yekaninejad, Sniehotta, Updegraff and Dombrowski (2014) report that loss-framed messages are more effective in inducing preventory actions concerning oral health. Brug, Ruiter and Van Assema (2003) find no significant effect of the frame on preventory action at all. Wansink and Pope (2015) conditioned the effectiveness of gain- and loss-framed messages on people’s involvement into the issue and found that loss-framed messages are especially effective if people are highly involved. To sum up, the existing empirical literature does not allow for a clear prediction in the setting which we analyze theoretically. In particular, to our knowledge, the effects of demotion and promotion nutrition campaigns have not been directly compared, neither theoretically nor empirically.

First, we find that both campaigns work as each of them shifts demand toward the healthier product. *Second*, guiding consumers’ attention on a product’s downside results in a stronger shift of demand than the promotion campaign. The latter result is based on the assumption that people are especially susceptible to information on familiar goods.³ Consumers are familiar with such items which they have consumed prior to the information campaign, that is, the unhealthy product for the target audience of the campaign. Consequently, consumers’ purchase behavior is more affected by a demotion than by a promotion campaign.

An interesting example is a recent campaign by Coca Cola. In order to prevent threatened regulatory action in the United States and the EU to restrict

³It is derived from the crucial assumption by Bordalo *et al.* (2012a) according to which people overweight information related to a product they are endowed with. It is also supported by empirical studies such as Johnson and Russo (1984) which finds that “greater familiarity increased learning during a new purchase decision.” Dropping this assumption, both campaigns have an equally sized, positive effect on the healthiness of consumers’ diets.

consumption of sugar-containing soft drinks (see New York Times, May 30, 2012 or Handelsblatt, January 16, 2013), Coca Cola started an own information campaign. Fearing harsh governmental interventions in order to demote soft drinks, Coca Cola initiated a campaign which instead promotes a healthy lifestyle and doing sports. However, according to our model, a governmental campaign which demotes an unhealthy diet is more likely to encourage a healthy way of living than Coca Cola's promotion of a healthy lifestyle. Thus, Coca Cola's initiative is advantageous for the soft-drink industry while regulatory authorities should doubt its efficiency.

Also related to this topic is the introduction and the failure of the Danish fat tax, which had to be abolished only one year after its introduction (The Economist, November 17, 2012). It failed to incentivize people to live healthier, but increased sales of unhealthy food items in neighbor countries. However, modifying consumers' attitudes toward unhealthy nutrition by demotion campaigns does not just relocate consumption, but may truly change consumption behavior as we argue in this article.

We proceed as follows. Section 2 introduces our behavioral model. Section 3 presents our analysis of the different campaigns' effects. In Section 4, we present various extensions of our model with respect to broader choice sets and weaker symmetry assumptions. However, our previous results remain largely valid. Finally, Section 5 concludes.

3.2 The Model

Suppose a market with two goods, one of which is healthy (*apple*, represented by the index “*A*”) and one is unhealthy (*chocolate*, represented by the index “*S*” as it contains a lot of sugar). Each consumer has to choose one of these two products.⁴ In our basic model, the price for each good is normalized to zero, while we extend this setup and include prices in Section 4.2. Good *t* can be described by a two dimensional quality vector $(q_{1t}, q_{2t}) \in \mathbb{R}^2$, where q_{1t} describes the tastiness of good *t* and q_{2t} describes good *t*'s healthiness, measured by the amount of contained sugar. Positive values describe that a product is tasty or healthy, while negative values indicate that it does not taste well or is unhealthy.

⁴Allowing purchase of multiple goods does not change our results as long as the subject's preference for diversity is not too strong.

A consumers' utility v inferred from good t is additively separable and linear in its quality parameters. It is given by

$$v(q_{1t}, q_{2t}) := wq_{1t} + (1 - w)q_{2t},$$

where w and $1 - w$ denote the decision weights assigned to each of the attributes. Each consumer is uniquely described by the parameter w , which we assume to be uniformly distributed on the interval $[0, 1]$. The overall mass of consumers is normalized to one. Therefore, consumers are located on a Hotelling line between zero and one, and the exact position gives weight w she assigns to the attribute “tastiness”.

We assume that chocolate is given by the vector $(q, -q)$ for $q \in \mathbb{R}^+$, while the apple is defined by the vector $(-q, q)$. Therefore, the former is tasty, but unhealthy, while the latter is healthy (value q), but does not taste well (value $-q$). We define a consumer's healthiness as the health parameter of the food she currently consumes: a consumer of chocolate has healthiness $-q$, while a consumer of apples has q . We assume that consumers are familiar with the product which they prefer, i.e., which gives the highest utility v .⁵ Consumers with $w > 1/2$ are familiar with chocolate and those with $w \leq 1/2$ are familiar with apples.

The government has the objective to maximize healthiness among the consumers and, therefore, designs an information campaign in order to induce healthier nutrition. Note that the government does not maximize consumer surplus in our setup. Our analysis presupposes that the government encourages healthy consumption, without taking consumers taste into consideration. This assumption is justified by the substantial negative externalities unhealthy diets induce, for instance, on health care expenditures. Such externalities have been known for a long time (see for example Rubin, Altman and Mendelson, 1994), but a recent study by Cawley and Meyerhoefer (2012) implies that the negative externalities are even larger than previously assumed. Therefore, it is plausible to assume that the positive impact of better tasting food on a consumer's surplus is outweighed by the negative externalities her unhealthy diet imposes on society. Therefore, overall healthiness might well be aligned with social welfare. Then, a govern-

⁵In particular, we assume that consumers have consumed that product in the past, i.e., prior to the information campaigns which we are analyzing in the following. Therefore, consumers are familiar with that product.

ment which internalizes the negative externalities of unhealthy nutrition (which we neglect in our model) maximizes social welfare by maximizing the share of consumers opting for healthy diets. We assume that the government has a fixed budget such that it can either promote the healthiness of the apple or demote the chocolate by focusing public attention on its unhealthiness. Each campaign has a fixed intensity, which cannot be affected by the government.⁶

We analyze if and how consumer decision making responds to such governmental campaigns. Prior to the campaigns, the indifferent consumer is located at $\hat{w} = 1/2$ and every consumer to the right ($w > \hat{w}$) consumes chocolate, whereas those to the left consume apples. Define $\mathcal{C}_I$ as the set of those consumers who consume chocolate prior to the campaign and $\mathcal{C}_A$ as the set of consumers who consume chocolate after the campaign. Then, the government maximizes the set $\mathcal{C}_I \setminus \mathcal{C}_A$. We call a campaign the more effective the more consumers are in $\mathcal{C}_I \setminus \mathcal{C}_A$, i.e., the more people switch to apples.

In the following, first we introduce the salience mechanism by Bordalo *et al.* (2012a). In Section 2.2 and 2.3, we apply this mechanism to two different governmental information campaigns.

3.2.1 Salience Theory

First, for each situation where a product is to be valued by a consumer there is a consideration set C which comprises all options which are mentally available at that point in time. These mentally available items do not have to be truly available. Instead, they may be fictional goods or historical goods the decision maker has in mind while making a choice.⁷ Suppose that the consideration set comprises $n \in \mathbb{N}$ items, each of which is uniquely described by the values it takes in the two attributes. Then, each good t is given by a vector $(q_{1t}, q_{2t}) \in \mathbb{R}^2$, where q_{1t} (and q_{2t} , respectively) denotes t 's value in the first (second) attribute and the consideration set equals $C = \{(q_{1t}, q_{2t}) | 1 \leq t \leq n\}$. The *reference good* $\bar{q}$ in C is

⁶In the extensions, we endogenize the efficiency of a campaign by assuming that a more efficient campaign comes at higher costs and has a higher effect on the consumers' valuations of products.

⁷Historical goods may correspond to goods that have been available in the past (see Bordalo *et al.*, 2013), where "historic" refers to historic prices. An item described by (q_{1t}, q_{2t}) is mentally available as long as a consumer considers the item. For example, if a consumer believes that there exists a very tasty and healthy product described by (q, q) , then this product is part of her consideration set. Also $(0, 0)$, indicating no consumption at all, may be included in the consideration set if the consumer considers the opportunity not to choose anything.

defined as

$$\bar{q} := (\bar{q}_1, \bar{q}_2) := \left(\frac{1}{n} \sum_{t=1}^n q_{1t}, \frac{1}{n} \sum_{t=1}^n q_{2t} \right),$$

where $\bar{q}_i$ gives the *reference value* of attribute i in set C for $i = 1, 2$. A consumer evaluates each item in her consideration set against this reference good. According to salience theory, the decision maker overweights such an attribute which is particularly salient in contrast to that attribute's reference value in C .

Hereby, salience of a good's attribute is assessed through a *salience function* $\sigma : \mathbb{R}^2 \rightarrow \mathbb{R}^+$, which compares good t 's attribute value q_{it} with the attribute's reference value $\bar{q}_i$ by assigning each pair $(q_{it}, \bar{q}_i)$ a positive number indicating how salient q_{it} is against $\bar{q}_i$. We call product t 's attribute i *salient* and its attribute j *not salient* (with respect to the salience function σ) if and only if $\sigma(q_{it}, \bar{q}_i) > \sigma(q_{jt}, \bar{q}_j)$ for $j \neq i$. If $\sigma(q_{it}, \bar{q}_i) = \sigma(q_{jt}, \bar{q}_j)$, then both attributes are equally salient. Formally, a salience function is defined via the two properties *ordering*, that is, if $[q_{it}, \bar{q}_i] \subset [q_{jt}, \bar{q}_j]$ then $\sigma(q_{it}, \bar{q}_i) < \sigma(q_{jt}, \bar{q}_j)$, and *homogeneity of degree zero*, that is, $\sigma(\alpha q_{it}, \alpha \bar{q}_i) = \sigma(q_{it}, \bar{q}_i)$ for all $\alpha \neq 0$. A typical salience function is given by $\sigma(0, 0) = 0$ and $\sigma(q_{it}, \bar{q}_i) = (|q_{it} - \bar{q}_i|) / (|q_{it}| + |\bar{q}_i|)$ otherwise.

A consumer's decision weights on a good's attributes are distorted due to salience. In particular, this distortion is modelled via a *salience parameter* $\delta \in [0, 1]$ which indicates to which degree the consumer neglects the less salient attribute. If a consumer decides rationally, she has $\delta = 1$. The smaller δ is, the larger is her susceptibility to the salience bias. In particular, she values (q_{1t}, q_{2t}) as

$$v^S(q_{1t}, q_{2t}) = w_1^{LT} q_{1t} + w_2^{LT} q_{2t},$$

where her distorted decision weights are defined as follows: if attribute 1 is salient and attribute 2 is not, then $w_1^{LT} = 2w/(1 + \delta)$ and $w_2^{LT} = 2\delta(1 - w)/(1 + \delta)$; if attribute 2 is salient but 1 is not, then $w_1^{LT} = 2\delta w/(1 + \delta)$ and $w_2^{LT} = 2(1 - w)/(1 + \delta)$; and if both attributes are equally salient, then $w_1^{LT} = w$ and $w_2^{LT} = 1 - w$. In the basic model, we assume that parameter δ is identical for all consumers, while we drop this assumption in the extensions. Furthermore, we assume that $\delta \in (0, 1)$, such that people are neither rational nor do they neglect the less salient attribute entirely.

We analyze the following game. At the first stage, the government launches an information campaign on attribute i of good $t \in C$. At the second stage, consumers are affected by this campaign and form valuations of the products

which are part of the campaign. At the third stage, people enter a store and assess all goods within the consideration set which comprises the truly available goods. Finally, the consumer purchases one product.

As in Bordalo *et al.* (2012a), a consumer picks the product (q_{1t}, q_{2t}) which gives her the highest final valuation $v^{S,F}$. If a good has been considered by the consumer only at the third stage, her final valuation of that product equals her third-stage valuation. If the respective good has been considered at the second and the third stage, its final valuation equals a convex combination of her second-stage valuation $v^{S,2}(q_{1t}, q_{2t})$ and her third-stage valuation $v^{S,3}(q_{1t}, q_{2t})$, that is

$$v^{S,F}(q_{1t}, q_{2t}) = \gamma v^{S,2}(q_{1t}, q_{2t}) + (1 - \gamma) v^{S,3}(q_{1t}, q_{2t})$$

for a parameter $\gamma \in (0, 1]$. Parameter γ could be understood as the probability with which a good's second stage evaluation persists. This model feature could also be interpreted as a consumer's refusal to adjust beliefs regularly, which is, for instance, the foundation for the theory of cognitive dissonance (see Akerlof and Dickens, 1982; Cooper, 2007).

We assume that a consumer's *valuation-persistency* $\gamma = \gamma(t, w)$ is a function of the advertised good t and of a consumer's preference for tastiness w . As the info campaign will center on either good A or S , we define $\gamma^A(w) := \gamma(A, w)$ and $\gamma^S(w) := \gamma(S, w)$. We assume that the persistency does not depend on the actual weights a consumer puts on the attributes, but only the good she is familiar with prior to the campaign. If $w > 1/2$, the consumer is familiar with good S , while $w \leq 1/2$ means that she is familiar with good A .⁸ Then, the functions $\gamma^S(w)$ and $\gamma^A(w)$ are piecewise constant with one discontinuity at $1/2$, that is $\gamma^t(w) = \gamma^t(1)$ for any $w > 1/2$ and $t \in \{A, S\}$ and $\gamma^t(w) = \gamma^t(0)$ for any $w \leq 1/2$ and $t \in \{A, S\}$. Define $\gamma_A := \gamma^A(1)$ and $\gamma_S := \gamma^S(1)$.

We investigate how the location of the indifferent consumer changes through the introduction of an information campaign. Here, we establish a critical assumption: we assume that consumers are more susceptible to information on goods they are familiar with. While a similar reasoning is exploited in Bordalo *et al.* (2012a) to establish the endowment effect, this assumption is also empirically justifiable. For instance, Johnson and Russo (1984) find that “greater

⁸Without loss of generality, throughout this paper we assume that the consumer who is indifferent between two products consumes the healthier product in each case.

familiarity increased learning during a new purchase decision”, that is, people are more susceptible toward information on familiar goods.⁹ Consumers in $\mathcal{C}_I$ are familiar with chocolate, such that they are more susceptible to information on chocolate than on apples. This gives

Assumption 1. *Beliefs concerning the familiar good are more persistent, i.e., $0 \leq \gamma_A < \gamma_S \leq 1$. That means that for consumers in $\mathcal{C}_I$, second-stage evaluations of chocolate are more persistent than second-stage evaluations of apples.*

3.2.2 Promotion of the Apple

Suppose that the government initiates an information campaign which promotes the healthiness of the *apple*. This may include advertisement posters or commercials on TV which stress how healthy the consumption of apples is. By the government’s promotion of the apple’s healthiness, consumers focus their attention on this aspect. Therefore, we assume that consumers contrast the apple, given by $(-q, q)$, with a (fictional) other good described by $(-q, \tilde{q})$ with $0 \leq \tilde{q} < q$. This item is not as healthy as the apple, but equally tasty as consumers are not reminded of differences in “tastiness” when confronted with an advertisement which solely focuses on “healthiness.” Then, the consumer’s consideration set at the second stage equals $C_2^A := \{(-q, \tilde{q}), (-q, q)\}$.¹⁰ Any salience function σ produces the result that the apple’s healthiness is salient while its tastiness is not. Formally,

$$\sigma\left(q, \frac{q + \tilde{q}}{2}\right) > \sigma(-q, -q),$$

as the apple’s healthiness q is above the average healthiness $(q + \tilde{q})/2$ within C_2^A , while the apple’s tastiness $-q$ meets the average within C_2^A , i.e., $-q$.¹¹ Since the salient attribute is additionally weighted by $2/(1 + \delta)$, while the other attribute is weighted by $2\delta/(1 + \delta)$, the final weights a consumer w puts on the attributes

⁹Consumer inertia might countervail campaign-induced learning, however, for both campaigns alike. Inert consumers might be unwilling to update their valuation of both goods and unwilling to refrain from switching consumption goods, no matter which campaign they are exposed to.

¹⁰Our analysis here is robust with respect to other fictional items in the consideration set, as long as these render the attribute of healthiness salient. Also including $(0, 0)$, i.e., choosing no good at all, does not change any of our results.

¹¹In our analysis, the explicit choice of a salience function σ is irrelevant for the results. The saliency of an attribute is independent of the explicit salience function throughout the entire paper.

are

$$w_1^{LT} = \frac{2\delta}{1+\delta}w \quad \text{and} \quad w_2^{LT} = \frac{2}{1+\delta}(1-w).$$

The valuation of the apple before making the consumption decision is a compound of the second- and the third-stage valuations, where for people in $\mathcal{C}_I$, parameter γ_A gives the weight of the apple's second-stage valuation and $1 - \gamma_A$ gives the weight of the apple's third-stage valuation. At the second stage, people are affected by the government's information campaign and they value the apple as explained in the preceding paragraph. At the third stage, consumers enter a store, consider all truly available products and therefore assess the apple within $C_3^A := \{(0, 0), (-q, q), (q, -q)\}$.

3.2.3 Demotion of the Chocolate

Alternatively, the government might set up a similar campaign, featuring advertisement posters or commercials which focus on the chocolate's downside, that is, its unhealthiness. Such a campaign implies that the chocolate's downside can be avoided without losing its upside, the tastiness. Therefore, we assume that chocolate is compared against a fictional item which is similar to chocolate concerning its tastiness, but different concerning its healthiness. Thus, a consumer's consideration set equals $C_2^S := \{(q, -\tilde{q}'), (q, -q)\}$ with $0 \leq \tilde{q}' < q$. Then, a local thinker assigns weights $w_1^{LT} = 2\delta w/(1+\delta)$ and $w_2^{LT} = 2(1-w)/(1+\delta)$ to the chocolate's attributes tastiness and healthiness.

After people have been exposed to the campaign, they enter a store and assess the chocolate within the set C_3^S which contains the truly available goods and the outside option. Therefore, $C_3^S = C_3^A =: C_3$. The final valuation of the chocolate equals the convex combination of its second-stage valuation (weight γ_S) and its third-stage valuation (weight $1 - \gamma_S$).

3.3 Analysis of the Effectiveness of the Campaigns

Here, we analyze in how far the two information campaigns change the location of the indifferent consumer.

3.3.1 Promotion of the Apple

Here, we continue the analysis started in subsection 3.2.2. At the second stage the apple's healthiness is salient and overrated, while its (bad) taste is underrated. Therefore, it is valued as

$$v^{S,2}(A) = \frac{2\delta}{1+\delta}w \cdot (-q) + \frac{2}{1+\delta}(1-w)q.$$

At the third stage, the apple is assessed in the presence of the chocolate, such that the average healthiness and the average tastiness are zero and no attribute, neither of the apple nor the chocolate, is more salient than the other. Therefore, $v^{S,3}(A) = w \cdot (-q) + (1-w) \cdot q$ and $v^{S,3}(S) = w \cdot q + (1-w) \cdot (-q)$ such that both products' valuations are unbiased at the third stage (as they have been prior to the information campaign).

The final valuation of the chocolate equals a convex combination of its second- and third-stage valuations, such that the apple's final valuation equals

$$v^{S,F}(A) = \gamma_A \left(\frac{2\delta}{1+\delta}w \cdot (-q) + \frac{2}{1+\delta}(1-w)q \right) + (1-\gamma_A)(w \cdot (-q) + (1-w)q).$$

This exceeds the final valuation of the chocolate $v^{S,F}(S) = v^{S,3}(S)$ if and only if

$$\frac{\gamma_A}{1+\delta} \left(\frac{w+w\delta-1}{1-2w} \right) + \frac{\gamma_A}{2} \geq 1.$$

If and only if a consumer's final valuation of an apple is higher than the valuation of chocolate, she consumes an apple. Thus, the indifferent consumer, whose final valuation of the apple equals her valuation of the chocolate, is located at

$$w^A := \frac{2+2\delta-\delta\gamma_A+\gamma_A}{4+4\delta}. \quad (3.1)$$

3.3.2 Demotion of the Chocolate

If the government's information campaign demotes the chocolate, its unhealthiness is salient at the second stage and the consumer values it as

$$v^{S,2}(S) = \frac{2\delta}{1+\delta}wq + \frac{2}{1+\delta}(1-w) \cdot (-q).$$

At the third stage the apple's and the chocolate's valuations are unbiased. Due to the persistence of second-stage valuations (indicated by weight γ_S), the final valuation of the chocolate is

$$v^{S,F}(S) = \gamma_S \left(\frac{2\delta}{1+\delta} w \cdot q + \frac{2}{1+\delta} (1-w) \cdot (-q) \right) + (1-\gamma_S) (w \cdot q + (1-w) \cdot (-q)).$$

Therefore, the indifferent consumer, described by weight w^S , is located at

$$w^S := \frac{2 + 2\delta - \delta\gamma_S + \gamma_S}{4 + 4\delta}. \quad (3.2)$$

3.3.3 Evaluation of the Campaigns

The larger the set $\mathcal{C}_I \setminus \mathcal{C}_A$ the more successful a campaign is. Let $t \in \{A, S\}$ denote the object of the information campaign, i.e., the apple or the chocolate. As long as $\delta < 1$ and $\gamma_t > 0$, the set $\mathcal{C}_I \setminus \mathcal{C}_A$ is non-empty for the campaign on t as the indifferent consumer has moved to the right, i.e.,

$$w^t := \frac{2 + 2\delta - \delta\gamma_t + \gamma_t}{4 + 4\delta} > \hat{w}. \quad (3.3)$$

How many people indeed switch their product choice through the campaign depends on δ , which indicates how susceptible consumers are toward campaigns, and on γ_t , which indicates how persistent valuations evoked by campaign t are. The smaller δ , the more consumers are manipulable by the campaign and the more people switch from consuming chocolate to consuming apples. The larger γ , the more persistent are previously formed beliefs, and thus the more effective the campaign is. These comparative statics hold for both campaigns, but due to Assumption 1 ($\gamma_A < \gamma_S$), the campaign demoting the chocolate such that this is assessed to be a “bad” is more effective. This gives

Proposition. *For exogenously fixed parameters $\delta \in [0, 1)$ and $\gamma \in (0, 1)$, the introduction of an information campaign $t \in \{A, S\}$ reduces the share of chocolate-consumers. The indifferent consumer moves from $\hat{w}$ to $w^t > \hat{w}$. Given $\gamma_S > \gamma_A$ (Assumption 1), the campaign which demotes the chocolate is more effective, i.e.,*

$$\frac{1}{2} < w^A < w^S \leq 1.$$

3.4 Extensions

In this section we extend our setup with respect to several aspects. We consider broader choice sets, goods with more attributes, asymmetric goods and endogenize the campaigns' costs.

3.4.1 Broader Choice Sets

If more than two products are available, then a campaign's effect on a consumer's valuation of the products is more diverse. Again, we restrict our analysis toward consumers in $\mathcal{C}_I$. We assume that n balanced products $(q_{1t}, q_{2t}) \in \mathbb{R}^2$ are available, where balance means $q_{1t} = -q_{2t}$ for all $1 \leq t \leq n$. Goods with a strictly positive value (> 0) in the health attribute we call "healthy," while those with a strictly negative value (< 0) we call "unhealthy." Initially, consumers in $\mathcal{C}_I$, i.e., those with $w > 1/2$, consume the most delicious product, which – due to balance – is the unhealthiest (we call it *chocolate*). The healthier a product, the less it will be enjoyed by consumers, so that the healthiest product (let's call it *apple*) is the one consumers in $\mathcal{C}_I$ value lowest. As in the previous section, we investigate the effect of governmental information campaigns. *First*, we analyze an information campaign which focuses on the chocolate's downside such that consumers focus excessively on its unhealthiness. The final valuation, a weighted average of the second- and third-stage valuations, will be such that consumers with $w > 1/2$ either stay with chocolate (if the campaign was too weak to make them switch) or switch to consuming the second most delicious good (which is the second unhealthiest product). That is because the ordering of preferences for the goods the campaign does not focus on is unaffected by the campaign. *Second*, we consider a campaign focusing on the healthiness of the apple. Similarly, this campaign distorts only the consumer's valuation of the apple. On the one hand, if the campaign has any effect, then some people with $w > 1/2$ switch directly from the most unhealthy to the healthiest product, the apple. On the other hand, however, the campaign has to be particularly strong to show any effect at all as the campaign has to turn the least favorable item, the apple, into the most attractive item.

Furthermore, we shortly discuss a campaign which deviates from our previous

assumptions. Therefore, we assume that the available products are

$$\left\{ \left(\frac{iq}{n}, -\frac{iq}{n} \right) \mid i \in \{\pm 1, \dots, \pm n\} \right\}.$$

As before, the unhealthiest product $(q, -q)$ is *chocolate*, while the healthiest product $(-q, q)$ we denote *apple*. The product with the lowest positive health parameter, i.e., $(-q/n, q/n)$ we call *apple puree*, while the product with the highest negative health parameter, i.e., $(q/n, -q/n)$, we call *diet chocolate*.

We assume that the demoting campaign does not focus on a single product's attribute, but on the attribute of "containing sugar" or "being unhealthy," such that at the second stage the health aspect of all unhealthy items is salient. Then, in order to induce consumers to change their consumption decision, the information campaign has to have such an effect that the chocolate's valuation becomes negative (that is, the chocolate is assessed as a "bad"). Then, all unhealthy goods' final valuation are negative (where the valuation is the more negative the unhealthier the respective product is) even though prior to the campaign and according to third-stage valuations product $(jq/n, -jq/n)$ is preferred over $(iq/n, -iq/n)$ for $1 \leq i < j \leq n$. This prior ranking is reversed through the campaign if

$$\begin{aligned} & \gamma_S \left(\frac{2\delta}{1+\delta} \frac{iq}{n} w - \frac{2}{1+\delta} (1-w) \frac{iq}{n} \right) + (1-\gamma_S) \left(w \frac{iq}{n} - (1-w) \frac{iq}{n} \right) \\ & > \gamma_S \left(\frac{2\delta}{1+\delta} \frac{jq}{n} w - \frac{2}{1+\delta} (1-w) \frac{jq}{n} \right) + (1-\gamma_S) \left(w \frac{jq}{n} - (1-w) \frac{jq}{n} \right), \end{aligned}$$

which holds if and only if

$$w < x_1 := \frac{1 + \delta + \gamma_S - \gamma_S \delta}{2(1 + \delta)}. \quad (3.4)$$

Note that this condition is independent of i and j . Therefore, each consumer prefers, among the unhealthy products, either chocolate $(q, -q)$ or diet chocolate $(q/n, -q/n)$, but no intermediary good. The most preferred healthy good is in each case the apple puree $(-q/n, q/n)$. Furthermore, after the demotion campaign a consumer favors the most preferred healthy good, the apple puree, over

chocolate if

$$\gamma_S \left(\frac{2\delta}{1+\delta}qw - \frac{2}{1+\delta}q(1-w) \right) + (1-\gamma_S)(wq - (1-w)q) < -w\frac{q}{n} + (1-w)q$$

or, equivalently,

$$w < x_2 := \frac{1 + \delta + n + n\delta + \gamma_S n - n\gamma_S \delta}{2(1+\delta)(n+1)}. \quad (3.5)$$

A consumer chooses apple puree over diet chocolate if and only if

$$\gamma_S \left(\frac{2\delta}{1+\delta}\frac{q}{n}w - \frac{2}{1+\delta}\frac{q}{n}(1-w) \right) + (1-\gamma_S) \left(w\frac{q}{n} - (1-w)\frac{q}{n} \right) < -w\frac{q}{n} + (1-w)\frac{q}{n},$$

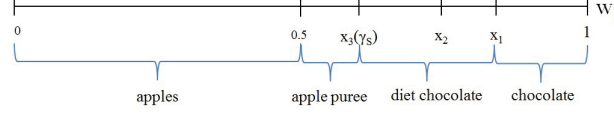
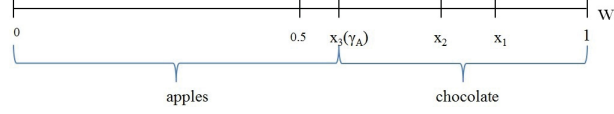
which is equivalent to

$$w < x_3 := \frac{2 + 2\delta + \gamma_S - \gamma_S \delta}{4(1+\delta)}. \quad (3.6)$$

We obtain the ordering $x_3 < x_2 < x_1$ for all $\delta \in (0, 1)$, $\gamma_S \in (0, 1]$ and $n \geq 2$. Therefore, consumers with $0 \leq w \leq 1/2$ consume apples. Consumers with $1/2 < w \leq x_3$ prefer apple puree as they prefer apple puree to diet chocolate and diet chocolate to chocolate. Consumers with $x_3 < w \leq x_2$ consume diet chocolate as they prefer diet chocolate over apple puree and apple puree over chocolate. Consumers with $x_2 < w \leq x_1$ go for diet chocolate as they prefer chocolate to apple puree and diet chocolate to chocolate, whereas those with $w > x_1$ remain buyers of chocolate.

We compare these results to a campaign which promotes the healthiness of all healthy products, i.e., which makes all healthy goods' healthiness salient at the first stage. All consumers in $\mathcal{C}_I$ prefer chocolate over diet chocolate both before and after the campaign as the relative ranking between these products is unaffected by the campaign. Substituting γ_S in the equations above by γ_A , we obtain that consumers with $w < x_1$ prefer the apple over the apple puree. Subjects with $w < x_2$ prefer the apple puree over the diet chocolate, and subjects with $w < x_3$ prefer the apple over the chocolate and the apple puree over the diet chocolate. Consequently, people with $w \leq x_3$ consume apples, while consumers with $w > x_3$ go for chocolate.

Thus, without imposing *Assumption 1*, both campaigns have advantages and

Figure 3.1: *Consumption decision after unhealthy goods are demoted*Figure 3.2: *Consumption decision after healthy goods are promoted*

disadvantages (see Figure 1 and Figure 2). Fewer people change their consumption decision after the promotion campaign, but they immediately switch to the healthiest product, the apple. After the demoting campaign, more people change their choice, however, not in favor of the healthiest product, but in favor of the compromising goods diet chocolate and apple puree.

Lemma 1. *Suppose a variety of n goods and two campaigns, which either (A) promote the healthiness of healthy products or (B) demote the unhealthiness of unhealthy products. The campaigns have two-fold effects. Campaign (A) induces less consumers, i.e., those with $w \leq x_3(\gamma_A)$, to switch their choices; however, these people directly switch to the healthiest product. Campaign (B) makes more people, i.e., those with $w \leq x_1$, switch; however, they do not switch to the healthiest product, but to intermediary products.*

Which campaign is more effective in raising overall health depends crucially on exogenous factors. Dropping the assumption of uniformly distributed consumer preferences, we observe that the demotion (promotion) campaign is more likely to be more effective if the variance of w is small (large). A small variance means that consumers' preferences for specific products are not very strong: the demotion campaign can induce these consumers to switch directly to the healthiest available alternative. If the variance, however, is large, many people have a strong preference for unhealthy goods. Here, it is more effective to demote these in order to make consumers aware of their bad impact on health. Even if consumers do not switch to the healthiest alternatives, the demotion campaign is more effective as it reaches those consumers which would be unaffected by the promotion campaign.

3.4.2 Further Attributes

In this extension, we incorporate a product's price as its third attribute. To assess salience for three attributes, we employ the more advanced model in Bordalo et al. (2012a). We assume that a consumer w 's utility from consuming good $(q_{1t}, q_{2t}, -p)$, where q_{1t} denotes the tastiness, q_{2t} the healthiness and $-p_t$ the price, is given by

$$v(q_{1t}, q_{2t}, -p) = wq_{1t} + (1 - w)q_{2t} - p_t.$$

An attribute is the most (least) salient attribute if the discrepancy to the attribute's average value within the consideration set, as measured by a salience function σ , is the highest (lowest) among all three attributes. The additional multiplicative factor put on the most salient attribute is given by $3/(1 + \delta + \delta^2)$, on the least salient attribute by $3\delta^2/(1 + \delta + \delta^2)$ and on the attribute which is neither most nor least salient by $3\delta/(1 + \delta + \delta^2)$ (see Definition 2 in Bordalo et al., 2012a). If two attributes are equally salient, the respective factors are averaged: if there is one least (most) salient attribute its additional factor is $3\delta^2/(1 + \delta + \delta^2)$ (respectively, $3/(1 + \delta + \delta^2)$) and the additional factors on the other two attributes are $3(1 + \delta)/(2 + 2\delta + 2\delta^2)$ (respectively, $3(\delta + \delta^2)/(2 + 2\delta + 2\delta^2)$).

As in Section 2, there are two products, chocolate, $(q, -q, p_S)$, and an apple, $(-q, q, p_A)$, and we compare the apple's promotion campaign with a campaign demoting the chocolate. The former campaign renders the apple's healthiness salient at the second stage, while the latter campaign renders the chocolate's unhealthiness salient. At the next stage, however, health and taste are equally salient while the price may be the most or the least salient attribute of the products. However, in any case our results in Section 3 remain valid. In particular, the higher a campaign's persistence γ , the more effective is the respective campaign. Therefore, the campaign which demotes the chocolate remains more effective than the promotion of the apple.

3.4.3 Heterogeneity in Products' Attributes

Suppose attributes, but not goods are balanced, i.e., chocolate is given by vector $(q, -q')$ and the apple is described by vector $(-q, q')$ for $q, q' \in \mathbb{R}^+$.¹² Then, the

¹²Under this specification, we call attributes balanced as they take, on average, the same value (i.e., 0). Goods, however, are not balanced as the sum of attribute values differs among

information campaign's effect depends on the difference $q - q'$. If q' exceeds q , then both information campaigns are futile as the chocolate's unhealthiness and the apple's healthiness are salient at the third stage anyway. In that case, the location of the indifferent consumer is independent from the campaign's persistence γ . Thus, in the following, we assume that q exceeds q' such that at the third stage the attribute "tastiness" is salient. If the chocolate is demoted, then the chocolate's unhealthiness is salient at the second stage, so that the indifferent consumer w^S is obtained by

$$\begin{aligned} & \gamma_S \left(\frac{2\delta}{1+\delta} q w^S - \frac{2}{1+\delta} q' (1 - w^S) \right) + (1 - \gamma_S) \left(\frac{2}{1+\delta} q w^S - \frac{2\delta}{1+\delta} q' (1 - w^S) \right) \\ &= -\frac{2}{1+\delta} w^S q + \frac{2\delta}{1+\delta} (1 - w^S) q', \end{aligned}$$

which gives

$$w^S = \frac{q'(\gamma_S + 2\delta - \gamma_S\delta)}{2\delta q' + 2q - \gamma_S\delta q' - \gamma_S q + q\gamma_S\delta + \gamma_S q'}. \quad (3.7)$$

In contrast, similar calculations show that the promotion of the apple gives the indifferent consumer's location at

$$w^A = \frac{q'(\gamma_A + 2\delta - \gamma_A\delta)}{2\delta q' + 2q - \gamma_A\delta q' - \gamma_A q + q\gamma_A\delta + \gamma_A q'}. \quad (3.8)$$

Due to $\gamma_S > \gamma_A$ (*Assumption 1*), the demotion of the chocolate is more effective, that is, $w^C > w^A$. The derivatives of w^A and w^S with respect to γ , to q and to q' yield the intuitive results that both campaigns are more effective, i.e., $\mathcal{C}_I \setminus \mathcal{C}_A$ is larger, if γ is larger, if q is smaller, or if q' is larger (c.p.).

If the symmetry is such that goods, but not attributes are balanced, that is chocolate is given by $(q, -q)$ and the apple is given by $(-q', q')$, then both goods are assessed rationally at the third stage as all good's attributes are equally salient within $C_2 := \{(0, 0), (-q', q'), (q, -q)\}$.¹³ The indifferent consumers under

the goods, i.e. $q - q' \neq -q + q'$ as long as $q \neq q'$.

¹³This follows from a salience function's homogeneity of degree zero; none of the chocolate's attributes is salient, $\sigma(q, q - q') = \sigma(-q, -q + q')$, and none of the apple's attributes is salient, $\sigma(-q', q - q') = \sigma(q', -q + q')$.

the two campaigns are given by

$$w^S = \frac{\gamma_S q + q' + q'\delta + q + q\delta - q\gamma_S\delta}{2(1+\delta)(q+q')},$$

$$w^A = \frac{\gamma_A q' + q + q\delta + q' + q'\delta - q'\gamma_A\delta}{2(1+\delta)(q+q')}.$$

Here, the demotion of the chocolate is not always more effective, which perfectly makes sense. If the healthiness of the apple is relatively large compared to the chocolate's unhealthiness, it is reasonable to assume that a promotion of the apple has a larger influence than a demotion of the chocolate as the chocolate's attribute values are rather unremarkable. In detail, we find that the demotion of the chocolate is more effective than the promotion of the apple, $w^S > w^A$, if and only if

$$\frac{q\gamma_S}{q'\gamma_A} > 1.$$

If $\gamma_S = \gamma_A$, then the information campaign should focus on the product with the more extreme attributes. If $\gamma_S > \gamma_A$ (which we impose in *Assumption 1*), then q' has to be remarkably higher than q in order to make the promotion of the apple more effective than the demotion of the chocolate.

Lemma 2. *If attributes, but not goods are balanced, the demotion of the chocolate is more effective, i.e., $w^C > w^A$, as long as Assumption 1 holds. If goods, but not attributes are balanced, the demotion of the chocolate is more effective than the promotion of the apple ($w^C > w^A$) if and only if $q\gamma_S > q'\gamma_A$.*

3.4.4 Endogenizing the Campaign's Intensity

Whereas in the previous analysis we have assumed that the campaign's intensity (measured by δ) is exogenous, here we endogenize the campaign's intensity by assuming that the government maximizes the population's healthiness minus the campaign's costs. A campaign's costs are increasing in its intensity $\delta_I \in [0, 1]$. We assume that a consumers' susceptibility to an information campaign, denoted δ , is increasing in the campaign's intensity and can be formalized as $\delta = 1 - \delta_I$. A subject's health is defined by the health parameter of the product she consumed. The indifferent consumer after a campaign which focuses on $t \in \{A, S\}$ is given by (3.3), where her location $w^t = w^t(\delta_I)$ depends on the campaign's intensity δ_I . Therefore, the population's overall health equals $H(\delta_I) := w^t(\delta_I)q + (1 -$

$w_1^t(\delta_I))(-q)$. An information campaign's costs are assumed to be given by the strictly monotonic increasing and convex function $C(\delta_I) = \alpha\delta_I^2$ for some $\alpha \geq q$.¹⁴ Given a campaign on product t , the government solves

$$\max_{\delta_I \in [0,1]} \{H(\delta_I) - C(\delta_I)\},$$

or, equivalently,

$$\max_{\delta_I \in [0,1]} \left(2q \cdot \frac{2 + 2(1 - \delta_I) - (1 - \delta_I)\gamma_t + \gamma_t}{4 + 4(1 - \delta_I)} - q - \alpha\delta_I^2 \right),$$

which yields the first-order condition

$$\frac{q\gamma_t}{(2 - \delta_I)^2} = 2\alpha\delta_I. \quad (3.9)$$

This equation has a unique solution $\delta_I^* \in [0, 1]$.¹⁵ Reasonably, δ_I^* is increasing in the persistence γ_t .¹⁶ Straightforward computations yield that for a fixed cost function the larger q (provided $\alpha \geq q$), the larger the respective equilibrium campaign intensity is.

To sum up, the unhealthier the product is and the more persistent valuations evoked by the campaign are, the more the government will spend on the campaign. If *Assumption 1* holds, the government will spend more on a campaign demoting the chocolate than on a campaign promoting the apple. The following lemma summarizes the results.

Lemma 3. *If a campaign's intensity is endogenous, the government will invest more in a demotion than in a promotion campaign as long as Assumption 1 holds. Furthermore, a campaign's intensity increases in the chocolate's unhealthiness and*

¹⁴We make the restriction of sufficiently high campaign costs, i.e., $\alpha \geq q$, to guarantee the existence of an inner solution of the maximization problem the government faces.

¹⁵Consider $H'(\delta_I) = \frac{q\gamma_t}{(2-\delta_I)^2}$ and $C'(\delta_I) = 2\alpha\delta_I$. Since both functions are strictly monotonically increasing, continuous, convex and $H'(0) > C'(0)$, but $H'(1) \leq C'(1)$, and $H''(\delta_I) = \frac{2q\gamma_t}{(1-\delta_I)^3} < 2q\gamma_t \leq 2q \leq 2\alpha = C''(\delta_I)$ for $0 \leq \delta_I < 1$, the solution to Equation (3.9) exists and is unique.

¹⁶Note first, that the function $\delta_I(2 - \delta_I)^2$ is strictly monotonic increasing on $[0, 2/3]$. Denote by $\delta_I(\gamma_t, \alpha, q)$ the equilibrium campaign intensity given by (3.9). We obtain $\cup_{\gamma_t \in [0,1]} \{\delta_I^*(\gamma_t, 1, 1)\} \subseteq [0, \hat{\delta}]$ for $\hat{\delta} = 4/3 - 2/3(\sin(\phi + \pi/6) + \sin(-\phi + \pi/3)\sqrt{3}) \approx 0.14$ with $\phi := 1/3 \arctan(\sqrt{999/25})$. Provided $\alpha \geq q$, we obtain $\cup_{\gamma_t \in [0,1]} \{\delta_I^*(\gamma_t, \alpha, q)\} \subseteq \cup_{\gamma_t \in [0,1]} \{\delta_I^*(\gamma_t, 1, 1)\}$, so that for $0 \leq \gamma_t^1 < \gamma_t^2 \leq 1$ the respective equilibrium campaign intensities fulfil $\delta_I^*(\gamma_t^1, \alpha, q) < \delta_I^*(\gamma_t^2, \alpha, q)$.

in the valuation-persistence.

3.5 Conclusion

We apply the theory of salience (Bordalo *et al.*, 2012a,b; 2013) to the current debate in consumer policy how to shift demand from unhealthy (chocolate) to healthy (apple) food. The government may initiate an information campaign which either stresses one product's unhealthiness (*demotion campaign*) or emphasizes the other product's healthiness (*promotion campaign*). Under the influence of the campaign, people undervalue the chocolate due to its pronounced unhealthiness or overvalue the apple due to its emphasized healthiness. Later on, confronted with all available alternatives, consumers assess products rationally. A good's final valuation, however, is a convex combination of its previous valuations such that the promotion of the apple leads to an overall overvaluation of the apple, whereas the demotion of the chocolate causes a final undervaluation of the chocolate. Consequently, both campaigns reduce the share of unhealthy diets by making some people switch to apples.

Whereas both campaigns work, the campaign focusing on the chocolate's downsides is more effective. Consumers's actual preferences determine their consumption history, and consumption experience makes consumers familiar with the respective product, i.e., with chocolate or the apple. Crucial is our assumption that people are more susceptible toward information on goods they are familiar with and which they have consumed in the past. Thus, the effect of the campaign is larger if it focuses on that product which has been consumed by the target audience in the past. Thus, for people who have consumed chocolate, the demoting campaign's adverse effect on the valuation of chocolate outweighs the promotion campaign's positive effect on the valuation of apples. It remains for future research to investigate the relative effectiveness of promoting and demoting campaigns empirically.

Our results are applicable to the realm of comparative advertising in two-product markets. In particular, they yield very different results for new and for established markets.¹⁷ Consider a firm which engages in advertising in order to

¹⁷There is a broad literature analyzing the effect of counteradvertising and comparative advertising (for an empirical investigation see Zucker, Hopkins, Sly, Urich, Kershaw and Solari, 2000, 2001; for an experimental investigation, see Gorn and Weinberg, 1984). However, findings were mixed (see Muehling, Stem and Raven, 1989; Pechmann and Stewart, 1990).

gain market share. According to our model, the demotion of the competing product may be more successful than the promotion of the own good's advantages. However, this finding relies on the assumption that people are familiar with one product of the market. If people do not have a consumption history, then there is no difference in both campaign's effects. The demoting advertisement has a relatively large effect only on those consumers who are used to consuming the rival product. A comparative advertisement campaign focusing on the rival products' downsides may be particularly successful in established markets, in which an incumbent firm or a new entrant intends to gain market share by making consumers switch. This is practiced, for instance, on the German market for giro accounts, where entrant firms advertise the incumbent firms' high prices. However, on new markets, where consumers are not familiar with some product, both advertisement campaigns are equally successful. In all cases, such campaigns are most efficient which could combine features of both benchmark campaigns, i.e., which proclaim the own product's upsides and the rival's product's downsides.

Chapter 4

Merger Remedies in Oligopoly under a Consumer Welfare Standard

Co-authored by Christian Wey

4.1 Introduction

Remedies are increasingly applied by antitrust agencies (in short: AA) in the US and EU to clear merger proposals which are otherwise subject to serious anticompetitive concerns (see FTC, 1999, EU, 2006, and OECD, 2011, for recent remedy reviews). The US Horizontal Merger Guidelines and the EU Merger Regulation allow for remedial offers to address competitive concerns (see DoJ, 2010, and EU, 2004, respectively). Accordingly, remedies are offered by the merging parties to effectively restore competition and to remove any competition concern the AA may have.

We analyze the impact of remedies on (horizontal) merger activity in oligopolistic industries if the AA follows a consumer surplus standard; that is, the AA blocks mergers which lower consumer surplus.¹ We focus our analysis on such

¹This is in line with recent Industrial Organization literature (e.g., Nocke and Whinston, 2010) which takes the consumer surplus standard for granted. For instance, Whinston (2007)

industries which are characterized by barriers to entry and where the amount of productive assets can be regarded as fixed. In these industries, divestitures of critical assets by the merging firms to a competitor firm can be used to increase market competition by reallocation (“structural remedies”).² Mergers are assumed to produce scale economies (resulting from combining the capital of the merging firms) and synergies (which directly reduce marginal production costs). Thus, a merger can be desirable from a consumer perspective when the merger synergies are sufficiently large.³ If synergies fall short of a certain threshold value, approval by the AA can be achieved with the use of remedies; i.e., physical asset sales to rival firms.

The possibility of clearing a merger conditional on remedies is shown to enlarge the set of profitable and acceptable mergers. More importantly, if a divestiture is necessary to keep prices from rising, then under reasonable conditions the merging parties will propose a divestiture which is price-restoring; i.e., the pre-merger price equals the post-merger price. Therefore, any merger which involves such a structural divestiture is *externality-free* because it leaves consumer surplus and outsiders’ profits unchanged.⁴ It follows that the consumer surplus standard ensures that mergers are only implemented if they increase social welfare. If the merging parties can extract the entire surplus from the asset sale, then the socially optimal buyer will be selected given a consumer standard. The reason is that the merged entity becomes the residual claimant in the asset sales process, so that the choice of the buyer firm maximizes both the merged firm’s profit and

states that the AA’s “enforcement practice in most countries (including the US and the EU) is closest to a consumer surplus standard.” Davies and Lyons (2007) emphasize that AAs have no mandate to use merger review for industrial policy purposes. Hence, remedies should only be applied if there is a threat to competition.

²For example, in the retailing sector divestitures concern suitable property and branches which are largely fixed in the industry. A similar role is taken by gasoline stations in the petroleum industry, by landing slots in the airline industry, and by spectrum in the mobile phone industry. In all these examples, the critical assets are largely fixed for some time period, but may change in the longer run because of innovations or entry. Antitrust authorities consider the “foreseeable” future in their decisions (which is typically confined to the next 1-2 years), so that the capital stock in the mentioned industries is usually regarded as fixed. As a consequence, the respective assets also qualify as divestitures which can counter anticompetitive merger effects already right after the execution of the merger.

³Our analysis is placed in a Cournot setting in which synergies are necessary to make consumers not worse off after the merger (see Farrell and Shapiro, 1990a; Spector, 2003; Vergé, 2010).

⁴Outsider firms remain unaffected by the merger as their optimal quantities do not change when the price stays put.

social welfare. These insights reveal a new efficiency rationale of the seemingly inefficient consumer surplus standard (or “price test”) which ignores changes in profits, and hence, total welfare.

Our model takes care of the following two remedy principles which are stated both in EU and US regulations (see, EU, 2008, and DoJ, 2011, respectively): *First*, the remedy is designed and proposed to the AA by the merging firms, while the AA can either reject or accept the offer. *Second*, the remedy must be proportional to the competitive concern (see EU, 2004, Article 30). The first property says that the merging firms are supposed to design a *fix-it-first remedy* which they have to propose to the AA before it decides about the merger proposal.⁵ Accordingly, we assume that the merging parties have to determine the remedial divestiture and the buyer firm to the AA in advance. Thereafter, the buyer firm either accepts or rejects the proposal. The second property is derived endogenously; in equilibrium, an approvable remedy is always such that its size is proportional to the anticompetitive effects of the full merger proposal. Hence, lower synergies and/or larger capital stocks of the merging firms must induce a larger divestiture to make the merger approvable. Moreover, when the anticompetitive concern increases (either because of lower synergies or because of larger capital stocks of the merging firms), then the scope for mergers approved conditional on remedies is reduced.

We extend our model by comparing the merger outcomes under different selling mechanisms which determine the extent of rent-extraction. If the merging firms’ must sell the divestiture at a fixed price (i.e., rent-extraction is limited), then in equilibrium it is sold to the weakest competitor (that is, typically, the smallest outsider firm). If a price-restoring remedy is sold through an auction, it will be acquired by the incumbent competitor with the highest willingness to pay. In general, only perfect selling power (or efficient bargaining between the parties) ensures that the divestiture is acquired by the socially efficient buyer. Fix-it-first remedies create “take-it or leave-it” power for the merging firms in the asset sales process because a rejection by the buyer puts the entire undertaking at risk. Thus, we provide a novel rationale for the efficiency of *fix-it-first remedies* which are favored both by the EU and the US merger guidelines.

⁵The rules are different in the second stage of the merger processes in the US and the EU (see, for instance, Wood, 2003, for a comparison of the US and EU merger control systems and the role of remedies therein, and Farrell, 2003, who describes the remedy settlement as a bargaining process between the merging parties and the AA).

We also examine remedy-dependent synergies such that the acquirer of the assets realizes synergies on its own or if the realized synergy of the merged firm decreases when assets have to be divested. In the former case, small divestitures which are price-decreasing become possible if the realized synergy of the acquiring firm is relatively large. In the latter case, the scope for approvable divestitures is reduced, but we show that our main results remain qualitatively valid.

Our paper contributes to the analysis of mergers in Cournot oligopoly when productive capital in an industry is fixed (Perry and Porter, 1985; Farrell and Shapiro, 1990a,b; McAfee and Williams, 1992). This approach was applied to structural remedies in Medvedev (2007), Vergé (2010), and Vasconcelos (2010). All the latter three works refer to specific Cournot oligopoly models and they invoke specific assumptions concerning functional forms. Vergé (2010) disregards merger synergies. It is shown that only under very restrictive assumptions a re-allocation of productive assets through structural remedies may increase consumer surplus. Medvedev (2007) shows for a three-firm oligopoly that remedies in association with merger synergies extend the scope for approvable mergers. Vasconcelos (2010) analyzes remedies for the case of a four-firm oligopoly when merger synergies are possible. Each firm owns one unit of capital and a firm's capital is indivisible. It is assumed that the AA restructures the industry optimally in order to maximize consumer surplus, which is crucial when there are at least three firms involved in a merger. In these instances an “over-fixing” problem associated with remedial divestitures may emerge (see also Farrell, 2003). Over-fixing unfolds adverse effects because a firm may abstain from proposing a (socially desirable) merger with two other firms as the acquirer expects, and correctly so, that the AA will use its power to sell one of the acquired firms to the remaining competitor. Consequently, the acquirer may strategically propose a one-firm takeover which can be worse from a consumer point of view than allowing a takeover of the two other firms.

Cabral (2003) analyzes mergers in a differentiated industry with free entry. When assets are sold to an entrant firm as a remedy then a “buy them off” effect follows, which means that an entrant firm is dissuaded from opening a new store (or introducing a new product variant). This effect may work against the interest of consumers, who are better off the more variants are offered in the market. Chen (2009) analyzes mergers in a three-firm oligopoly model of dynamic capital accumulation. A merger may then have long-run effects that are worse than its

short-run effects. We disregard the issue of endogenous entry and endogenous capacities as the capital is assumed to be fixed in the industry.

Our analysis also adds to the literature which identifies circumstances such that a consumer surplus standard is preferable in competition policy (Besanko and Spulber, 1993, Neven and Röller, 2005, and Armstrong and Vickers, 2010). In contrast to existing theories, our point is that a consumer standard in merger control leads to socially efficient remedial divestitures.

The impact of remedies on the effectiveness of merger control has also been investigated empirically (see Duso, Gugler and Yurtoglu, 2011, and Duso, Gugler and Szücs, 2013, for the EU and Clougherty and Seldeslachts, 2013, for the US).⁶ These works use event studies which identify the anticompetitive effect of a merger by abnormal stock market returns of competing firms. Overall, the results appear to indicate that an upfront-buyer remedy tends to restore the pre-merger competitive situation.

We proceed as follows. Section 2 presents the basic model. In Section 3 we conduct the merger analysis for two different merger control regimes depending on whether or not remedies are feasible. Section 4 presents extensions of our model before Section 5 concludes.

4.2 The Model

We analyze the effects of remedies in a Cournot oligopoly with homogeneous products by extending the analysis of Farrell and Shapiro (1990a). There are $n \geq 3$ firms indexed by $i \in I = \{1, \dots, n\}$. All firms produce a homogeneous good with inverse market demand given by a twice differentiable function $p(X)$, where p is price, X is industry output, and $p'(X) < 0$. Firm i 's production costs depend on its output level, x_i , and the capital stock, k_i , it uses for production. Total productive capital of the industry, $\bar{K}$, is fixed and distributed among the firms in the industry; i.e., $k_i > 0$ for all $i \in I$ and $\sum_{i \in I} k_i = \bar{K}$. Firm i 's total production cost function is given by $c^i := c^i(x_i, k_i)$.⁷ We invoke the standard assumption that additional capital lowers the cost and the marginal cost curve; i.e., $c_k^i < 0$ and $c_{xk}^i < 0$. Firms set their output levels simultaneously (Cournot competition).

⁶Ormosi (2012) analyzes major EU merger cases and shows that remedial offers and efficiency claims are often strategic to avoid costly delay in litigation processes.

⁷We abbreviate a function's partial derivative by indexing the respective variable; for instance $c_x^i \equiv \partial c^i(x_i, k_i) / \partial x_i$.

Each firm i maximizes its profit $\pi_i = p(X)x_i - c^i(x_i, k_i)$ given its rivals' outputs, which yields the first-order conditions

$$p(X) + x_i p'(X) - c_x^i(x_i, k_i) = 0, \text{ for all } i \in I. \quad (4.1)$$

In a Cournot equilibrium, (4.1) holds for all firms $i \in I$. From (4.1) it follows that firm i produces a larger quantity than firm j if and only if its marginal production costs are lower; i.e., $c_x^i < c_x^j$ holds. We assume that each firm's reaction function slopes downward with a slope between -1 and 0 , for which it is sufficient to assume that⁸

$$p'(X) + x_i p''(X) < 0 \quad \text{holds for all } i \in I. \quad (4.2)$$

The AA applies a consumer standard when evaluating a merger proposal. Therefore, a merger is approved if and only if the post-merger price level does not exceed the pre-merger equilibrium price p^* . We distinguish two different merger control regimes, depending on whether or not remedies are feasible.⁹

- *No-remedy regime* (in short: *NR*): If the merger guidelines do not allow for a remedial divestiture, then the AA can either approve or block the merger proposal altogether.
- *Remedy regime* (in short: *R*): The merger guidelines allow for an approval conditional on a divestiture to a competitor if it counters any price-increasing effect of the proposed merger.

We examine a bilateral merger with firm i being the acquirer and firm j the target firm. Firms i and j merge if the merged entity's profit does not fall short of the sum of the pre-merger profits. A merger allows to recombine the capital of the merging firms to explore economies of scale.¹⁰ If firms i and j merge, they generate a synergy, which is measured by the parameter $s := s(i, j) \in [0, 1]$. The synergy rotates the cost function downward such that marginal costs for a given

⁸Inequality (4.2) holds if the industry demand curve satisfies $P''(X)X + P'(X) < 0$. It is a standard assumption in Cournot analysis and guarantees the existence of a unique Cournot equilibrium when marginal costs are non-decreasing.

⁹Throughout the analysis we assume that the AA can only impose a remedy on the merging firms that the parties themselves propose. This mirrors legal practice in the EU and in the US (see EU, 2006/2008, and DoJ, 2011).

¹⁰After the merger it is optimal to bring all the new entity's capital together rather than leaving it divided among the plants of the pre-merger configuration which is optimal because of $c_{xk} < 0$ (see also Farrell and Shapiro, 1990b, p. 113).

level of output are lowered. More precisely, the merged firm $M = M(i, j)$ (which combines the assets of firms i and j) produces with the cost function $c^M(x, k, s)$, where k denotes the merged firm's capital, possibly reduced by divested assets. Let $c^M(x, k, s)$ be continuous in s with $c^M(x, k, 1) = c^i(x, k)$ and $c^M(x, k, 0) = 0$. Perfect synergies ($s = 0$) imply that the firm's costs are reduced to zero, while the absence of any synergies ($s = 1$) implies that the merged firm produces with the pre-merger cost function $c^i(x, k)$. We assume that the synergy reduces marginal production costs,

$$\partial c_x^M(x, k, s)/\partial s > 0 \quad \text{holds for all } x, k > 0.$$

Let $0 \leq \sigma \leq k_j$ denote the share of firm j 's capital which stays under control of the merged firm M after a possible divestiture.¹¹ Accordingly, $k_j - \sigma$ is the share of firm j 's capital which goes as a divestiture to another firm, say firm l . Let I_M denote all firms which are active after the merger; i.e., $I_M := I \setminus \{i, j\} \cup M$. Furthermore, denote the total pre-merger equilibrium quantity by X^* and the post-merger equilibrium quantity by $X^s(k_j - \sigma)$, the latter depending on the divestiture level $k_j - \sigma$ and synergy level s .

We impose two independence conditions on the interplay between the synergy level and the remedy. *First*, we assume that the synergy level $s(i, j)$ is unaffected by the size of the divestiture. *Second*, the buyer of the assets does not realize any synergies.¹² Consequently, the merged entity faces overall costs of $c^M(x_M, k_i + \sigma, s)$, while firm l operates with the cost function $c^l(x_l, k_l + k_j - \sigma)$.¹³

In addition, we invoke two more assumptions concerning firms' cost functions. *First*, all firms (except the merged firm) have access to the same technology.¹⁴ *Second*, all firms (including the merged firm) have constant marginal costs.¹⁵

¹¹We suppose that the acquirer divests parts of the target firm's assets if the AA requires a remedy to approve the merger. We could also assume that the authority requires that parts of the acquirer's assets are divested, which would not change the results of our analysis.

¹²Below, we discuss how our results change if we relax each of these requirements.

¹³In our model, the effects of a structural remedy are not burdened with uncertainties which may play a role in practical merger control (see Davies and Lyons, 2007).

¹⁴This assumption implies that asymmetries among firms (apart from the merged firm) only depend on the amount of productive assets they own. It allows to perform a comparative static analysis with regard to the equilibrium divestiture level.

¹⁵Even though this assumption restricts the generality of our results, the constant-marginal cost case is important in itself. In fact, many results obtained in the merger literature (for instance, Salant, Switzer and Reynolds, 1983, and Nocke and Whinston, 2010) are based on constant marginal costs.

Specifically, we suppose that each firm $i \in I$ produces with the cost function

$$c^i(x_i, k_i) = \frac{x_i}{k_i} \quad (4.3)$$

prior to the merger. If firms i and j merge to form the merged entity M , they realize the synergy level s and (possibly) divest $k_j - \sigma$ to firm l . The merged firm's cost function is then given by

$$c^M(x, k_i + \sigma, s) = \frac{sx}{k_i + \sigma}, \quad (4.4)$$

while the acquiring firm l produces with the pre-merger cost function

$$c^l(x, k_l + k_j - \sigma) = \frac{x}{k_l + k_j - \sigma}. \quad (4.5)$$

Note that the synergy level s enters the merged firm's cost function (4.4) in multiplicative form, so that $c^M(x, k, 1) = c^i(x, k)$ and $c^M(x, k, 0) = 0$ follow. We analyze the following merger game under the NR and the R regime: In the first stage, firms i and j decide whether or not to propose a merger to the AA. If they decide to merge, they can also specify a divestiture under regime R which they sell to a competing firm $l \in I \setminus \{i, j\}$. In the second stage, the AA either approves or blocks the merger proposal according to a consumer standard. In the third stage, firms compete à la Cournot.

4.3 Merger Analysis and Main Results

First, we examine how a change in capital $d\mathbf{k} := (dk_1, \dots, dk_n)$ affects equilibrium quantities $d\mathbf{x} := (dx_1, \dots, dx_n)$. Following Farrell and Shapiro (1990a), the total derivative of firm i 's first-order condition with respect to X and k_i can be written as¹⁶

$$dx_i = -\lambda_i dX + \delta_i dk_i, \quad (4.6)$$

where

$$\delta_i := \delta_i(k) := \frac{c_{xk}^i}{p'(X)} > 0 \quad (4.7)$$

¹⁶Note that we assume $c_{xx} = 0$ which simplifies the expressions below when compared with the corresponding expressions in Farrell and Shapiro (1990a).

and

$$\lambda_i := \frac{p'(X) + x_i p''(X)}{p'(X)} > 0. \quad (4.8)$$

The variable δ_i gives the direct effect of capital k_i on firm i 's output x_i and λ_i denotes firm i 's equilibrium responsiveness to changes in price. There is a direct relationship between λ_i and the slope of firm i 's reaction function R_i which is given by $\lambda_i = -R_i/(1 + R_i)$ (see Farrell and Shapiro, 1990a). Summing up Condition (4.6) for all firms yields the following lemma (see Farrell and Shapiro, 1990a, Prop. 2).¹⁷

Lemma 1 (Effects of selling units of capital). *A sale of a small amount of capital from firm j to firm l increases industry output and reduces the market price if and only if $\delta_l > \delta_j$.*

Lemma 1 gives a necessary and sufficient condition under which small asset sales to a rival firm increase consumer surplus. Our main analysis builds on this local result and investigates under which circumstances the divestitures of a merged firm can restore the pre-merger industry output.

Second, we impose a condition under which a merger satisfies the consumer standard at least if the realized synergy is maximal ($s = 0$). A merger between firms i and j , which creates synergies s , leads to an output level of the merged firm that is weakly larger than the sum of the firms' outputs before the merger if and only if¹⁸

$$c_x^i + c_x^j - c_x^M \geq p(X^*). \quad (4.9)$$

Using the cost functions (4.3) and (4.4), Condition (4.9) becomes

$$\frac{1}{k_i} + \frac{1}{k_j} - \frac{s}{k_i + k_j} \geq p(X^*). \quad (4.10)$$

This condition is more likely to be fulfilled if the merging firms' capital stocks, k_i and k_j , are not too large. Or, conversely, the smaller the merging firms are, the more likely the consumer surplus standard is met. Similarly, Condition (4.10) is more likely to be fulfilled the lower the value of the synergy parameter s becomes. In the following, we assume that Condition (4.10) is fulfilled when the merger synergies are maximal.

¹⁷We present all omitted proofs in the Appendix.

¹⁸See Farrell and Shapiro (1990b), Prop. 1, p. 112.

Assumption 1. *A merger between firms i and j increases the industry output if the merger synergies are maximal; i.e., Condition (4.10) holds at $s = 0$.*

4.3.1 Merger Outcomes With and Without Remedies

No-remedy regime (NR). Under the no-remedy regime, the AA can only clear or reject a merger proposal in its entirety. Hence, if a merger is approved, then $\sigma = k_j$ holds. We obtain the following lemma according to which mergers are approved if and only if the generated synergy does not fall short of a certain threshold value.

Lemma 2 (Full mergers). *Suppose a no-remedy regime (NR). Then, there exists a unique synergy level $\bar{s} := \bar{s}(i, j) \in [0, 1]$, such that a merger of firms i and j does not reduce industry output X^* if and only if $s \leq \bar{s}$. Hence, the AA approves a merger proposal between firms i and j if and only if $s \leq \bar{s}$. Such a merger is strictly profitable for the merging firms.*

The critical synergy level $\bar{s}$ equals the synergy level for which Condition (4.10) holds with equality; i.e., it is the synergy level for which consumer surplus does not change after the merger. Lemma 2 then makes use of the fact that for $s \leq \bar{s}$ the merged firm produces more than both firms i and j together before the merger (with equality holding at $s = \bar{s}$). This implies that the market price does not increase and consumers are not worse off after the merger. Moreover, profitability of the merger follows from noticing that the merged firm's production costs are reduced over all output levels because of the increased productive capital and the realized synergy. According to Lemma 2, only mergers with relatively large synergies can pass the decision screen of the AA. If the synergy level falls short of the critical value (i.e., $s > \bar{s}$ holds), then the post-merger price increases, in which case the AA blocks the merger proposal altogether.

The critical synergy level $\bar{s} = \bar{s}(i, j)$ depends on the capital stocks k_i and k_j . The left-hand side of Condition (4.10) monotonically decreases in the parameters s , k_i and k_j , while the right-hand side does not depend on these parameters. Hence, larger values of k_i and/or k_j imply a lower value of the critical synergy level $\bar{s}$. Precisely, $\bar{s}(i', j) < \bar{s}(i'', j)$ if $k_{i'} > k_{i''}$ and $\bar{s}(i, j') < \bar{s}(i, j'')$ if $k_{j'} > k_{j''}$. Intuitively, this result depends on the fact that the price-raising effect of a merger increases when the merging firms are larger. In addition, a merger of relatively small firms creates a more competitive firm which tends to intensify competition

with existing larger firms. Therefore, the critical synergy level $\bar{s}$ decreases in the size of the merging firms. It is also noteworthy that the critical synergy level, $\bar{s}$, neither depends on the capital stocks of the outsider firms nor on their distribution. The reason is that the merger does not affect the price level at $s = \bar{s}$ such that the outsider firms' equilibrium quantities remain unaffected by the merger.

Remedy regime (R). With a remedy rule at hand, the AA can make a merger proposal conditional on structural remedies. According to the consumer surplus standard, the AA will accept all remedial offers which offset the price-increasing effect of reduced competition. It follows from Lemma 2 that remedies become relevant if the synergy parameter s is larger than $\bar{s}$. In those instances, the merged firm may offer to divest a share of the target firm's capital, $k_j - \sigma$, which suffices to lower the market price or to keep it at the pre-merger level.

Lemma 3 (Approvability). *Suppose a remedy regime R . If a merger between firms i and j yields relatively large synergies with $s \leq \bar{s} := \bar{s}(i, j)$, it is approved without a remedy. For lower synergy levels, $s > \bar{s}$, there exists a unique threshold value $\bar{s}^R \geq \bar{s}$, such that any merger proposal with $s \in (\bar{s}, \bar{s}^R]$ is approvable with a certain divestiture level. For merger proposals with $s > \bar{s}^R$, no divestiture level exists which would induce the AA to approve the merger.*

Typically, $\bar{s}^R > \bar{s}$ holds, such that the feasibility of remedies strictly increases the scope for mergers. Then there is an interval of synergies $(\bar{s}, \bar{s}^R]$ for which divestitures exist that resolve the AA's anticompetitive concerns such that a merger between firms i and j becomes approvable. If, however, the created synergy is too low (i.e., $s > \bar{s}^R$), then divestitures cannot outweigh the merger's anticompetitive effects.

In fact, the proof of Lemma 3 reveals that remedies strictly increase the scope for mergers (i.e., $\bar{s}^R > \bar{s}$) if and only if

$$k_i + k_j > \sqrt{\bar{s}} \min_{l \in I \setminus \{i, j\}} \{k_l\} \quad (4.11)$$

holds. Condition (4.11) ensures that there is a firm l for which the direct effect of capital on output is larger than for the merged firm M , that is, for which $\delta_l(k_l) > \delta_M(k_i + k_j)$ holds. In that case, selling assets of M to firm l increases industry output and therefore increases the scope for mergers. In particular,

(4.11) holds if the merged entity M is not the smallest firm in the market. If, however, there exists a firm which is smaller than M , then competition can be strengthened through selling capital to this firm.

Note that approvable remedies are most likely to exist for small buyer firms. To see this, assume that firms i and j merge and divest $k_j - \sigma$ to some firm l . Denote the sum of firms' post-merger marginal costs as $MC := \sum_{m \in I_M} c_x^m$. Summing up firms' first-order conditions yields

$$p'(X)X + (n-1)p(X) = MC. \quad (4.12)$$

The left-hand side of (4.12) is decreasing in X due to Condition (4.2). Thus, the equilibrium industry output is the larger the smaller the sum of firms' marginal costs becomes (given that the number of active firms stays constant). Consequently, if the divestiture $k_j - \sigma$ is approvable for buyer firm l , then this divestiture is also approvable for buyer firm l' as long as firm l' is smaller than firm l ; i.e., as long as $k_{l'} \leq k_l$ holds. In particular, there is a certain threshold value $\tilde{k} \in \{k_l | l \in I \setminus \{i, j\}\}$, such that there exists an approvable divestiture to be sold to firm l if and only if $k_l \leq \tilde{k}$.

So far we have discussed the approvability of mergers involving divestitures. Next, we examine the profitability of a merger which involves divestitures to a competitor. For the remainder of this section, we assume that the merging firms have full bargaining power in the asset sales process.

Assumption 2. *The merged firm can make take-it or leave-it offers to each firm in the market. It can also tailor the divestiture level to each buyer.*

Suppose that a merger involves divestitures to ensure its approval by the AA. The following lemma states that if the synergy is such that an approvable merger (possibly involving a divestiture) exists, then there exists also an approvable and profitable merger for the same synergy level.¹⁹

Lemma 4 (Profitability). *Suppose a remedy regime R . A profitable and approvable merger generating synergy s (possibly with a remedy) exists if and only if $s \leq \bar{s}^R$.*

The critical value $\bar{s}^R$ is derived from the approvability condition. As for

¹⁹This result depends on Assumption 2. If the merged firm does not have perfect selling power, then the profitability condition may restrict the range of synergy parameters for which approvable and profitable divestiture levels exist.

any merger with synergies $s \in (\bar{s}, \bar{s}^R]$ there exists a divestiture which ensures approvability, there is also always a divestiture level which is price-restoring for the same synergy level. Given such a price-restoring divestiture level, the merger is always profitable because of its cost-reducing effect and because of Assumption 2 according to which the merged firm can extract all gains from trade from the buyer firm.

How the exact value of $\bar{s}^R$ depends on the capital that the merger combines (i.e., $k_M := k_i + k_j$), hinges on the following trade-off. On the one hand, the larger the merging firms' capital stocks are, the lower is the industry output after a full merger for a given synergy level s . To see this, we compare the sum of all firms' marginal costs after a merger of firms i' and j and after a merger of firms i'' and j , where $k_{i'} > k_{i''}$; i.e., firm i' being larger than firm i'' . Denote the former sum by $MC(i', j)$ and the latter sum by $MC(i'', j)$, respectively. Comparing both sums gives

$$MC(i', j) - MC(i'', j) = \frac{s}{k_{i'} + k_j} + \frac{1}{k_{i''}} - \left(\frac{s}{k_{i''} + k_j} + \frac{1}{k_{i'}} \right) > 0.$$

As the industry output is the larger the lower the sum of marginal costs MC , a full merger between firms i' and j induces a lower post-merger output level than the merger between firms i'' and j . Thus, *ceteris paribus*, the larger the merging firms' capital, the larger is the market power effect which tends to reduce the value of $\bar{s}^R$.

On the other hand, the larger the merging firms are, the larger is the quantity which can be restored through a divestiture to a rival firm. This can be seen from Lemma 1. If the direct effect of capital on output is smaller for the merged firm than for the buyer firm (i.e., $\delta_M < \delta_l$), then divesting capital increases the total output until $\delta_M = \delta_l$. The divestiture to firm l which maximizes industry output is then given by

$$k_j - \bar{\sigma} = \frac{1}{\sqrt{s} + 1} (k_i + k_j - \sqrt{s}k_l). \quad (4.13)$$

The size of $k_j - \bar{\sigma}$ increases in $k_M = k_i + k_j$, but decreases in the capital stock k_l of the buyer firm. The larger the divestiture (as long as it does not surpass $k_j - \bar{\sigma}$ in size), the larger is the restored output level. Therefore, we can conclude that both the merger's anticompetitive effect and the quantity which can be restored through a divestiture increase when the combined capital of the merging firms

increases. Which of these effects dominates depends on the shape of the demand function and on the capital stocks of the firms.

We summarize our results concerning the merger outcome under regime R as follows.

Proposition 1 (Implementation). *Suppose a remedy regime R . Then all mergers with relatively large synergies, $s \leq \bar{s}$, are profitable and are approved without a remedy. For lower synergy levels $s \in (\bar{s}, \bar{s}^R]$, a merger with a certain divestiture exists which is approved by the AA and which is also profitable. For $s > \bar{s}^R$, no merger is implemented since there exists no remedy which could fix the AA's competitive concerns.*

Proposition 1 states that there is a monotone relationship between a merger's synergy level and the AA's final decision. Precisely, there exists a unique threshold value of the synergy level, $\bar{s}^R$, up to which mergers (possibly including a certain divestiture) are implementable. Given that Condition (4.11) holds, this threshold value strictly exceeds $\bar{s}$. If the merger synergies are too low (i.e., $s > \bar{s}^R$), then allowing for remedies does not change the AA's decision when compared with the NR regime.²⁰ If there are several potential buyer firms for which an approvable remedy exists, then the identity of the buyer firm is not determined yet. In particular, it depends on the asset sales mechanism which can vary between “full rent extraction” (Assumption 2) and “no rent extraction” (selling at a price of zero) as we will examine in detail below.

4.3.2 Social Welfare

According to Proposition 1, the introduction of remedies may change the market structure and, therefore, also social welfare (the sum of consumer surplus and producer surplus), which we denote by SW . We compare social welfare if the merger control regime allows for remedies and if it does not. The analysis in the following is restricted to synergy levels $s \in (\bar{s}, \bar{s}^R]$ for which remedies strictly increase the scope for approvable and profitable mergers.

Binding consumer surplus standard. If there is a divestiture such that the

²⁰Note that if the merged firm is forced to sell the assets at a fixed price, then Lemma 4 and Proposition 1 still hold, however, with a potentially different profitability threshold value $\bar{s}^R$. The proofs stay analogous, so that our insights do not depend qualitatively on assuming perfect selling power (Assumption 2).

consumer surplus constraint is satisfied, then (due to continuity of the cost function) there also exists at least one divestiture level such that the consumer surplus standard binds (i.e., pre- and post-merger prices are the same). We call such a divestiture level a *price-restoring divestiture*. It is externality-free as the consumer surplus and profits of those firms not involved in the merger process are unaffected and remain at their pre-merger levels. In particular, the smallest divestiture level $\min_{\sigma \in [0, k_j]} \{k_j - \sigma\}$ which satisfies the consumer surplus standard condition is such a price-restoring divestiture. While it appears to be intuitive that the merged firm should prefer not to divest more than required by the AA, this is not always the case. The next lemma states conditions under which the merged firm proposes to divest the smallest approvable divestiture which we denote by $k_j - \hat{\sigma}$.

Lemma 5 (Price-restoring divestitures). *Suppose a remedy regime R and assume $s \in (\bar{s}, \bar{s}^R]$. Then each of the following conditions is sufficient to ensure a price-restoring divestiture.*

- i) Independent of the merged firm's selling power, the merged firm proposes the minimal price-restoring divestiture $k_j - \hat{\sigma}$ if $\delta_l(k_l + k_j - \hat{\sigma}) \leq \delta_M(k_i + \hat{\sigma})$.*
- ii) If the divestiture is sold at a fixed price, then the merged firm proposes the minimal, price-restoring divestiture $k_j - \hat{\sigma}$.*
- iii) If the merged firm has the entire selling power, then it will propose the minimal, price-restoring divestiture $k_j - \hat{\sigma}$ if*

$$2 \left(\frac{x_l}{(k_l + k_j - \sigma)^2} - \frac{s x_M}{(k_i + \sigma)^2} \right) < \left(\frac{1}{(k_l + k_j - \sigma)^2} - \frac{s}{(k_i + \sigma)^2} \right) \frac{(1 + \lambda_l)x_l + (1 + \lambda_M)x_M}{1 + \sum_{m \in I_M} \lambda_m} \quad (4.14)$$

holds for all $\sigma > \bar{\sigma}$, where $k_j - \bar{\sigma}$ is the remedy which induces the lowest possible post-merger price over the interval $\sigma \in [0, k_j]$.

Parts *i*)-*iii*) of Lemma 5 can be explained as follows. *Part i*): From Lemma 1 we directly observe that the remedy must be price-restoring of size $k_j - \hat{\sigma}$ if $\delta_l(k_l + k_j - \hat{\sigma}) \leq \delta_M(k_i + \hat{\sigma})$ holds as $\delta_l(k_l + k_j - \hat{\sigma})$ and $\delta_M(k_i + \hat{\sigma})$ denote the direct effects of capital on M 's and l 's output levels after l has acquired the assets $k_j - \hat{\sigma}$. Selling more assets implies a market price which is above p^* , so that the consumer surplus condition is violated.²¹ Therefore, in equilibrium, the consumer

²¹In the proof of Lemma 3 (see Appendix), we note that the function $\delta_l(k_l + k_j - \sigma) - \delta_M(k_i + \sigma)$

surplus standard must be binding.

Part ii): If the merged firm sells the assets at a fixed price, it has no incentive to divest more than the AA requires. Hence, it proposes to divest the minimal price-restoring divestiture $k_j - \hat{\sigma}$, so that the consumer surplus condition binds.

Part iii): If the merged firm has the entire selling power, then (4.14) is the condition under which it cannot profitably sell more to firm l than the minimal required asset package $k_j - \hat{\sigma}$. Each of the following two requirements *a)* and *b)* is sufficient for (4.14) to hold.

a) If $\delta_l(k_l + k_j - \hat{\sigma}) > \delta_M(k_i + \hat{\sigma})$ (i.e., the large bracket on the right-hand side of (4.14) is positive) and if $c_k^l > c_k^M$ (i.e., the large bracket on the left-hand side of (4.14) is negative) hold for all $\sigma > \bar{\sigma}$, then the implemented remedy will be price-restoring of size $k_i + \hat{\sigma}$.²² To see this, note the following. In general, if a firm has a larger δ than another firm, it also faces higher marginal costs and a lower equilibrium output level. Thus, $\delta_l(k_l + k_j - \hat{\sigma}) > \delta_M(k_i + \hat{\sigma})$ implies $x_M > x_l$. If $x_M > x_l$ holds, then $c_k^l > c_k^M$ is also likely to hold. While $\delta_l(k_l + k_j - \hat{\sigma}) > \delta_M(k_i + \hat{\sigma})$ and $c_k^l > c_k^M$ ensure that (4.14) holds, we show in the Appendix that (4.14) is sufficient for the divestiture to be price-restoring. The intuition behind this condition is that the merged firm does not have an incentive to sell more capital than necessary if the capital lowers its own production costs by more than the rival firm's production costs; i.e., if the merged firm can use the capital more efficiently.

b) If $\delta_l(k_l + k_j - \hat{\sigma}) > \delta_M(k_i + \hat{\sigma})$, the proposed merger will involve the price-restoring divestiture $k_j - \hat{\sigma}$ if $2(1 + \sum_{m \in I_M} \lambda_m) < (1 + \lambda_l)x_l + (1 + \lambda_M)x_M$. For instance, a linear demand function, $p(X) = a - bX$, implies $\lambda_i = 1$, so that that the preceding condition is equivalent to $n < x_l + x_M$. This holds if the reservation price a is sufficiently large.

If none of the conditions listed in Lemma 5 holds, then the merging parties may divest more than required by the AA. In that case, prices may strictly decrease and consumers may be strictly better off when remedies are feasible.²³ In the following, we restrict our analysis to externality-free mergers. Therefore,

has at most one zero on $\sigma \in [0, 1]$. Therefore, it suffices to require that $\delta_l(k_l + k_j - \sigma) \leq \delta_M(k_i + \sigma)$ holds at $\sigma = \hat{\sigma}$.

²²Note that $\delta_l(k_l + k_j - \hat{\sigma}) = -1/[p'(X)(k_l + k_j - \sigma)^2]$ and $\delta_M(k_M + \hat{\sigma}) = -s/[p'(X)(k_i + \sigma)^2]$. Furthermore, $c_k^l = -c_\sigma^l = -x_l/(k_l + k_j - \sigma)^2$ and $c_k^M = c_\sigma^M = -sx_M/(k_i + \sigma)^2$.

²³Price-decreasing divestitures may also exist if the buyer of the divested assets experiences synergies on its own (see Section 4 below).

for the remainder of our analysis we invoke Assumption 3.

Assumption 3. *Suppose $s \in (\bar{s}, \bar{s}^R]$. All proposed divestitures are price-restoring.*

Given Assumption 3, we can easily derive the proportionality-principle claimed in the remedy guidelines; namely, the remedy's size should be proportional to the anticompetitive concern. If the merged firm's synergy level increases, the merger's anticompetitive effects are smaller such that it has to divest less assets in order to satisfy the consumer surplus standard.

Lemma 6 (Proportionality principle). *Suppose that $s \in (\bar{s}, \bar{s}^R]$ and Assumption 3 hold. Then the size of the price-restoring divestiture sold to a firm l increases in s .*

If a merger is externality-free, then the first-order conditions of the outsider firms remain unaffected by the merger. As a consequence, the social welfare effect of remedies depends only on a comparison of the total production costs for the firms involved in the merger (firms i and j) and firm l which buys the divested assets. We define $W(i, j, s)$ as the set of potential buyers for which a price-restoring remedy exists, where firms i and j are the merging firms which realize synergy s . Let $SW(l)$ denote social welfare when firm $l \in W(i, j, s)$ acquires the price-restoring divestiture that was offered to it by the merged entity. Firm $l' \in W(i, j, s)$ is the *socially optimal buyer* if and only if $SW(l') \geq SW(l'')$ for all $l'' \in W(i, j, s)$. We can state the following proposition.

Proposition 2 (First efficiency result). *Suppose that $s \in (\bar{s}, \bar{s}^R]$ and Assumption 3 hold. Given a consumer surplus standard, firms merge if and only if the merger raises social surplus. Assume that the merging parties can choose to divest assets to any incumbent competitor. If the merging parties can extract the entire gains from the asset sales (e.g., through a take-it or leave-it offer) then they select the socially optimal buyer.*

Proposition 2 shows that a merger control regime which allows for remedies under a consumer surplus standard is always preferable from a social welfare perspective when compared with regime *NR*. The reason for this result is quite general: given that consumer surplus is held fixed, under Cournot competition the market price must be held fixed and therefore the profits of any outsider firm not buying the divestiture assets. Then, the merger only affects the profits of the merged firm and the firm which buys the divested assets. The merging firms'

incentive to select the most efficient buyer is fully aligned with the social welfare-maximizing choice. The merging firms are residual claimants and act socially optimally as they maximize the gains from trade under the remedy constraint. Formally, suppose there is more than one possible buyer l for price-restoring remedies. The merged firm then chooses the buyer for which the sum of the profit changes of the merged firm, $\Delta\pi_M$, and the buyer firm, $\Delta\pi_l$, are maximal. If the consumer surplus standard binds, the change in consumer surplus, ΔCS , is zero which implies that the change of the outsider firms' profits, $\sum_{k \in I_M \setminus \{M, l\}} \Delta\pi_k$, is also zero. Hence, in this case, maximizing $\Delta\pi_M + \Delta\pi_l$ through the choice of a buyer firm is equivalent to maximizing the change in social welfare $\Delta SW := \Delta\pi_M + \Delta\pi_l + \sum_{k \in I_M \setminus \{M, l\}} \Delta\pi_k + \Delta CS$ because there are no externalities; i.e., $\sum_{k \in I_M \setminus \{M, l\}} \Delta\pi_k + \Delta CS = 0$ holds. It follows that the consumer surplus standard ensures that the merged entity chooses the social welfare maximizing buyer and social welfare increases strictly. We can generalize this reasoning to any oligopoly market with homogenous products.

Corollary 1. *Suppose an arbitrary homogenous goods oligopoly market and assume that the merging parties propose a price-restoring remedy to the AA (which uses a consumer surplus standard). Then the following efficiency result holds: If the merging parties can extract the entire gains from the asset sales, then they will pick the socially optimal buyer.*

This efficiency result crucially depends on the fact that the AA applies a consumer standard. If, instead, the AA applies a social welfare standard, a similar efficiency result cannot be obtained. According to a social welfare standard, all mergers are approved which do not lower social welfare. Suppose a full merger between two firms strictly lowers social welfare such that a remedy becomes necessary. If we presume that the merged firm always prefers a minimal remedy (in spirit of Lemma 5), then the merged firm always chooses social welfare-restoring remedies such that social welfare cannot increase beyond the pre-merger level. It also follows that the merged firm selects the buyer which maximizes $\Delta\pi_M + \Delta\pi_l$ which is equivalent to maximizing the negative externality of the merger; namely, $-\sum_{k \in I_M \setminus \{M, l\}} \Delta\pi_k - \Delta CS$.

4.4 Extensions and Discussion

We analyze two extensions of our basic setup. *First*, we investigate the equilibrium outcomes under different selling mechanisms to show that our efficiency result concerning the consumer surplus standard (Proposition 2) depends crucially on the merged firm's ability to extract all rents from selling the assets. *Second*, we examine remedy-dependent synergies according to which the size of the divestiture lowers the merged firm's synergy or creates a synergy for the buyer firm.

4.4.1 Different Selling Mechanisms

Different selling mechanisms for a divestiture might induce different post-merger market structures and outcomes. When there are several possible buyer candidates then, depending on the selling mechanism, a different buyer may be chosen. Suppose that $s \in (\bar{s}, \bar{s}^R]$. We examine remedial asset sales for three different selling mechanisms to show how distortions from the socially optimal choice (according to Proposition 2) can occur. *First*, the divestiture may be sold at a fixed price. *Second*, the divestiture may be auctioned off. *Third*, the merged firm has perfect seller power, so that it can make a take-it or leave-it proposal to a preselected buyer. In each case, we assume that the divested remedy is price-restoring. As before, $W(i, j, s)$ denotes the set of potential buyers for which a price-restoring remedy exists, where firms i and j are the merging firms which realize synergy s . Note that any other buyer not in $W(i, j, s)$ will be disregarded by the AA as the consumer surplus standard would be violated for any divestiture level in those instances. Furthermore, note that the size of the price-restoring remedy depends on the buyer itself, that is, each remedy is buyer-specific.

We, therefore, assume the following two-stage procedure. In the first stage, the merged firm determines for each potential buyer firm in $W(i, j, s)$ a price-restoring divestiture. In the second stage, the merged entity sells exactly one of these price-restoring divestitures to the targeted buyer. If the divestiture is to be sold at a fixed price, the merged entity selects one buyer firm and offers the remedy at a pre-determined price. If it is sold through an auction, then each buyer firm bids for the price-restoring divestiture that was offered to it by the merged entity. The firm with the highest bid wins the auction. If the merged firm has perfect selling power, it selects one firm in $W(i, j, s)$ and makes a take-it

or leave-it offer for the divestiture that was assigned to that firm.

Selling at a fixed price. Assume that the divestiture is sold at a fixed price. In order to ensure that no potential buyer is excluded, we assume that the selling price is zero. As a consequence, the merged firm selects the buyer which leads to the highest post-merger profit level. As a firm produces a larger quantity the lower its marginal costs are, the merged firm's output will also be the larger the less capital it divests. Therefore, the merged firm selects a buyer firm to minimize the size of the asset sale.

Bidding for the divestiture. An auction does not allow for buyer selection as the divestiture goes to the buyer with the highest bid. For simplicity, we take it for granted that the merged firm can extract the entire willingness to pay for a divestiture from the winning bidder; for example, by setting a reserve price. If the divestiture is sold through an auction in which all buyers bid their maximum willingness to pay, then the divestiture goes to the buyer for which the profit-differential through the acquisition of the remedy is largest. A firm l 's maximum willingness to pay equals the difference between its post-acquisition and its pre-merger profit as the sale of a price-restoring remedy to an incumbent competitor is externality-free so that firm l 's profit is not affected if it does not acquire the assets. The winner of the auction is likely to be a firm for which the price-restoring divestiture is rather large. A large divestiture weakens the merged firm's market position and lowers its equilibrium output, but enables the acquirer to steal a rather large proportion of the merged firm's market share. Consequently, a larger price-restoring divestiture shifts equilibrium output to the acquirer, at the cost of the merged firm. Therefore, the winner of the auction may not be the firm which is either preferred by the seller or from a social welfare point of view, as a relatively large output-share is reallocated to the buyer firm.

Perfect selling power. If the merged firm can commit to making a take-it or leave-it offer to a preselected firm, it extracts all gains from trade as we have shown in the previous section.

Proposition 3 (Second efficiency result). *Suppose firms i and j propose a merger with synergy level $s \in (\bar{s}, \bar{s}^R]$, so that the AA requires a divestiture in order to approve a merger proposal. Suppose the divestiture is price-restoring. The outcome of the sales process crucially depends on the selling mechanism.*

i) If the divestiture is sold at a fixed price which does not exclude any potential

buyer (thus is assumed to be zero), then the merged firm sells the remedy to a firm for which the size of the divestiture is minimal. For a linear demand function, $p(X) = a - bX$, this is the smallest firm within $W(i, j, s)$.

ii) If the divestiture is sold through an auction, in which all buyers bid their maximum willingness to pay, then the merged firm sells the remedy to a firm with the largest post- and pre-merger profit differential. For a linear demand function, $p(X) = a - bX$, this is the largest firm within $W(i, j, s)$.

iii) If the merged firm can make a take-it or leave-it offer to a preselected buyer then the divestiture is sold to the socially optimal buyer within $W(i, j, s)$.

Proposition 3 shows that the merged firm's ability to extract rents from the asset sale determines the divestiture level and the buyer's identity. If, for some reason, potential buyers can avoid to get absorbed in a bidding race, so that rent extraction is severely limited, then the merging parties minimize the amount of assets to be sold (part *i*) of Proposition 3). If rent extraction is enhanced, for instance, when the asset sale is structured through an auction-type selling process, then the divestiture should be expected to go to a firm which can run the additional assets most profitably (part *ii*) of Proposition 3). Even though such a buyer may not be preferred by the merged firm as it may "steal" its market share, the merged firm cannot avoid such an outcome if the remedy is sold through an auction. Finally, part *iii*) of Proposition 3 shows that the merged firm's divestiture decision is perfectly aligned with the social welfare maximizing rule whenever it can commit to make a take-it or leave-it offer to a preselected buyer. The merged firm is then able to extract the entire surplus created by the divestiture process. As the sale of a price-restoring remedy is externality-free, it follows that the merged firm will make the socially optimal choice.

In Dertwinkel-Kalt and Wey (2012) we show that it depends on the specific setup and the synergy level s whether the socially optimal buyer is more likely to be an efficient (i.e., large) firm or an inefficient (i.e., small) competitor. A relatively inefficient firm can be regarded as an "entrant" firm which has not yet acquired sufficient capital to get a substantial market share. In contrast, efficient firms can be regarded as incumbent competitors which are established in the market and have built up a considerable capital stock. Therefore, our analysis mirrors a feature of the remedy guidelines, according to which remedies might be sold to an entrant firm or an incumbent competitor. Per se, it cannot be determined which buyer type is optimal from a social-welfare perspective.

The message of Proposition 3 is that the merging parties should have a maximum of power in the asset sales process, because this would lead to the selection of the socially preferred buyer. It is noteworthy that remedy guidelines mirror our findings. For instance, the merger remedy guidelines of the DOJ distinguish between “fix-it-first remedies” and “post consummation sales” (DOJ, 2011, pp. 22-25). Successful fix-it-first remedies eliminate the competitive concerns and allow the AA to clear the merger without the need to file the case in court. In contrast, post-consummation sales induce the AA to file the case in court to obtain a consent decree, which allows the remedial provisions to be enforced and monitored because of the court’s contempt power. The guidelines clearly favor an adequate fix-it-first remedy, while the post-consummation sale is much more restrictive (and costly) for the merging parties.²⁴ With regard to the fix-it-first remedy, the guidelines “provide the parties with the maximum flexibility in fashioning the appropriate divestiture” (DOJ, 2011, p. 22). Accordingly, the merging parties can adjust the divestiture freely, so that the assets can be “tailored to a specific proposed purchaser” (DOJ, 2011, p. 22). In contrast, if a consent decree is needed for a post-consummation sale, then the guidelines build up a credible threat of force. *First*, a package of assets to be divested must be identified in advance, and *second*, “crown jewels” must be offered “to increase the likelihood that an appropriate purchaser will emerge” (DOJ, 2011, p. 24).

Those rules increase the commitment value of the merging parties when proposing an asset sale to a potential purchaser to obtain a fix-it-first remedy. *First*, the guidelines give a maximum of flexibility in adjusting the asset sale to the competitiveness of the purchaser. *Second*, entering into a consent decree is costly, full of uncertainty, and further burdened with the crown-jewel provision. Those additional costs may make the entire merger unattractive, adding to the commitment value necessary to extract rents in the fix-it-first sales process.

4.4.2 Remedy-Dependent Synergies

So far we have assumed that only the merging firms realize a fixed synergy level. We discuss two extensions: first, the firm which buys the divested assets may

²⁴Quite bluntly, the remedy guidelines state: “For the parties, resolving a merger’s competitive issue with an upfront buyer can shorten the divestiture process, provide more certainty about the transaction than if they (...) must seek a buyer for a package of assets post-consummation, and avoid the possibility of a sale dictated by the Division in which the parties might have to give up a larger package of assets” (DOJ, 2011, p. 22).

realize synergies itself, and second, the merged firm's synergy level may depend negatively on the amount of the assets to be divested.

In the *first case*, the acquirer of the assets may generate a synergy t , which effect is analogous to that of s (i.e., $t \in [0, 1]$ enters the acquirer's cost function as a multiplicative factor). The vector (k_l, t_l) describes the efficiency of an acquiring firm l . Given that the price-restoring condition is fulfilled, the merging firms' incentives to search for the most efficient buyer are fully aligned with the social welfare-maximizing choice. As before, the reason for this result is that the merged firm maximizes the gains from trading the remedy as long as it has perfect selling power.

Corollary 2. *Suppose an arbitrary oligopoly market and assume that the merging parties propose a price-restoring remedy to the AA (which uses a consumer surplus standard). Assume that buyers of different efficiencies (k_l, t_l) exist. Then the following efficiency result holds: If the merged firm has perfect selling power, then it selects the most efficient buyer.*

Note also that a very small divestiture (" ε -divestiture") may become possible which is not price-restoring, but price-decreasing. Even a small divestiture may have a significant impact on competition if the divested assets create a considerable synergy t . As such a divestiture raises the competitor's efficiency significantly while only marginally lowering the merger's efficiency, consumer surplus may strictly increase through the merger.

In the *second case*, the divestiture of assets may lower the synergy level of the merging firms. In the following we show that the scope for mergers must shrink if divestitures reduce the merged firm's synergies. Assume that Condition (4.11) holds (i.e., $\bar{s} < \bar{s}^R$). Suppose that the synergy level of the merged entity depends on the divestiture; i.e., $s'(\sigma) = \partial s(\sigma)/\partial \sigma < 0$. Define $s := s(k_j)$ as the synergy level realized if no capital is divested. The following lemma shows that Proposition 1 remains qualitatively valid when considering a negative impact of divestitures on merger synergies.

Lemma 7. *Suppose a remedy regime R . Firms i and j are the merger candidates and $\bar{s} < \bar{s}^R$ holds. Let $s := s(k_j)$ denote the synergy level of a full merger, while divestitures reduce merger synergies; i.e., $s'(\sigma) < 0$. Then all mergers with relatively large synergies, $s \leq \bar{s}$, are profitable and are approved without a remedy. There is a threshold value $\bar{s}^{R,D} \in [\bar{s}, \bar{s}^R)$ such that for merger proposals*

with $s \in (\bar{s}, \bar{s}^{R,D}]$, a merger with a certain divestiture is proposed and approved by the AA. If $s > \bar{s}^{R,D}$, no merger will be implemented. As $\bar{s}^{R,D} < \bar{s}^R$ holds, the scope for mergers is reduced if divestitures affect synergies negatively (i.e., $s'(\sigma) < 0$ holds) when compared with the case when they do not affect merger synergies (i.e., $s'(\sigma) = 0$ holds).

From Condition (4.13) it can be seen that the scope for mergers shrinks when divestitures reduce merger synergies. Given $s'(\sigma) < 0$, the divestiture $k_j - \bar{\sigma}$ which maximizes industry output is smaller when compared with the case where remedies do not affect merger synergies, so that $\bar{s}^{R,D} < \bar{s}^R$ holds. In the extreme case, when even a very small divestiture erases all merger synergies, the entire range for approvable synergies may vanish (i.e., $\bar{s}^{R,D} = \bar{s}$ holds).

If, however, there is a remedy which suffices to fix the AA's concerns, then this is even *more* likely to be price-restoring than in our basic model. This is the case because the merged entity has *less* incentives to sell more assets than necessary if this affects its realized synergies negatively. Formally, we obtain the following lemma.

Lemma 8. *Suppose a remedy regime R and assume $s \in (\bar{s}, \bar{s}^{R,D}]$. If the merged firm sells a price-restoring divestiture when synergies do not depend on divestitures, i.e., $s'(\sigma) = 0$, then it also sells a price-restoring divestiture if synergies depend on divestitures, i.e., $s'(\sigma) < 0$.*

If the negative effect of remedies on the realized synergy level s is relatively small, then the consumer surplus standard fully unfolds the advantageous effects which we have shown so far. The social welfare standard becomes relatively more attractive when the negative effect of an asset sale is large. Assume a merger with relatively small synergies which is approved fully under a social welfare standard but not under a consumer standard. If the negative effect of assets sales, $\partial s / \partial \sigma$, is strong, then an approvable remedy may fail to exist, so that the merger is blocked under the consumer surplus standard. Hence, such a merger cannot occur under a consumer surplus standard. Under a social welfare standard, however, it goes through and induces possibly strictly larger levels of social welfare.

4.5 Conclusion

We analyzed the effects of remedies on merger activity in a Cournot oligopoly model with homogeneous products under a consumer welfare standard. In general, remedies increase the scope for profitable mergers that do not harm consumers. In particular, if the consumer surplus standard binds, the merger does not change the equilibrium market price and is therefore *externality-free*. Accordingly, the profits of firms not involved in the merger process do not change. We derive fairly general conditions under which the consumer surplus standard binds and obtain that remedial offers must be larger when the merger's synergy level is smaller, which mirrors the proportionality principle in the US- and the EU-remedy guidelines.

Furthermore, we derived several efficiency properties concerning current merger control regimes. The ability of the merging firms to extract the gains from trading the divested assets is critical when the purchaser is endogenously determined. If the merging parties' ability to extract these gains is maximal, that is, if they can make a take-it or leave-it offer to a preselected buyer, then the socially optimal buyer is selected. The merging firms have strong incentives to search for the socially optimal buyer as this tends to increase the feasible set of mergers and, at the same time, maximizes the gains from trading the divestiture. The consumer surplus standard together with the formulation of merger remedy guidelines yields efficient outcomes with respect to two features. *First*, a remedy regime in combination with a consumer surplus standard ensures that only those mergers are implemented which are strictly social welfare-enhancing. This is achieved in a way such that no market participant is made worse off through the merger. *Second*, as endorsed by the guidelines, firms should have a maximum of power in the asset sales process which concerns the selection of the buyer firm, the design of the divestiture asset, and its selling price. It then follows that the socially efficient remedial divestiture is implemented.

However, our model also has some limitations. For instance, we take it for granted that claimed synergies are verifiable, that is, the AA can fully anticipate the size of synergies created through a merger which may be not the case in reality. In addition, we regard industry capital as fixed and abstracted from a long-run perspective where the industry's capital stock may be endogenous because of innovations and entry.

Appendix

In this Appendix we provide the omitted proofs.

Proof of Lemma 1. This proof is analogous to the proof of Proposition 2 in Farrell and Shapiro (1990a). In order to assess how a change in capital $d\mathbf{k} = (dk_1, \dots, dk_n)$ affects equilibrium quantities $d\mathbf{x} = (dx_1, \dots, dx_n)$, we take the total derivative of (4.1) with respect to k_j and x_j which gives

$$[p'(X) + x_j p''(X)]dX + p'(X)dx_j - c_{xk}^j dk_j = 0.$$

Using (4.6) and (4.8) and defining $\Lambda := \sum_i \lambda_i$ we obtain

$$dX = \sum_i \delta_i dk_i / (1 + \Lambda). \quad (4.15)$$

Let capital dk be sold from firm j to firm l , so that the preceding formula simplifies to

$$\frac{dX}{dk} = \frac{\delta_l - \delta_j}{1 + \Lambda}. \quad (4.16)$$

This proves the lemma. $\square$

Proof of Lemma 2. Let x_i^* and X^* denote the pre-merger equilibrium levels of firm i 's output and of the industry output, respectively. Let x_M^s and X^s denote the merged firm's equilibrium output and equilibrium industry output, respectively, after firms i and j have merged and have realized synergy level s . By Assumption 1, industry output increases strictly at $s = 0$. Note that the industry output X^s is strictly monotonically decreasing in the sum of firms' marginal costs. As the merged firm's cost function is monotone and continuous in s , it follows that industry output is also monotonically and continuously decreasing in s . If there is no synergy parameter $s \in [0, 1)$ for which the post-merger industry output falls short of the pre-merger output, i.e., for which $X^s < X^*$ holds, then we define $\bar{s} := 1$. Otherwise, there exists a unique threshold value $\bar{s} \in [0, 1)$ such that industry output increases, $X^s > X^*$, if and only if $s < \bar{s}$, while it decreases, $X^s < X^*$, if and only if $s > \bar{s}$, with equality holding at $s = \bar{s}$. Note that all approvable mergers (for which $s \leq \bar{s}$ holds) are profitable as the joint output of the merging firms (weakly) increases while marginal and infra-marginal production costs decrease. $\square$

Proof of Lemma 3. Let firms i and j be the merger candidates. Note that

merging and selling the divestiture simultaneously is formally equivalent to a two-stage procedure where firms i and j merge before they divest $k_j - \sigma$ to a rival firm l .

If $s \leq \bar{s}$, then consumers are not harmed by the merger, and the AA applying a consumer-surplus standard approves a full merger. For lower synergy levels ($s > \bar{s}$), however, a full merger cannot be approved by the AA since the industry's post-merger equilibrium quantity falls below the pre-merger industry output level. In order to assess to which extent remedies can enlarge the scope for approvable mergers, we *first* show that there exists a unique threshold value of the synergy parameter s for each potential buyer l up to which a divestiture increases industry output locally.²⁵ *Second*, we derive a condition under which remedies strictly increase the scope for mergers for a certain buyer firm l . *Third*, we show that the existence of an approvable remedy for a certain buyer firm l is monotone in the realized synergy level. Next, we generalize our findings toward all potential buyers l : *fourth*, we obtain a unique synergy threshold value up to which remedies enlarge the scope of mergers, and *fifth*, we state a weak condition under which remedies strictly enlarge the scope for mergers.

Step 1 (Local effects of a divestiture on industry output). Let $x^s(\sigma)$ and $X^s(\sigma)$ denote the equilibrium quantities for a given divestiture level $k_j - \sigma \geq 0$ and a given buyer firm $l \in I \setminus \{i, j\}$. Given the specification of firms' cost functions (4.3)-(4.5), we obtain

$$\begin{aligned} c_x^M(x, k, s) &= \frac{s}{k}, \\ c_{xk}^M(x, k, s) &= -\frac{s}{k^2}. \end{aligned}$$

After divesting $k_j - \sigma$ to firm l , the direct effects of capital on output for firms M and l are given by

$$\begin{aligned} \delta_M(k_i + \sigma) &= \frac{c_{xk}^M}{p'} = \frac{s/(k_i + \sigma)^2}{-p'(X^s(\sigma))} \text{ and} \\ \delta_l(k_l + k_j - \sigma) &= \frac{c_{xk}^l}{p'} = \frac{1/(k_l + k_j - \sigma)^2}{-p'(X^s(\sigma))}, \text{ respectively.} \end{aligned}$$

Therefore, the difference of the direct effects of capital on output between the

²⁵This is the main property which our proof exploits. Therefore, only the exact threshold values which we derive, but not the logic of our proof rely on the constant marginal cost specification which we have imposed.

merged firm M and the acquirer l of the assets $k_j - \sigma$, which is given by

$$\delta_M(k_i + \sigma) - \delta_l(k_l + k_j - \sigma) = \frac{1}{-p'(X^s(\sigma))} \left[\frac{s}{(k_i + \sigma)^2} - \frac{1}{(k_l + k_j - \sigma)^2} \right],$$

is continuous and has at most one zero on the interval $\sigma \in [0, k_j]$. If there is no such zero and $\delta_M(k_i + \sigma) > \delta_l(k_l + k_j - \sigma)$ holds for all $\sigma \in [0, k_j]$, then set $\bar{\sigma} = k_j$. If there is no such zero and $\delta_M(k_i + \sigma) < \delta_l(k_l + k_j - \sigma)$ holds for all $\sigma \in [0, k_j]$, then set $\bar{\sigma} = 0$. Otherwise, there is a unique threshold value

$$\bar{\sigma} = \bar{\sigma}(s) = \frac{1}{\sqrt{s} + 1} \left(-k_i + \sqrt{s}k_j + \sqrt{s}k_l \right), \quad (4.17)$$

for which the direct effect of capital on output is the same for the merged firm M and the acquirer of the assets l ; i.e., for which $\delta_M(k_i + \bar{\sigma}) = \delta_l(k_l + k_j - \bar{\sigma})$ holds. The threshold value $\bar{\sigma}$ gives the unique maximum divestiture up to which a divestiture can increase the industry output. We find that

$$\delta_M(k_i + \sigma) < \delta_l(k_l + k_j - \sigma) \quad (4.18)$$

holds if and only if

$$\sigma > \bar{\sigma}. \quad (4.19)$$

This means that the direct effect of capital on output is larger for the merged firm M than for buyer l if and only if the divestiture's size exceeds the threshold value $k_j - \bar{\sigma}$. Note that

$$\frac{\partial \bar{\sigma}}{\partial s} = \frac{1}{2\sqrt{s}} \frac{(k_i + k_j + k_l)}{(\sqrt{s} + 1)^2} > 0,$$

such that the threshold value $\bar{\sigma}$ is strictly increasing in s . Therefore, the range of divestitures $\{k_j - \sigma | \sigma > \bar{\sigma}\}$ for which $\delta_M(k_i + \sigma) < \delta_l(k_l + k_j - \sigma)$ holds, strictly increases with a higher synergy level (i.e., a lower parameter value s).

Step 2 (Remedies increase the scope for acceptable mergers). In order to prove that remedies increase the scope for mergers, we have to investigate those potential buyers l for which $\delta_M(k_i + \sigma) < \delta_l(k_l + k_j - \sigma)$ holds for a small divestiture $k_j - \sigma$ and for some $s > \bar{s}$. For a certain buyer l , Condition (4.18) holds if and only if $\sigma \in (\bar{\sigma}, k_j]$, while this interval may be empty. Fix l and define $\varepsilon(s) = \max\{k_j - \bar{\sigma}(s), 0\}$. Since $\bar{\sigma}$ is monotonically increasing in s , the function

$\varepsilon(s)$ is monotonically decreasing in s .

For the moment, we assume that $\varepsilon := \varepsilon(\bar{s}) > 0$ (which holds if $k_j - \bar{\sigma} > 0$). According to (4.17), this is equivalent to assuming that

$$k_i + k_j > \sqrt{\bar{s}}k_l \quad (4.20)$$

holds. Given $\varepsilon > 0$, Condition (4.18) holds for $s = \bar{s}$ and for all $\sigma \in (k_j - \varepsilon, k_j]$. Since $\delta_l(k_l + k_j - \sigma) - \delta_M(k_i + \sigma)$ is continuous in s and since $d\bar{\sigma}/ds > 0$, for each $\varepsilon' < \varepsilon$ we can define $s' = s'(\varepsilon') > \bar{s}$ to be the largest $\hat{s}$ such that Condition (4.18) holds for all $s \in [\bar{s}, \hat{s}]$ and for all $\sigma \in (k_j - \varepsilon', k_j]$. For each ε' , define $\varepsilon'' = \varepsilon''(\varepsilon') = \min_{s \in [\bar{s}, s']} [X^s(k_j - \varepsilon') - X^s(k_j)]$. *First*, $X^s(k_j - \varepsilon') - X^s(k_j) > 0$ holds for all $s \in (\bar{s}, s')$. *Second*, $\lim_{s \rightarrow \bar{s}} X^s(k_j - \varepsilon') - X^s(k_j) = X^{\bar{s}}(k_j - \varepsilon') - X^{\bar{s}}(k_j) > 0$ holds and *third*, $\lim_{s \rightarrow s'} X^s(k_j - \varepsilon') - X^s(k_j) > 0$ holds. Therefore, ε'' is well defined and $\varepsilon'' > 0$. As for each fixed σ , the equilibrium quantity $X^s(\sigma)$ is continuous in s , there exists a largest $s \in (\bar{s}, s'(\varepsilon'))$ which satisfies $X^* - X^s(k_j) \leq \varepsilon''$; we denote this synergy by $s'' = s''(\varepsilon')$. Then, $X^* - X^s(k_j) \leq \varepsilon''$ holds for all $s \in [\bar{s}, s'']$.

As a consequence, $X^s(k_j - \varepsilon') - X^* = [X^s(k_j - \varepsilon') - X^s(k_j)] - [X^* - X^s(k_j)] \geq \varepsilon'' - \varepsilon'' = 0$ for all $s \in [\bar{s}, s'']$. Thus, for synergy $s \in (\bar{s}, s'']$ there exists a divestiture which can offset the merger's negative effect on aggregate output. Consequently, as long as our initial assumption $\varepsilon(\bar{s}) > 0$ holds, for all such $s \in (\bar{s}, s'']$ there exists a remedy which fixes the AA's concerns. We will call such a remedy an *approvable remedy*.

Step 3 (Monotonicity and uniqueness). Clearly, $\partial X^s / \partial s < 0$ holds as a larger s implies a lower synergy and therefore a higher sum of firms' marginal production costs. If there is an approvable remedy sold to firm l for a merger which realizes synergy s , then there is an approvable remedy also for higher synergies, i.e., lower s . As a consequence, there is a threshold synergy value s_l^R such that there exists an acceptable remedy if and only if the merger synergy satisfies $s \leq s_l^R$. Precisely, this threshold value can be defined as $s_l^R := \sup_{\varepsilon' < \varepsilon(\bar{s})} s''(\varepsilon') \in [\bar{s}, 1]$ if $\varepsilon(\bar{s}) > 0$ and $s_l^R := \bar{s}$ if $\varepsilon(\bar{s}) = 0$.

Step 4 (Extending toward all potential buyers). We can repeat the analysis with all potential buyer firms $l \neq i, j$. Allowing for remedies to be divested to any competitor further increases the scope where remedies can induce a merger's approval. We define $\bar{s}^R := \max_{l \in I \setminus \{i, j\}} s_l^R \in [\bar{s}, 1]$. Therefore, the synergy range where mergers do not harm consumers is strictly increased through remedies if

there is a firm l such that $s_l^R > \bar{s}$.

Step 5 (Condition such that remedies increase the scope for mergers strictly).

Extending Condition (4.20) toward all potential buyers yields that divestitures strictly increase the scope for mergers if and only if

$$k_i + k_j > \sqrt{\bar{s}} \min_{l \in I \setminus \{i,j\}} \{k_l\}.$$

This proves the lemma. $\square$

Proof of Lemma 4. For synergy levels $s \in [\bar{s}, \bar{s}^R]$ there is a merger of firms i and j (potentially involving a divestiture sold to some firm l) which does not increase the final good's price. Then (due to continuity of the cost function) there also exists at least one divestiture level $k_j - \sigma$ such that the consumer surplus standard binds (i.e., pre- and post-merger prices are the same). Given this divestiture level, the joint post-merger equilibrium output of firms M and l , i.e., $x_M^s + x_l^s$, equals the joint pre-merger output of firms i , j and l , i.e., $x_i^* + x_j^* + x_l^*$ (where the superscript “ s ” indicates equilibrium outcomes after a merger generating synergy s and superscript “ $*$ ” denotes pre-merger equilibrium outcomes), while this output is produced at strictly lower costs after the merger. Then, the sum of the merged firm's and the buyer firm's profits $\Pi_M^s + \Pi_l^s$ exceeds the sum of firms' pre-merger profits $\Pi_i^* + \Pi_j^* + \Pi_l^*$. As the merged firm M has perfect selling power, it can extract up to $\Pi_M^s + \Pi_l^s - \Pi_l^*$, which is larger than $\Pi_i^* + \Pi_j^*$. Thus, for every synergy level $s \in [\bar{s}, \bar{s}^R]$ there exists an approvable merger (possibly involving a divestiture) which is also profitable. $\square$

Proof of Lemma 5. Part *i*) is immediate while part *ii*) follows directly from Lemma 1. In order to prove part *iii*), we derive condition (4.14). Using Equation (13) of Farrell and Shapiro (1990a), the derivative of the sum of firm M 's and firm l 's profits with respect to σ can be written as²⁶

$$\begin{aligned} \frac{d(\Pi_M + \Pi_l)}{d\sigma} = & -p'(X) \left(\delta_M x_M - \delta_l x_l + \frac{\delta_l - \delta_M}{1 + \Lambda} ((1 + \lambda_l)x_l + (1 + \lambda_M)x_M) \right) \\ & - c_k^M + c_k^l. \end{aligned}$$

²⁶The following equation can be derived by using the total derivatives of firm l 's and firm M 's first-order conditions with respect to x , X and σ .

Substituting δ_M , δ_l , c_k^M and c_k^l and re-arranging yields

$$\begin{aligned} \frac{d(\Pi_M + \Pi_l)}{d\sigma} = & 2 \left(\frac{sx_M}{(k_i + \sigma)^2} - \frac{x_l}{(k_l + k_j - \sigma)^2} \right) + \\ & \left(\frac{1}{(k_l + k_j - \sigma)^2} - \frac{s}{(k_i + \sigma)^2} \right) \left(\frac{(1 + \lambda_l)x_l + (1 + \lambda_M)x_M}{1 + \Lambda} \right). \end{aligned}$$

This proves the lemma. $\square$

Proof of Lemma 6. For $s \in (\bar{s}, \bar{s}^R]$ let $k_j - \hat{\sigma}$ be the price-restoring equilibrium divestiture to be sold to firm l . Suppose the synergy parameter s falls marginally. Holding $\hat{\sigma}$ fixed, the final good price decreases. Due to Assumption 3, the merging firms will adjust the remedy in order to keep the remedy price-restoring. As $\delta_l(k_l + k_j - \sigma) \geq \delta_M(k_i + \sigma)$ for synergy s and all $\sigma > \hat{\sigma}$, this inequation holds also for a synergy parameter slightly below s and all $\sigma > \hat{\sigma}$. Therefore, the respective price-restoring remedy is smaller than $k_j - \hat{\sigma}$. $\square$

Proof of Proposition 3. We prove each part of the proposition separately.

Part i) As the merged firm does not earn any revenues from selling the assets, it maximizes its own market profit. The market profit is maximal if the size of the divestiture is minimal. This must be so as additional capital lowers marginal production costs and as the own equilibrium quantity strictly increases with lower marginal costs. We consider the linear demand function $p = a - bX$ with parameters $a, b > 0$. In order to assess the impact of a divestiture to firm l on the industry output, we analyze condition (4.16) and obtain

$$\frac{dX}{d\sigma} = \frac{\delta_M(\sigma) - \delta_l(\sigma)}{(1 + \Lambda)} = \frac{\frac{s}{(k_i + \sigma)^2} - \frac{1}{(k_l + k_j - \sigma)^2}}{nb}, \quad (4.21)$$

which is strictly monotonically decreasing in k_l for all admissible σ . Therefore, the size of the price-restoring divestiture, i.e., the divestiture which suffices to restore the pre-merger industry quantity, is smallest if the merged firm divests to the firm $l \in W(i, j, s)$ which holds the smallest capital stock.

Part ii) Let $\tilde{l}$ be the firm with the largest capital stock within $W(i, j, s)$; i.e., $k_{\tilde{l}} \geq k_l$ for all $l \in W(i, j, s)$. *First*, note that firm $\tilde{l}$ produces the largest pre-merger equilibrium quantity, i.e., $\tilde{l} \in \arg \max_{l \in W(i, j, s)} \{x_l^*\}$. *Second*, Equality (4.21) implies that the price-restoring divestiture $k_j - \sigma$ is weakly larger for firm $\tilde{l}$ than for all other firms $l \in W(i, j, s)$. *Third*, as the pre-merger industry quantity

is required to be restored through the divestiture process and as the quantity produced by the merged firm M is strictly monotonically decreasing in the size of the divestiture $k_j - \sigma$, firms of size $k_{\tilde{l}}$ record the largest increase in equilibrium output through the acquisition of the price-restoring divestiture. This means that $\tilde{l} \in \arg \max_{l \in W(i,j,s)} \{\bar{x}_l - x_l^*\}$, where $\bar{x}_l$ denotes firm l 's equilibrium output after the acquisition of a price-restoring divestiture. *Fourth*, a firm l 's willingness to pay for a price-restoring divestiture, $WTP(l)$, equals the difference between its profit after the asset's acquisition, Π_l , and its pre-merger profit, Π_l^* . For the demand function $p = a - bX$ with parameters $a, b > 0$, a firm l producing quantity x_l earns profit $\Pi_l = bx_l^2$ (which can be easily seen from inspecting a firm's first-order condition). It then follows that $\tilde{l} \in \arg \max_{l \in W(i,j,s)} WTP(l)$, which proves the claim.

Part iii) This follows from Proposition 2. □

Proof of Lemma 7. We provide a sketch of the proof. First, we show that the minimal synergy level which fulfills the consumer surplus standard must be lower when divestitures reduce synergies; i.e., $\bar{s}^{R,D} < \bar{s}^R$ holds. Second, we argue that the monotonicity of the AA's decision rule remains valid (as shown in Proposition 1).

The industry output after a merger of firms i and j and divestiture $k_j - \sigma$ to firm l is proportional to

$$MC(s(\sigma)) := \frac{s(\sigma)}{k_i + \sigma} + \frac{1}{k_l + k_j - \sigma} + \sum_{m \in I_M \setminus \{M, l\}} \frac{1}{k_m}.$$

Provided $\bar{s} < \bar{s}^R$, in our main model a merger which generates synergy $\bar{s}^R$ is approvable with a certain divestiture. We denote $MC(\bar{s}^R)$ as the respective sum of firms' marginal costs. If $s'(\sigma) < 0$ and the full synergy $s = s(k_j)$ equals $\bar{s}^R$, then $MC(s(\sigma)) > MC(\bar{s}^R)$ for $\sigma < k_j$. We have seen that if $s'(\sigma) = 0$ holds, then for synergy level $\bar{s}^R$ there is no approvable divestiture such that the consumer surplus strictly decreases. Consequently, if $s'(\sigma) < 0$, then there is no approvable divestiture for synergy level $s(k_j) = \bar{s}^R$. Thus, mergers with a synergy level of $s(k_j) = \bar{s}^R$ (and strictly lower synergies) are not approvable. Therefore, the scope for mergers under a consumer surplus standard shrinks if remedies frustrate the merger's synergy. While the notation will be more complicated, the monotonicity results can be obtained by an analogous analysis as in the proof of Lemma 3.

Finally, the profitability condition is satisfied due to the same reasoning as in Lemma 4. $\square$

Proof of Lemma 8. If $s'(\sigma) < 0$, then

$$\delta_M(k_i + \sigma) = \frac{s(\sigma)/(k_i + \sigma)^2 - s'(\sigma)/(k_i + \sigma)}{-p'(X^s(\sigma))},$$

such that the equation used in the proof of Lemma 5 can be re-written as

$$\begin{aligned} \frac{d(\Pi_M + \Pi_l)}{d\sigma} = & 2 \left(\frac{s(\sigma)x_M}{(k_i + \sigma)^2} - \frac{x_l}{(k_l + k_j - \sigma)^2} - \frac{s'(\sigma)x_M}{(k_i + \sigma)} \right) \\ & + \left(\frac{1}{(k_l + k_j - \sigma)^2} - \frac{s(\sigma)}{(k_i + \sigma)^2} - \frac{s'(\sigma)}{k + \sigma} \right) \frac{(1 + \lambda_l)x_l + (1 + \lambda_M)x_M}{1 + \sum_{m \in I_M} \lambda_m}. \end{aligned} \quad (4.22)$$

As $s'(\sigma)/(k + \sigma) < 0$, we obtain that $d(\Pi_M + \Pi_l)/d\sigma > 0$ holds for $s'(\sigma) < 0$ (given it holds for $s'(\sigma) = 0$). Thus, mergers are more likely to be price-restoring if divestitures reduce the merger synergies. $\square$

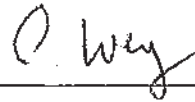
Declaration of Contribution

Hereby I, Markus Dertwinkel-Kalt, declare that the chapter “Merger Remedies in Oligopoly under a Consumer Welfare Standard” is co-authored by Prof. Dr. Christian Wey.

My contributions to this chapter are as follows:

- I have contributed to the Introduction
- I have written major parts of the Model
- I have written major parts of the Analysis
- I have derived the Extensions

Signature of coauthor 1 (Prof. Dr. Christian Wey):

A handwritten signature in black ink, appearing to read 'C. Wey', is written over a horizontal line.

Chapter 5

Raising Rivals' Cost Through Buyer Power

Co-authored by Justus Haucap and Christian Wey

5.1 Introduction

We contribute to the literature that compares different pricing regimes (*discriminatory* vs. *uniform* pricing) in vertical settings, where an upstream monopolist supplies an input to downstream firms which compete in Cournot fashion in the final goods market. In a seminal contribution to the topic Katz (1987) has shown that price discrimination can raise the price to all buyers when they are Cournot competitors in the downstream market. In that setting downstream firms are assumed to be symmetric except that one of the buyers (the “dominant” firm) has a better outside option than rivals.¹

Katz’s result can be described for the two-firms case as follows. Suppose that the dominant firm’s outside option is a binding constraint both when discrimination is forbidden and when it is allowed. Under discriminatory pricing, the dominant firm obtains a relatively low input price because of its outside option. In equilibrium it is indifferent between purchasing from the supplier and using

¹See Inderst and Valletti (2009) for a generalization of Katz (1987) and Brien (2014) for a qualification of Katz’s result. The latter work is complementary to our undertaking. It shows that the dominant firm’s source of bargaining power is critical for the Katz result to hold.

the outside option. If, however, price discrimination is banned, typically the monopolist adjusts by lowering the price for the rival firm, but raising the price for the dominant firm. But this is not optimal in the presence of buyer power since a price reduction to the rival firm reduces the dominant firm's profit. Therefore, a price reduction to the rival firm must be accompanied by a reduction in the price charged from the dominant firm to prevent it from turning to its outside option. This reasoning gives rise to a new (low-uniform price) equilibrium if the own profit effect dominates the cross profit effects; that is, if an increase in the dominant firm's input price affects its profit by more (in absolute value) than an increase in the rival's wholesale price. Then, raising the dominant firm's price toward the rival's price in order to satisfy the non-discrimination constraint will not work if the seller wishes to continue selling to the dominant firm. Thus, the monopolist must lower the uniform input price for both firms. Since both prices fall, a non-discrimination rule reduces the final good price and increases consumer surplus.

Our point is that this reasoning is not valid anymore when downstream firms are asymmetric; in particular, when firms differ in their productivity levels with regard to the use of the input. In such a setting, cross profit effects might dominate own profit effects such that the dominant firm's profit is increasing rather than decreasing in a common wholesale price. If this is the case, then a downstream firm's buyer power unfolds upward pressure on the uniform input price as an input price increase raises the marginal cost of the rival by more than it raises the marginal cost of the dominant firm. If differences in input efficiencies are sufficiently pronounced, then a relatively efficient downstream firm benefits from a high uniform input price because of a raising rivals' costs effect (see Williamson, 1968). Here, the seller's optimal response to a non-discrimination constraint is to raise rather than lower the price it charges the dominant firm. Therefore, we reverse Katz (1987) by establishing that in the presence of buyer power consumers may be better off if discriminatory pricing is feasible.

In Section 2, we introduce the model. We provide an example in Section 3 and prove its generality in Section 4. Finally, Section 5 concludes.

5.2 The Model

We consider an upstream monopolist producing an input good which it sells to n downstream firms (indexed by $i \in I = \{1, \dots, n\}$) at price w_i . Under discriminatory pricing (indexed by “ D ”) the upstream monopolist can charge different prices from downstream firms. When discriminatory pricing is banned (indexed by “ U ”), the monopolist must charge a uniform input price from all downstream firms. We consider a two-stage game, where the upstream firm first sets either discriminatory prices (regime D) or a uniform price (regime U). In the second stage, downstream firms compete in the final goods market à la Cournot.

Let q_i denote firm i ’s output of the homogenous final good. The inverse demand function $P(Q)$ is downward sloping, $P'(Q) < 0$, where $Q := \sum_i q_i$. Firm i ’s cost function is given by $C_i(q_i, w_i) = \alpha_i w_i q_i + \beta_i q_i$, for $i = 1, \dots, n$, where $\alpha_i \geq 0$ measures the input efficiency of firm i (“ α -efficiency”) and $\beta_i \geq 0$ represents additional marginal production costs of firm i (“ β -efficiency”).² Firm i ’s profit function is then given by $\Pi_i = P(Q)q_i - \alpha_i w_i q_i - \beta_i q_i$.

Downstream firm $k \in I$ has buyer power through an outside option which gives rise to a profit level of V^0 .³ We assume that this outside option is binding and effectively constraints the upstream monopolist’s maximization problem which is given by⁴

$$\begin{aligned} \max_{w_1, \dots, w_n \geq 0} L &= \sum_{i=1}^n \alpha_i q_i w_i \\ \text{subject to } \Pi_k(q_k, Q_{-k}) &\geq V^0, \end{aligned}$$

²Yoshida (2000) established the distinction between α - and β -efficiencies. Whereas the assumption of symmetric α -efficiencies may be plausible with respect to storable retailing and durable goods, there are many conceivable instances where downstream firms differ in their α -efficiencies. In the case of unionized labor, firms may differ in their labor productivities such that (presumably, more capital-intensive) firms can use their labor force more efficiently than others. Or, in the case of raw materials, some firms may produce less waste and thus use their inputs more efficiently in the production process of the final good. In the case of tradable emission rights for carbon dioxide, firms typically differ in their emission levels that are necessary to produce a given quantity of electricity, steel, or cement, to name just a few examples. Even with respect to retailing and perishable goods certain retailers may be more efficient while others generate more spoiled goods.

³See Dertwinkel-Kalt *et al.* (2015a) for an example with an endogenous outside option, where a firm can integrate backward as in Katz (1987).

⁴We assume throughout our analysis that the upstream monopolist finds it optimal to sell to all downstream firms. Hence, in equilibrium all downstream firm are active and procure the input from the monopolist. This assumption is also critical in Katz (1987) and Yoshida (2000).

where $Q_{-k} := \sum_{j=1, j \neq k}^n q_j$. If price discrimination is banned, then the monopolist's problem is additionally constrained by the requirement $w_1 = \dots = w_n$.

We assume that each firms' reaction function slopes downward with slope between -1 and 0 , which follows from⁵

$$P''(Q)q_i + P'(Q) < 0 \text{ for } i = 1, \dots, n. \quad (5.1)$$

We first present an example to show that buyer power can make discriminatory pricing more attractive than uniform pricing from a consumer surplus perspective. In a second step we show the generality of our result.

5.3 Example

We show by example that in the presence of buyer power (i.e., a dominant downstream firm has an outside option) consumers can be made better off under discriminatory than under non-discriminatory pricing. Let $P = 1 - Q$, $n = 2$, $\beta_1 = \beta_2 = 0$, $\alpha_1 = 1$ and $\alpha_2 = 3$ and let the upstream supplier produce at cost zero. Solving downstream firms' first-order conditions we obtain firms' optimal outputs $q_1(w_1, w_2) = 1/3 - 2w_1/3 + w_2$ and $q_2(w_1, w_2) = 1/3 + w_1/3 - 2w_2$. If the input price is uniform, then $q_1(w) = (1 + w)/3$ and $q_2(w) = (1 - 5w)/3$. Given those derived demands, we examine the optimal price setting of the input supplier.

We first analyze the price discriminatory regime. The upstream manufacturer solves

$$\max_{w_1, w_2 \geq 0} (\alpha_1 w_1 q_1(w_1, w_2) + \alpha_2 w_2 q_2(w_1, w_2)).$$

This gives rise to the first-order conditions

$$\alpha_i q_i + \alpha_i w_i \frac{dq_i}{dw_i} = 0, \text{ for } i = 1, 2,$$

which yield the equilibrium input prices $w_1^D = 1/2$ and $w_2^D = 1/6$.

Second, we solve the manufacturer's maximization problem under uniform pricing. The upstream firm solves $\max_{w \geq 0} w(q_1(w) + q_2(w))$, which yields the

⁵This inequality holds if the industry demand curve satisfies $P''(Q)Q + P'(Q) < 0$.

first-order condition

$$Q + w \left(\frac{dq_1}{dw} + \frac{dq_2}{dw} \right) = 0.$$

This gives the optimal uniform input price $w^U = 1/7$. Firm 1 earns under the price-discriminatory regime $\pi_1^D = 1/36 \approx 0.028$, while it realizes $\pi_1^U = 64/441 \approx 0.145$ under the uniform pricing regime. It is easily checked that consumers strictly favor uniform pricing.

Now we introduce an outside option for firm 1 which provides profit level V^0 . Assume that the outside option binds under both regimes.⁶ We show that the profit of the relatively efficient firm increases over some range in the common wholesale price, such that under uniform pricing the input price will rise in firm 1's outside option. Under the discriminatory regime, w_1 is decreasing in V^0 and w_2 is independent of V^0 . Solving for the optimal input prices (provided that V^0 binds) gives $w_1^D = 3/4 - 3\sqrt{V^0}/2$ and $w_2^D = 1/6$ and under uniform pricing $w^U = w_1^U = w_2^U = 3\sqrt{V^0} - 1$. Defining the sum of firm's marginal costs as $MC := \sum_i \alpha_i w_i + \beta_i = \alpha_1 w_1 + \alpha_2 w_2$, we obtain $MC^D = 5/4 - 3\sqrt{V^0}/2$ and $MC^U = 12\sqrt{V^0} - 4$, so that

$$MC^D < MC^U \text{ if and only if } V^0 > \frac{49}{324} \approx 0.151 > \pi_1^U.$$

Note that consumer surplus is monotonically increasing in the overall quantity Q , while Q is monotonically decreasing in the sum of firms' marginal costs. It follows that, if firm 1's outside option is sufficiently attractive, final consumers benefit from input price discrimination. Instead, uniform pricing induces firm 1 to use its buyer power to establish higher input prices, which leads to a reduction in consumer surplus.

5.4 General Analysis

We investigate the previous example in a more general setup and derive conditions on the downstream firm's input efficiencies for which the result by Katz (1987) is reversed; i.e., where consumers favor a discriminatory pricing regime. The key

⁶This is of course a simplification which allows us to abstract from a full specification of subgames which would follow if firm 1 reverts to its outside option. In general, the outside option may be binding only in one regime and the upstream monopolist may want to supply only firm 2 instead of meeting firm 1's outside option (see Dertwinkel-Kalt *et al.*, 2015a, for such an analysis).

element of our general analysis is to specify a necessary and sufficient condition for firm k 's profit to increase with a rise in the uniform input price. Firm k 's profit increases in the uniform input price w if and only if

$$\frac{d\Pi_k(q_k, Q_{-k})}{dw} = \frac{\partial \Pi_k}{\partial w} + \frac{\partial \Pi_k}{\partial q_k} \frac{dq_k}{dw} + \frac{\partial \Pi_k}{\partial Q_{-k}} \frac{dQ_{-k}}{dw} > 0 \quad (5.2)$$

holds, where $\frac{\partial \Pi_k}{\partial w} = -\alpha_k q_k$, $\frac{\partial \Pi_k}{\partial q_k} \frac{dq_k}{dw} = 0$ (envelope theorem), and $\frac{\partial \Pi_k}{\partial Q_{-k}} \frac{dQ_{-k}}{dw} = P' q_k \frac{dQ_{-k}}{dw}$. Thus, (5.2) is equivalent to

$$q_k \left(-\alpha_k + P' \frac{dQ_{-k}}{dw} \right) > 0. \quad (5.3)$$

In a Cournot-Nash equilibrium, all firms' first-order conditions are fulfilled; i.e.,

$$\Pi'_i = P' q_i + P - \alpha_i w - \beta_i = 0, \text{ for all } i \in I. \quad (5.4)$$

Summing over all $i \in I \setminus \{k\}$ first-order conditions yields

$$P' Q_{-k} + (n-1)P - \sum_{i \neq k} (\alpha_i w + \beta_i) = 0. \quad (5.5)$$

Note that in equilibrium the total output Q is inversely proportional to the sum of firms' marginal production costs $MC := \sum_{i=1}^n \alpha_i w_i + \beta_i$. Taking the total derivative of (5.5) with respect to w , q_k and Q_{-k} gives

$$(P'' Q_{-k} + nP') dQ_{-k} + (P'' Q_{-k} + (n-1)P') dq_k - \left(\sum_{i \neq k} \alpha_i \right) dw = 0,$$

which is equivalent to

$$\frac{dQ_{-k}}{dw} = \frac{\sum_{i \neq k} \alpha_i - (P'' Q_{-k} + (n-1)P') dq_k / dw}{P'' Q_{-k} + nP'}. \quad (5.6)$$

Accordingly, taking the total derivative of firm k 's first-order condition and rearranging, we obtain

$$\frac{dq_k}{dw} = \frac{\alpha_k - (P'' q_k + P') dQ_{-k} / dw}{P'' q_k + 2P'}. \quad (5.7)$$

Substituting (5.7) into (5.6) and plugging this into (5.3), we obtain the following condition which ensures that firm k 's profit depends positively on the uniform input price:

$$\frac{a_k}{\sum_{i \neq k} \alpha_i} < \frac{2P' + P''q_k}{2nP' + P''(q_k + 2Q_{-k})}. \quad (5.8)$$

If firms are sufficiently asymmetric with regard to their α -efficiencies, then there is always some firm j for which $\alpha_j / \sum_{i \neq j} \alpha_i \geq 1/(n-1)$ holds, while the right-hand side of (5.8) is strictly smaller than $1/(n-1)$.⁷ Thus, condition (5.2) implies that $d\Pi_i(q_i, Q_{-i})/dw < 0$ holds for some $i \in I$. Consequently, if firm k 's profit is increasing in the uniform input price, then there is at least one other firm i for which the profit decreases in w . In particular, firms which produce with an α -efficiency below the market's average can never benefit from input price increases. Interestingly, in order for condition (5.2) to hold, it is not important how many firms are more or less efficient than firm k , but only the relation to firms' average efficiency in the market is critical. It is noteworthy that only α -efficiencies play a role since they can, in contrast to β -efficiencies, result in overproportional disadvantages for rival downstream firms. An increase in the input price can, therefore, benefit a firm only if other firms are harmed overproportionally so that a *raising rival's cost* effect exists.

Lemma 1. *Firm k 's profit is increasing in the uniform input price w if and only if condition (5.8) holds which depends on the downstream firms' α -efficiencies but not on their β -efficiencies. For the linear demand case, with $P'' = 0$, this condition reduces to*

$$\frac{a_k}{\sum_{i \neq k} \alpha_i} < \frac{1}{n}.$$

Next, we compare the discriminatory and the non-discriminatory pricing regimes. We show that consumer surplus can be lower under non-discriminatory pricing. Suppose an equilibrium under discriminatory pricing $(w_1^D, \dots, w_n^D)$. Suppose also that in this equilibrium the dominant firm's outside option is binding. This equilibrium gives rise to a certain consumer surplus level which is inversely related to the sum of firms' marginal costs. We can next calculate the uniform input price, $\bar{w}$, which gives rise to the same sum of firms' marginal costs (and hence the same consumer surplus level) as under the discriminatory prices $(w_1^D, \dots, w_n^D)$. This

⁷It is obvious that it is below $1/(n-1)$ if $P'' \leq 0$. If $P'' > 0$, then condition (5.1) implies $2nP' + P''(q_k + 2Q_{-k}) = 2(n-1)P' + P''q_k + 2(P' + P''Q_{-k}) < 2(n-1)P' + P''q_k$ so that the right hand side of condition (5.8) is below $1/(n-1)$.

“consumer-surplus fixing” price is given by $\bar{w} =: \sum_i \alpha_i w_i^D / \sum_i \alpha_i$. Assume that the dominant firm’s profit level is smaller under the uniform input price $\bar{w}$ than under the discriminatory pricing equilibrium. Hence, the dominant firm’s outside option is better in this case, but suppose that the resulting gap is not too large. Given that condition (5.8) holds, it then follows that the upstream monopolist must *increase* the uniform input price above $\bar{w}$ to induce the dominant firm to accept the offer. The following proposition summarizes this reasoning.

Proposition 1. *Let $(w_1^D, \dots, w_n^D)$ be the vector of input prices in the discriminatory equilibrium in which the dominant firm’s outside option binds. Let $\bar{w}$ be the uniform input price which gives rise to the same consumer surplus as under the discriminatory equilibrium. Assume that the dominant firm’s profit level is smaller under the uniform input price $\bar{w}$ than in the discriminatory equilibrium. If the dominant firm’s outside option can be made profitably binding and if condition (5.8) holds, then the equilibrium uniform input price fulfills $w^U > \bar{w}$. In that case, consumer surplus is strictly lower under uniform pricing when compared with discriminatory pricing.*

Proposition 1 reverses the result by Katz (1987) that price discrimination bans are desirable from a consumer’s perspective in the presence of buyer power. In Katz’s model the dominant firm’s binding outside option unfolds downward pressure on the uniform input price, which leads to a lower final good price and an increase in consumer surplus. This relationship follows from the assumption that firm i ’s marginal cost function is given by $w + \beta_i$, so that firms are allowed to differ only with respect to their β -efficiency, but not with respect to their α -efficiency.

5.5 Conclusion

We have provided a rationale why the exercise of buyer power of downstream firms vis-à-vis an input supplier may result in an overall higher input price under uniform pricing, which reduces consumer surplus. Based on this, we have argued why price discrimination of a monopoly supplier may benefit consumers in the presence of downstream buyer power. A relatively efficient downstream firm may benefit from a higher uniform input price because of a raising rivals’ costs effect where rival firms’ are harmed overproportionally from an input price increase.

This, however, can only happen if firms are sufficiently asymmetric with regard to their input efficiencies.

Declaration of Contribution

Hereby I, Markus Dertwinkel-Kalt, declare that the chapter “Raising Rivals’ Cost Through Buyer Power” is co-authored by Prof. Dr. Justus Haucap and Prof. Dr. Christian Wey. It has been published in Economics Letters (Dertwinkel-Kalt, Haucap and Wey, 2015).

My contributions to this chapter are as follows:

- I have written major parts of the Introduction
- I have calculated the Example
- I have contributed to the Model
- I have written major parts of the General Analysis
- I have contributed to the Conclusion

Signature of coauthor 1 (Prof. Dr. Justus Haucap):



Signature of coauthor 2 (Prof. Dr. Christian Wey):



Chapter 6

Conclusion

In this thesis, four articles on behavioral economics and industrial organization have been presented. Two of them test salience theory and apply it to consumer policy. The other two articles contribute to theoretical industrial organization and discuss issues of merger remedies and price discrimination.

Chapter 2 provides the first incentivized test of exchange asymmetries for unpleasant items, so-called *bads*. While loss aversion predicts 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 switch) for bads. The investigation of exchange asymmetries for bads is a key element to distinguish between the validity of loss aversion- and attention-based theories. As we find a strong endowment effect for bads, our results speak in favor of loss aversion. Therefore, attention-effects may not be strong enough to dominate loss aversion in the two-stage procedure on which our experiment is built. Our results suggest that loss aversion is a solitary key phenomenon which should be incorporated into behavioral theories of individual decision making.

Chapter 3 applies salience theory to consumer policy and argues how information campaigns can affect consumers who are susceptible to the salience-bias introduced in the preceding chapter. If a government intends to encourage healthier diets without harming consumers by raising taxes, information campaigns which focus consumers' attention either on the healthiness of one item or the unhealthiness of the other item work. According to our approach, however, it is more efficient to proclaim the unhealthiness of one product in order to present it as a "bad." Our results also predict in which markets comparative advertisement is especially effective and in which it is not.

Chapter 4 analyzes welfare effects of structural remedies on merger activity in a Cournot oligopoly when the antitrust agency applies a consumer surplus standard. We derive conditions such that otherwise price-increasing mergers become externality free by the use of remedial divestitures. In this case, the consumer surplus standard ensures that mergers are only implemented if they raise social welfare. If the merging parties can extract the entire surplus from the asset sale, then the socially optimal buyer will be selected under a consumer standard.

Chapter 5 challenges the view that a ban on price discrimination in input markets is particularly desirable in the presence of buyer power. A necessary and sufficient condition is derived such that a higher input price benefits a subset of relatively efficient downstream firms. In such instances, consumers may be better off if discriminatory pricing is feasible. Therefore, in order to assess the impact of discriminatory input pricing on consumer surplus in the presence of buyer power, firms' relative efficiencies with respect to input goods are to be considered.

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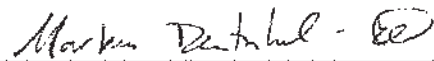
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Appendix

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, 3. Juni 2015.

Markus Dertwinkel-Kalt