



**How Product Assortments Affect Buyer Preferences: Empirical Analysis of the Robustness of the Compromise Effect**

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# How Product Assortments Affect Buyer Preferences: Empirical Analysis of the Robustness of the Compromise Effect



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## *Abstract*

Behavioral research revealed that product assortments can influence buyer preferences and affect purchase decisions between options of a product line. In this article, the compromise effect is investigated according to which the share of a product is expected to increase when it is in an intermediate position in an assortment subset. Since most of the previous studies on the compromise effect used artificial designs that lack realism, a limited external validity of experimental findings is to be supposed. This is a drawback, especially when decisions about compositions of real product lines should be supported. Therefore, an enhanced experimental design is presented with subjects making unforced and binding choices between real brands, which is similar to regular purchase decisions. Although results of our studies prove robustness, the magnitude of the compromise effect is significantly reduced in such real marketplace scenarios hence notably influencing predictions of sales and profitability of product lines.

## *Keywords*

Consumer Behavior; Compromise Effect; Consumer Preferences; Assortment Planning; Experimental Design; Choice in Context

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## Introduction

Determining profitable product assortments is a challenging task for managers in retailing. In a recently published article, this problem is described as making appropriate trade-offs between the breadth (variety of different product categories), depth (number of units within a category), and the service level (number of different items of a unit) with respect to constraints of a certain retailer such as physical space or amount of money ready for inventory investments (Mantrala et al. 2009). More specifically, regarding the depth of merchandise in a certain product category, the joint decision of both selecting and positioning adequate product units at certain price and quality levels in so-called product lines is considered one of the central problems in retailing (McIntyre and Miller 1999).

Thus, managers need profound information about consumers' preferences and attitudes which then determine the composition of the product line and support decisions like introducing new products and repositioning or eliminating established units like national or store brands (Sayman and Raju 2004). Therefore, to facilitate assortment and product line planning, a major objective in research on retailing is to develop robust models to predict consumers' response. A common and widely accepted approach is to use standard models of normative choice. However, the accuracy of predictions of such models is limited since prior research on choice behavior identified several anomalies that challenge some of the main assumptions of the theory of rational choice. In this paper, a specific behavioral anomaly termed the compromise effect (CE) is investigated which states that the share of an option is expected to increase when it is in an intermediate position with respect to attributes that primarily determine consumers' decisions between alternatives of a product line and diminishes when it is an extreme alternative in the choice set under consideration (Simonson 1989).

Changing the depth of offered product lines can influence consumers' buying behavior, induce demand shifts towards certain units of a product line, and have a strong impact on categories' profitability, thus becoming an important factor in retail competition (Simonson 1999). For exam-

ple, on the supposition that compromise effects hold true for real purchases, adding an expensive premium product to a narrow product line consisting of a low and a medium price/quality unit will shift the latter one into an intermediate position, thus increasing purchases of that mid-priced product and decreasing the sales of the low-priced product. Since medium priced alternatives generally realize different (and most often presumably higher) margins than low-priced units, category profits of a retailer might be substantially increased by a certain composition of the product line (Raghubir 2004).

Thus, the importance of research on anomalies like the compromise effect becomes obvious. In sharp contrast to most of the previous research on CE, not only hypothetical choices in artificial experimental environments were observed in our studies. We also applied experimental designs that relate closely to real buying decisions that consumers face in regular purchases at the point of sale. Thus, the main question our studies address is the robustness of CE: is the compromise effect merely an artificial effect that occurs in hypothetical decisions in laboratory experimental tests or does the compromise effect generalize to situations where consumers make binding buying decisions between real alternatives of a product line? Furthermore, violations of main assumptions of the standard theory of rational choice like the so called Independence of Irrelevant Alternatives Axiom (IIA-Axiom) are investigated.

## **Background**

### *Standard Theory of Rational Choice, Context and Compromise Effects*

The standard theory of rational choice assumes value maximization. A decision maker associates a subjective value (utility) with each option of a choice set under consideration and chooses the option with the highest value. In terms of purchasing decisions for instance, this means that consumers assess the value of a pocket calculator provided by TI using information about relevant features like price, number of functions, memory storage, display size or certain brand associations like perceived image or quality, and select the product with the highest overall value. Value maximization is based on stable underlying preference structures. Therefore, it is axiomatically asserted that

preferences are consistent, coherent, and even immutable, which means that preferences are determined only by relevant alternatives. Regarding the example described above, a consumer who prefers a certain pocket calculator by TI over HP when only these two products are offered, should retain this preference order unchanged when another pocket calculator unit supplied by Casio is included in the purchase decision. This assumption is termed in choice theory the *Independence of Irrelevant Alternatives Axiom (IIA-Axiom)*, which claims that the preference between options does not depend on the absence or presence of other options in the decision process. As a consequence, choice models assume constant substitution rates between options, hence ensuring *regularity*, according to which no option can increase its choice share when other options are additionally included in a choice set (Luce 1959). Furthermore, due to the so-called *similarity hypothesis*, the addition of a new option to a choice set will take more share from alternatives perceived more similar to the new entrant (Tversky 1972). This means that given a new pocket calculator provided by Casio enters the market, neither TI nor HP should increase their initial market shares and the brand that is perceived more similar to Casio by consumers should suffer more from its introduction.

However, the fundamental assumption of consistent and stable underlying preferences between options is challenged by experimental results showing that the ranking of alternatives within a given choice set often depends on relative positions and the composition of the choice set itself (Bateman et al. 2007). Choice can therefore often be assumed as context-dependent. Several so called *context effects* have been identified by researchers in the past, one of them being the attraction effect (Huber et al. 1982; Huber and Puto 1983; Simonson and Tversky 1992): options that become superior by the addition of asymmetrically dominated or relatively inferior options (decoys) to a choice set, should gain significant shares even though the decoys are typically not chosen and can therefore be reasonably considered as irrelevant for decision makers.

A second kind of context effect is what was termed *compromise effect* first published by Simonson (1989). Suppose that options like units of a product line are evaluated mainly with respect to two nearly equally important attributes like perceived quality and price of different units.

The compromise effect claims that the addition of an extreme option (high price/premium quality: denoted hereafter H) to a core set consisting of another extreme (low price/basic quality: L) and a medium option (medium price/quality: M) will increase the choice share of the intermediate alternative that is the compromise option M. Thus, the compromise option M is perceived more attractive in the triple choice set  $\{L, M, H\}$  than in either of the pair core sets  $\{L, M\}$  or  $\{M, H\}$  respectively.

Though empirical studies have demonstrated that the compromise effect is common, robust, and not exceptional, it is by no means inevitable (Sheng et al. 2005). Although researchers recently suggested different context-dependent choice models that capture this phenomenon and which often outperform standard valuation maximization models, there is currently still no comprehensive theory that allows one to predict both the occurrence as well as the magnitude of CE (Kivetz et al. 2004). Generally, empirical results have shown that CE is stronger among subjects who expect to justify their choice and that compromise effects occur even when options are not available at the time of decision, e.g. options that are listed but not on sale, for example goods being out of stock, fully booked services (travels, flights), or so called phantom alternatives (Doyle et. al. 1999, Simonson 1989). Furthermore, especially in price-quality trade-offs described above, CE becomes more likely to occur when an extreme premium option H instead of an opposite extreme in terms of a basic alternative L, is included to a pair core set ( Simonson 1989).

Specifically, it is argued in literature that CE typically occurs when options are characterized by a trade-off between attributes with diminishing marginal value (Simonson 1993). Therefore, compromise effects are often explained in literature by extremeness aversion that extends the basic principle of loss aversion to advantages and disadvantages as defined in terms of relative positions of options in the choice set rather than relative to encoded, adapted reference points (Tversky and Kahneman 1991). Extremeness aversion suggests that (all else being equal), the addition of the extreme option H increases the choice share of M, because M has only small advantages and disadvantages with respect to option L and H, whereas both options L and H have larger advantages and disadvantages with respect to each other (Chernev 2005). As a consequence, options with extreme

values become less attractive and the compromise option M is more likely to be chosen in a triple than in pair choice sets (Simonson and Tversky 1992).

Overall, results of research on context effects in general suggest that, contrary to economic standard theories, consumers do not make choices solely with respect to predefined and stable underlying preference structures (Drolet 2002). There is profound evidence that choice is often more about constructing preferences at the time of choice and several violations of main assumptions of normative choice models like the IIA-Axiom, regularity, or the similarity hypothesis have been detected (Bettman et al. 1998). As for marketing implications, it becomes obvious that the influence of different compositions on sales, revenues, and profits of a certain product line cannot be assessed and modeled based solely on utilities or subjective values of the units under consideration (Simonson 1993). Consumer preferences and purchasing decisions between units are influenced by configurations of the entire product line within which they are embedded (Drolet et al. 2000). Thus, under certain circumstances, marketing managers might influence or even manipulate consumers' buying decisions by including or eliminating inferior, asymmetrically dominated, extreme or compromise options in product lines.

#### *Previous Research on Compromise Effect and Contribution of the Paper*

Research on context effects in general has a long tradition especially in marketing literature (for a review see (Heath and Chatterjee 1995)). However, a closer examination of the designs that were used in prior research clearly reveals a *lack of realism* (Novemsky et al. 2007; Sinn et al. 2007). Since findings are supposed to support managerial decisions like assortment planning of retailers, research designs should also address the compromise effect in situations that are as close as possible to real purchase decisions in market settings. These regular buying decisions are characterized by binding transactions between branded products, circumscribable in terms of relevant intrinsic product attributes (design, functions) and extrinsic information cues like brand, brand-associated image, quality, and price (Zeithaml 1988). To the best of our knowledge, there is only one pub-

lished study investigating context effects in such regular buying decisions in in-store purchases at the point of sale (Doyle et. al. 1999).

In contrast, most experimental designs applied in laboratory environments to investigate behavioral anomalies observed merely *hypothetical choices or elicited choice probabilities*, while subjects faced no consequence of their decisions in terms of receiving products or even spending pocket money for getting selected options (see e.g. (Amir and Levav 2008; Chernev 2005; Drolet et al. 2000; Huber et al. 1982; Huber and Puto 1983; Kivetz et al. 2004; Rathneshwar et al. 1987; Simonson 1989; Simonson and Tversky 1992)). Thus, a major problem of applied economic and behavioral research in general then becomes apparent (Holt and Laury 2002; Holt and Laury 2005), which is the occurrence of a hypothetical bias due to the fact that subjects often do not face real consequences of their decisions in experimental environments. For instance, in a meta-analysis of studies which compare hypothetically and bindingly revealed willingness to pay of subjects for private and public goods, Murphy et al. (2005) identified significant overestimations when subjects make hypothetical decisions. Accordingly, from a psychological perspective the introduction of real payoff incentive mechanisms to experimental environments is suggested, as the influence of factors that are beyond the control of the experimenter and which might bias subjects' decisions is significantly reduced (Siegel and Goldstein 1959). Furthermore, economic experiments in risk research demonstrated that behavioral anomalies such as the preference reversal phenomenon—which shows in the domain of gambles that subjects often prefer a lottery A over a lottery B when evaluated jointly, though they are willing to pay more for the latter when both alternatives are evaluated separately—are admittedly robust when hypothetical or small real payoffs are introduced (Grether and Plott 1979; Tversky and Thaler 1990). However, when real payment tests with substantial payoffs are conducted, the overall rate of preference reversals is reduced significantly from 62 percent to 15 percent of the subjects (Bohm 1994). These findings indicate that the use of real payoffs may cause a substantial reduction of the magnitude of behavioral anomalies in choice settings. Therefore, any research on behavioral anomalies needs to test the robustness choice patterns in real payoff settings.

Furthermore, regarding research on compromise effect specifically, many studies used *forced choices* instead of including no-buy options in the choice sets similar to regular buying decisions where consumers always have the option not to buy any of the brands for instance due to inadequate offers or unacceptable price levels of products. However, empirical results indicate that behavioral anomalies and especially compromise effects become more likely when subjects' choices are forced artificially and they hence do not have the option of choosing none of the alternatives presented in the decision process (Dhar 1997; Dhar and Simonson 2003).

Moreover, only recent research work started considering real and definable brands available for purchasing in marketplaces (Sinn et al. 2007), whereas in former studies most often *fictitious or unbranded options* labeled with letters or numbers or merely identical branded line extensions served as options of the choice set (e.g. Sheng, Parker and Nakamoto 2005). Additionally, in some of the studies on context effects, *prices were excluded* deliberately or subjects were told that options were equally priced to avoid price quality inferences (Chernev 2005). Moreover, Simonson and Tversky (1992) pointed out, that CE-inducing differences in evaluation of perceived advantages and disadvantages may not exist for certain attributes such as prices, and that the extremeness aversion principle holds primarily for quality attributes (Sheng, Parker and Nakamoto 2005). However, extrinsic information cues like prices and brands often differentiate products in the today's marketplace which is comprised of a variety of increasingly similar offerings. Thus, as was pointed out in recent research correctly, it can be reasonably assumed that price levels, brands, and brand-associated qualities often serve as risk-reducing information chunks when consumers use simple choice heuristics (Sinn et al. 2007). Considering the habitual character of decisions in fast moving consumer good categories, brands, and prices are to a certain degree always part of consumers' decision environment. Therefore, similar to well established designs in pricing research such as the conjoint measurement-based brand price trade-off approach, realistic price levels, and real brands should be included in the stimuli design (Blamires 1997), especially when the robustness of the behavioral anomalies like the compromise effect is under investigation.

To summarize this brief review of designs applied in studies on context effect in general and compromise effect in particular, though definitely generating conclusive results, the findings and implications of prior research might be biased and potentially overestimated due to the hypothetical and sometimes artificial experimental setting. The failure to use realistic environments may limit the external validity and thus place boundaries on major findings of the studies. This is a major drawback, especially when managerial implications for retailers' pricing or positioning decisions of units in product lines should be derived. This gap in past research is remarkable, not to say surprising, because researchers in previous as well as in recently published studies explicitly noted this call for realism and suggested that future behavioral research should test whether compromise effects are merely artificial or do they persist in real choices and thus generalize to more natural consumer environments respectively (Simonson 1989; Sinn et al. 2007). Thus, designs of our studies incorporated certain aspects of real marketplace scenarios, extended previous studies, and therefore filled this gap in past research.

### **Hypotheses Development**

The question our studies address is whether the compromise effect generalizes to buying decisions that are designed closer to real marketplace scenarios. To test the robustness of the compromise effect, choices in our studies were framed both hypothetically as well as bindingly with the latter being a setting where subjects faced real consequences of their decisions. In purchase decisions in experimental environments where subjects typically make more than one decision (multistage decisions), binding consequences can be implemented in the decision process, for instance in terms of risk-free payoffs (selected winners receive the option chosen in a certain decision as a gift or free sample, see e.g. Simonson 1992), or formal buying obligations (each subject either has to buy a product chosen at a given price or definitely cannot buy when she has chosen a no-buy option in that certain decision). In order to ensure a higher degree of realism, the latter approach was applied in one of our designs, where the binding decision for each subject was determined by a random payoff mechanism similar to a lottery and described in detail later.

Further, our designs included a no-buy option as well as only real brands and items definable in terms of relevant attributes regarding the specific product categories under examination. Similar to regular buying decisions, visible price tags were included in visualizations of shelves and units respectively during the whole decision process as suggested by Blamires (1998).

In general, studies on context effect used a stimuli design in accordance with a paradigm applied in prior research. Respondents were presented with several choice sets consisting of either two (pair) or three alternatives (triple) described by two attribute values (see e.g. Huber et al. 1982; Rathneshwar et al. 1987; Simonson 1989). In our designs, we used a setting similar to the situation described in the background section: a high price/premium quality brand H is added in the triple set {L, M, H} to a pair core set of a low- and medium-price/quality brand {L, M}. Since in such a configuration, compromise effects proved to be a robust behavioral anomaly in prior research (Simonson and Tversky 1992), we expect the CE to occur both in a hypothetical framing as well as in settings where subjects face real consequences of their decisions and the buying obligations of subjects are determined by a random payoff mechanism. However, due to the occurrence of the hypothetical bias identified in previous research and described above, we assume that the magnitude of CE diminishes significantly when subjects face real consequences of their decisions instead of choosing merely hypothetically.

- H<sub>1</sub>: The compromise effect (increase of share of intermediate option M when extreme option H is added) occurs when subjects' decisions are hypothetically framed.**
- H<sub>2</sub>: The compromise effect (increase of share of intermediate option M when extreme option H is added) occurs when buying obligations of subjects are determined by a random payoff mechanism.**
- H<sub>3</sub>: The magnitude of compromise effect (increase of share of intermediate option M when extreme option H is added) diminishes when subjects face consequences of their decisions instead of making choices in a hypothetical environment.**

## Study One

### *Method and Procedure*

For ensuring sufficient homogeneity between experimental conditions of our laboratory tests, we recruited female undergraduates as subjects for all of our studies. Based on information about buying behavior and preferences of these females gathered in numerous preliminary studies,

we selected two widely used fast moving consumer good categories of this target group (toothpaste and shampoo). Only subjects with at least a basic level of buying experience and brand knowledge were considered, thus ensuring sufficient product affinity and response among participants. Two standard items of brands offered nationally at low and medium price/quality levels served as option L (Dentagard, Herbal Essences) and M (Colgate, Elvital) of the core sets, whereas a differentiated unit deliberately represented the expensive premium option H in each product category (Sensodyne, P.Mitchell). Concerning specific product attribute values, pretest information suggested a focus in both categories on the whole bundle of attributes subjects associate with a certain brand name and the median price information based on market observations as general information cues similar to most of the other studies in this field (McIntyre and Miller 1999).

To check *a priori* whether brand-associated image and quality perceptions of the brands were manipulated successfully, a ranking procedure eliciting robust preference values was used (Bateman et al. 2007). A different sample of ninety female participants of the same parent population was asked in a separate pretest lottery for a ranking of the three brands in each product category in terms of arranging them from the most- (rank 1) to least-preferred (rank 3). Participants were informed at start that ten percent of them would be selected at random as winners in one of the product categories, two brands were selected at random for each of these winners. Winners received as a gift the brand they had ranked higher before. Results confirm coherence between rankings and price/quality positions of the brands in product lines: more than 60 percent of the participants preferred the expensive premium option H in each product category as a gift. Mean rankings for toothpaste were L=2.50, M=2.04, and H=1.46 for the toothpaste units and L=2.22, M=2.02, and H=1.75 for shampoos. Mean values differed from each other significantly as expected in both categories ( $t > 1.8$  and  $p < 0.10$  for each brand combination L/M and M/H in paired-samples T-Tests). Thus, in contrast to stimuli designs investigating attraction effects, option H has in fact an extreme position concerning both price- and brand-associated quality as intended and is definitely not perceived as an asymmetrically dominated or a clearly inferior alternative in a sense of a decoy.

Subjects of experimental study one were 75 female undergraduates from different fields of study at a German University who agreed to fill out a one-paged, two-sided questionnaire during classroom surveys. In a between-subjects design<sup>1</sup>, the composition of the choice set CS was manipulated in both product categories under examination (CS2={L,M}; CS3={L,M,H}). Participants were randomly assigned to one of these two experimental conditions. Demographical and buying behavioral information (age, faculty, relevant sets, price consciousness, price estimations, etc.) were gathered as well as a hypothetical decision between certain brands in each product category. Similar to previous designs, subjects were instructed at the start to imagine that they needed to buy a toothpaste or shampoo and that they found in a local store a certain set of brands from which to choose only one as in regular buying decisions (Sinn et al. 2007). Further, they were explicitly solicited to “purchase” in as realistic a manner as possible such as in regular buying decisions, though they knew *a priori* that they would definitely not face any consequences of their decisions.

### *Results*

Contingency analysis of demographical and buying behavior information confirmed no significant disparities between our experimental conditions (each  $\chi^2 < 3.3$ , n.s.). It has to be noted that in contrast to previous studies on compromise effect, option H gains only small choice shares far below ten percent, presumably due to its extreme position with respect to the differentiated position at a high price level (Simonson and Tversky 1992). Firstly, concerning the perception of subjects, alternative H can therefore be reasonably considered as irrelevant in the triple choice set {L,M,H} presumably in terms of a too expensive brand. Secondly, the negligible share of H allows for direct comparisons of choice shares of option L and M instead of calculating normalized relative shares and check so-called betweenness inequalities to identify CE (Kivetz et al. 2004; Simonson and Tversky 1992; Tversky and Simonson 1993). As can be seen in the upper section of table 1, overall results clearly support hypothesis H1 in terms of the well-documented compromise effect. The addition of the extreme premium option H to the core set {L,M} increases the choice share of the compromise alternative M in both product categories under examination significantly by almost 30 per-

cent when subjects face no real consequences, thus making hypothetical decisions. Note that the compromise effect occurs, though the extreme option H has nearly not been chosen by participants in this survey, hence violating the IIA-Axiom as well as the regularity and the similarity hypothesis as main assumptions of normative choice models. While these findings merely confirm results of prior research, the question arises whether such compromise effects are not only artificial, but robust and can be obtained in real purchase decisions of consumers as well.

## **Study Two**

### *Method and Procedure*

In study two, the degree of realism was significantly enlarged by considering certain characteristics of regular buying decisions. In order to make a better comparison, the same product categories and brands served as options of the choice sets analogous to study one. A larger sample of 233 female subjects was recruited from the same parent population, but differing from the sample from the participants of study one and the pretest samples. Again, only subjects with at least a basic level of buying experience and brand knowledge in the product categories were considered. In a between-subjects design, participants were randomly assigned to one of the two experimental conditions CS2 {L,M} (n=118) and CS3 {L,M,H} (n=115). Subjects received a show-up-fee (8€ cash payment). Recruitment and payment of the show-up-fee was executed two weeks before the laboratory experiment took place in order to evade empirically proven biasing effects like the “house money effect” which is often induced when cash incentives are delivered immediately at the beginning of an experiment (Thaler and Johnson 1990).

During the laboratory experiment participants’ willingness to buy was determined in a first section. Placed into cabins with a virtual shelf on a computer screen, subjects had to indicate in seven different purchasing decisions (price scenarios) in each product category which brand if any, they would buy, given certain real market price levels of the brands. Six decisions contained a systematic trade-off in terms of an increasing price of option L and a decreasing price of option M whereas option H varied in price randomly within a smaller range. Both brand positions in the vir-

tual shelf as well as price scenario orders were determined at random to evade biasing influences such as starting point bias, sequence, or primacy/recency effects (Mitchell and Carson 1989). Furthermore, a replication of the price scenario presented in the second decision was included at the end of this section for reasons of checking validity and decision consistency at an individual level. To avoid hypothetical bias, a random payoff mechanism similar to standard procedures for eliciting preferences was applied (Grether and Plott 1979). Subjects were explicitly instructed at the start that they had to draw a ball with a number from a box at the end of the experiment. That number indicated a certain price scenario. The decision a subject made in that scenario became binding. That means that participants either were obliged to buy (spent their own pocket money to pay the price of a chosen product for receiving it), or they could not buy any of the products in case of having chosen the no-buy option in that scenario. Thus, subjects were fully aware of the consequences of their decisions. Furthermore, the random payoff mechanism induces independence of each decision of a single subject in the experiment, hence avoiding so called portfolio effects which are assumed to bias choice behavior significantly in such multistage decisions (Grether and Plott 1979). After gathering information about buying behavior (purchase frequency, brand usage, price, and quality consciousness) and demographical characteristics of the sample in a second section, the random payoff mechanism was applied in the final section of the experiment. Transactions were also realized in the laboratory environment one week after experiments took place for practical reasons (ensuring sufficient liquidity of subjects and stockpiling products on demand).

Overall, in contrast to most of the designs used in prior research on context effects, our experimental framing obviously relates much closer to a natural consumer environment. Similar to real marketplace scenarios, subjects faced unforced but binding purchase decisions between real brands. Therefore, the whole setting of the buying decision situation can be classified as a realistic laboratory experiment and contains, in fact a touch of realism (McIntyre and Miller 1999).

### *Results*

Contingency analysis of demographical and buying behavior information confirmed no significant disparities between both experimental conditions (each  $\chi^2 < 5.1$ , n.s.). As for hypothesis H2, analysis indicates the occurrence of a compromise effect even in binding buying decisions in both product categories. Again, though very few subjects selected the high price/premium quality option H itself (less than five percent), the addition of this extreme alternative H to the choice set in CS3 shifts option M into the compromise position and influences subjects' buying behavior. Note that we consider only buying decisions of subjects, shares of no-buy options are excluded from analysis hereafter. Furthermore, results depicted in the lower section of table 1 are based on aggregated data. Hence, the total number of decisions (denoted (d) and given in parenthesis for each condition) exceeds the total number of subjects (n) due to the multistage character of our design. As can be seen, purchases of the compromise brand M increase by around ten percent whereas the choice share of the extreme alternative L decreases significantly in both product groups under examination.

Hypothesis H3 gives rise to the question of whether realistic framings similar to regular buying decisions like the one we used in study two tend to avoid occurrence or reduce magnitude of the compromise effect in comparison to hypothetical choices. Remember that in contrast to study one, participants of study two faced binding decisions in terms of spending their own pocket money for getting real products, whereas participants of study one solely made hypothetical decisions without any consequences, hence subjected clearly to an environment with a lower degree of realism. As shown in table 1, two effects of these different design settings become apparent.

Firstly, considering both product categories, the mean share of the compromise brand M in CS2 is clearly higher (nearly 50 percent) in study one than in study two (around 25 percent). Regarding our specific sample (female undergraduates), we assumed subjects to be generally price-conscious and price-sensitive, respectively. Accordingly, analysis of information about buying behavior gathered in the second section of study two reveals a substantial percentage of price-oriented subjects in both categories (nearly forty percent). Since such so-called deal-prone consumers are evidently expected to prefer cheaper offerings in general (Kumar et al. 1998), three out of four par-

ticipants tended to choose the low-priced brand rather than a medium-priced brand in study two where buying obligations were applied in the decision environment and subjects faced risk of spending pocket money. Therefore, the observed difference in the level of choice share of option M in both studies is actually consistent and not likely to be an effect of a sampling error.<sup>2</sup>

Secondly, concerning the magnitude of CE; it turns out that the hypothetical setting in study one seems to induce larger gains in choice share of the intermediate alternative M (around thirty percent in absolute values) than the realistic consumer environment applied in study two (nearly ten percent). This indicates a hypothetical bias in terms of an overestimation in the amount of twenty percent. A closer examination of a mean rate of increase (MRI), computed as percentage gain of compromise brand shares in both product categories, reveals significant differences between the studies. We observed a calibration factor of 1.62 in the hypothetical study one whereas an MRI of 1.39 was computed in study two. That is, adding the high price/premium quality brand H to the core set {L,M} increases the share of purchases of the compromise brand by a factor of 1.39 (Toothpaste: 1.35, Shampoo: 1.44) in binding purchase decisions. The difference of the mean rate of increase in hypothetical and binding framings turns out to be significant according to a univariate ANOVA ( $F(1,2)=17.3$ ,  $p<0.1$ ), thus clearly supporting hypothesis H3. As expected, the magnitude of the compromise effect diminishes significantly when subjects face consequences of their buying decisions. In previous research based on hypothetical designs, a wide range in MRI calibration factors from 1.2 to 1.8 could be observed in different product categories, e.g. calculators, portable grills, batteries, cameras, binoculars, scanners, cordless phones, snow throwers (Simonson 1989; Simonson and Tversky 1992; Sheng, Parker and Nakamoto 2005; Sinn et al. 2007), thus indicating that the magnitude of the shift of market share for the compromise option does also vary across different product categories.

Table 1: CE in hypothetical and binding buying decisions

	Product category	Toothpaste (n=75)		Shampoo (n=75)	
	Condition CS	CS2 (n=33)	CS3 (n=42)	CS2 (n=33)	CS3 (n=42)
Study one MRI=1.62	L (%)	52	16	49	14
	M (%)	48	79	51	81
	H (%)	-	5	-	5
			$\chi^2=11.1, p<0.01$	$\chi^2=10.9, p<0.01$	
	Product category	Toothpaste (n=233)		Shampoo (n=233)	
	Condition CS	CS2 (d=625)	CS3 (d=634)	CS2 (d=486)	CS3 (d=579)
Study two MRI=1.39	L (%)	75	62	74	64
	M (%)	25	36	26	35
	H (%)	-	2	-	1
			$\chi^2=21.5, p<0.01$	$\chi^2=11.9, p<0.01$	

### Validation

Additionally, validity of the results of study two was checked. More than nine out of ten participants fulfilled their buying obligation drawn at random without complaining though they actually could not have been forced to make transactions. This means that subjects were fully conscious of the consequences of their choice, decided like they normally do in real purchases, and felt comfortable with the outcomes of their decisions. Secondly, an analysis of the check-scenarios replicated at the end of the binding buying decisions in the first section reveals an overall correctness of more than 95 percent in all experimental conditions, though according to statements after the experiments, subjects were not aware of an inclusion of identical price scenarios. This indicates a high degree of decisions' consistency even at an individual level (McIntyre and Miller 1999). Therefore, the observed compromise effect is obviously not induced by mental overloads due to the higher complexity of the decision setting in condition CS3. Thirdly, it turns out that prices accepted by participants in the decision scenarios of our experimental setting really reflect regular buying environment and behavior. As depicted in table 2 and discernable especially in experimental condition CS3, we observed a very good fit between highest prices subjects were willing to pay (WTP) for both of the brands L and M in each product category and marketplace price ranges and mode values of these brands based on market observations.

Table 2: Participants' willingness to pay (WTP) vs. market-based price levels

	Prices		Experimentally revealed WTP		Market-based observations	
	Condition	CS	CS2	CS3	Price Range	Mode Price
Toothpaste	L (€)		0.76	0.81	0.55-0.89	0.79
	M (€)		1.24	1.32	1.29-2.19	1.69
Shampoo	L (€)		1.48	1.60	1.25-2.09	1.69
	M (€)		2.06	2.14	1.95-2.79	2.39

### General Discussion

The two studies presented in this paper systematically examined the influence of different compositions of product assortments (depth in terms of the number of units offered within product categories) on consumers' buying behavior in general. In particular, previous research indicates that in some cases, consumers tend to shift preferences towards intermediate compromise options when a core assortment consisting of only a low and a medium price/quality option is enlarged by a high price/quality alternative. Despite the large number of empirical studies that have examined such compromise effects over the recent decades, very few used experimental settings that relate close to natural consumer environments. In sharp contrast, the design of our study two primarily incorporated certain aspects of real marketplace scenarios, thus observing unforced and binding buying decisions of experienced participants of a real target group between real circumscribable brands in two frequently used fast moving consumer product categories in laboratory experiments.

Similar to results of prior research based on hypothetical experimental settings, we found significant support for the efficacy of the compromise effect in general. Therefore, CE is not an artificial effect, but rather a robust behavior anomaly that occurs even when subjects face real consequences of their decisions in terms of spending pocket money for receiving a certain real product. Hence, constraints and limitations of major findings and uncertainty as to practical implications induced by artificial choice environments used in previous experiments are significantly reduced. However, a closer examination of the hypothetically framed study one and the binding decisions conducted in study two reveals a diminishing magnitude of CE in terms of an almost twenty percent

smaller gain in share of the compromise brand when subjects face real consequences of their decisions, hence clearly indicating a hypothetical bias.

It is noteworthy that we included a differentiated high-price/premium quality brand as alternative H in our experimental setting deliberately thus making this extreme option very unlikely to be chosen by participants. However, the compromise effect proved to be robust though this option H can reasonably be assumed as an irrelevant alternative for most of the subjects of our studies at least in the context of our experimental setting. Thus, a violation of the fundamental IIA-Axiom of choice theory and the similarity and regularity hypothesis is detected once again even in a natural consumer environment. Similar to implications of prior research, this finding stresses the need of incorporating context-dependent decisions when choice behavior has to be modeled instead of solely applying traditional normative models of rational choice.

#### *Managerial Implications and Future Research*

As mentioned in the background section of this paper, our studies clearly confirm that consumers' preferences and purchase decisions between units are influenced by configurations of the entire product line within which they are embedded. According to our results, options positioned as a compromise gain significant shares in both of the product categories under examination when high-price/quality products are included in the assortment even in more natural consumer environments. Thus, with respect to the specific margins of the units of the product line, the occurrence of compromise effects enables managers to improve the retailer's position with respect to realized sales, revenues, and profits simply by adding or excluding extreme options H (high-price/quality alternative) to or from a certain category.

However, findings of prior research discussed above revealed that the occurrence of CE is not inevitable. From the economic perspective, whenever anomalies in buying behavior of consumers such as compromise effects are detected, retailers should take the opportunity of making money with changes of assortments into account. Therefore, to give substantial support for managerial decisions about the composition of product lines in certain real product categories, the necessity of

field experiments (store and market tests) or laboratory-based pretests becomes obvious. Since our results confirm that the magnitude of the compromise effect is overestimated significantly in hypothetical designs, experimental environments should be designed as realistically as possible when laboratory experiments are conducted (which is often the case, e.g. for reason of lower costs of conducting, better handling, controlling influences of other factors which determine buying behavior, avoiding negative image effects of temporary changes of real assortments or others).

Regarding this obvious hypothetical bias, table 3 in the appendix demonstrates an example based on market information of a local store of a large national retail chain. Given the consumers' choice shares of the core set brands L and M observed in both experimental conditions CS2 and CS3 in our studies, we registered units sold in year 2008 of both of these top brands in the category toothpaste (around 7.800) and shampoo (around 5.200 units) and computed predicted sales for each option accordingly. Imputed margins per unit were derived by the difference between regular buying prices observed in stores of a nationwide wholesaler chain and median selling prices observed in that local store of the national retail chain<sup>3</sup>. Based on the magnitude of the compromise effect that we encountered in study two, product line margins per period would increase by 12.6 percent (from 1.599€ to 1.802€) for the category toothpaste and by 6.4 percent (from 1.965€ to 2.090€) for shampoos when the high-price/quality option is added to the pair core set, whereas the predicted CE-induced increase in gain is much greater (27.8 or 16.6 percent, respectively) when shares are derived merely from hypothetical decisions observed in study one. Therefore, for the purpose of increasing external validity of findings, a higher degree of realism than applied in previous laboratory-based research is recommended when managerial decisions have to be supported by results from experimental research (Sheng, Nakamoto and Parker 2005).

As for the general importance of behavioral anomalies like the compromise effect for assortment planning of retailers, the relatively small increase in absolute margins per year in both product lines (203€ for toothpaste, 125€ for shampoo) appears to be less noticeable and probably not worth considering. However, taking into account the broad variety of different product catego-

ries offered in this local and similar other stores of the retail chain, the total number of stores in the retailers' local sales territory (1.544 stores with sales of nearly €6.3 billion registered in 2008) and the nationwide number of stores of the whole retail chain (12.000 stores with sales of €43 billion expected in 2009), the importance of this issue in terms of realizing possible system-wide benefits is definitely stressed.

## Notes

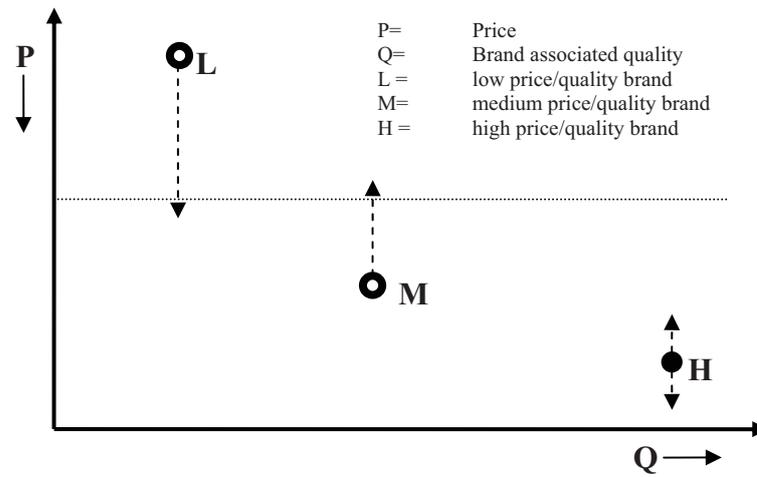
- <sup>1</sup> Though several investigators have criticized the adequacy of between-subjects designs by pointing out that no single subject exhibited the hypothesized judgment or behavior, we deliberately used this design in both studies similar to most of the prior research to avoid memory-based response in the questionnaire or possible biasing effects during intervals between sessions like variety seeking and others (Heath and Chatterjee 1995; Rathneshwar et al. 1987).
- <sup>2</sup> Moreover, comparing shares of the core sets brands {L, M} in condition CS3 and relative shares based on market observations in a local store of a national retail chain, a sufficient fit can be obtained (e.g. relative sales of 65% for the brand Dentagard and 35% for Colgate in the category toothpaste).
- <sup>3</sup> Note that this margin is rather a naïve approximation for convenience, thus excluding exact calculations of the retailer's fix or personnel costs or bargains realized in direct deals with manufacturers or others. However, experience-based information suggests a lower mean return on sales [RoS] of about one or two percent in the German retail food and non-food sector.

## Appendix

Table 3: Changes in profit considering observed magnitudes of compromise effect in hypothetical and binding decisions

<b>STUDY ONE</b>	Prices			Shares		Sales		Margins		
Toothpaste	Buying Price	Retail Price	Margin per unit	CS2	CS3 <sub>a</sub>	CS2	CS3 <sub>a</sub>	CS2	CS3 <sub>a</sub>	
Dentagard	0.65€	0.79€	+0.14€	52%	16%	4.056	1.248	568€	175€	
Colgate	1.29€	1.69€	+0.40€	48%	79%	3.744	6.162	1.498€	2.465€	
<sub>a</sub> = shares, sales and gross margins of option H excluded							Margins	<b>2.066€</b>	<b>2.640€</b>	<b>+ 574€</b> <b>(+27.8%)</b>
Shampoo	Buying Price	Retail Price	Margin per Unit	CS2	CS3 <sub>a</sub>	CS2	CS3 <sub>a</sub>	CS2	CS3 <sub>a</sub>	
Herbal	1.39€	1.69€	+0.30€	49%	14%	2.548	728	764€	218€	
Elvital	1.79€	2.39€	+0.60€	51%	81%	2.652	4.212	1.592€	2.527€	
<sub>a</sub> = shares, sales and gross margins of option H excluded							Margins	<b>2.356€</b>	<b>2.745€</b>	<b>+ 389€</b> <b>(+16.6%)</b>
<b>STUDY TWO</b>	Prices			Shares		Sales		Margins		
Toothpaste	Buying Price	Retail Price	Margin per unit	CS2	CS3 <sub>a</sub>	CS2	CS3 <sub>a</sub>	CS2	CS3 <sub>a</sub>	
Dentagard	0.65€	0.79€	+0.14€	75%	62%	5.850	4.836	819€	678€	
Colgate	1.29€	1.69€	+0.40€	25%	36%	1.950	2.808	780€	1.124€	
<sub>a</sub> = shares, sales and gross margins of option H excluded							Margins	<b>1.599€</b>	<b>1.802€</b>	<b>+ 203€</b> <b>(+12.6%)</b>
Shampoo	Buying Price	Retail Price	Margin per unit	CS2	CS3 <sub>a</sub>	CS2	CS3 <sub>a</sub>	CS2	CS3 <sub>a</sub>	
Herbal	1.39€	1.69€	+0.30€	74%	64%	3.848	3.328	1.154€	998€	
Elvital	1.79€	2.39€	+0.60€	26%	35%	1.352	1.820	811€	1.092€	
<sub>a</sub> = shares, sales and gross margins of option H excluded							Margins	<b>1.965€</b>	<b>2.090€</b>	<b>+ 125€</b> <b>(+ 6.4%)</b>

Figure 1: Trade-off price scenarios of study two



toothpaste Scenario	price L Dentagard €	price M Colgate €	price H Sensodyne €	shampoo Scenario	price L Herbal €	price M Elvital €	price H Paul Mitchell €
1	0.19	1.99		1	0.99	2.79	
2	0.39	1.79		2	1.19	2.59	
3	0.59	1.59	varying randomly around 3.99	3	1.39	2.39	varying randomly around 18.75
4	0.79	1.39		4	1.59	2.29	
5	0.99	1.19		5	1.79	1.99	
6	1.19	0.99		6	1.99	1.79	
7	replication			7	replication		

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