THE EFFECT OF GLUCOSE CONSUMPTION ON CUSTOMERS' PRICE FAIRNESS PERCEPTION*

Marc Linzmayer/Mirja Hubert/Tim Eberhardt/Thomas M. Fojcik/Peter Kenning**

ABSTRACT

Price fairness research has not yet developed a comprehensive explanation of what drives customers' perception of price fairness. Here, we show that customers perceive product prices as having greater fairness after glucose intake, thus identifying a biological driver of customer price fairness perception. We also show that there is no linear effect of glucose consumption on customers' price fairness perception, and that glucose intake does not lead to significant differences in the mood states of participants. Our results demonstrate how the integration of neuroscience concepts and theories can provide deeper insights on automatic and unconscious processes, hence making it possible for marketing and consumer researchers to better understand customers' price fairness perceptions.

JEL Classification: C92, D03, D87, M31.

Keywords: Consumer/Decision Neuroscience; Customer Biology; Fairness Judgments; Glucose Intake; Price Fairness.

* We would like to thank the editor and guest editor of the *sbr*, Prof. Dr. Wolfgang Ballwieser and Prof. Dr. Isabell Welpke, as well as the anonymous reviewers, for their excellent work in providing guidance on ways to improve the article. Moreover, we are grateful to Rudolph Wenzler of Raphael Pharmacy (Meckenbeuren, Germany) for the support regarding the glucose for Study 1. In addition, we thank Jun.-Prof. Dr. Marco Hubert for his support during the data acquisition for Study 2. We also appreciate the numerous and helpful comments of participants of the Association for Consumer Research North American Conference in Pittsburgh 2009.

** Marc Linzmayer holds a PhD in Business Administration (Dr. rer. pol.) and is a research assistant at the University of St. Gallen, Institute of Retail Management (IRM-HSG), Dufourstrasse 40a, 9000 St. Gallen, Switzerland. Mirja Hubert holds a PhD in Business Administration (Dr. rer. pol.) and is a research assistant at Zeppelin University, Am Seemooser Horn 20, 88045 Friedrichshafen, Germany. Tim Eberhardt holds a PhD in Business Administration (Dr. rer. pol.) and is CEO at Münster Research Institute, Hügelsstr. 3, 48493 Wettringen, Germany. Thomas M. Fojcik is a research assistant and doctoral candidate in the Department of General Business Administration and International Automotive Management at the University of Duisburg-Essen, Germany. Peter Kenning is Chair of Marketing at Zeppelin University, Am Seemooser Horn 20, 88045 Friedrichshafen, Germany.

Corresponding Author: Marc Linzmayer (marc.linzmayer@unisg.ch).

1 INTRODUCTION

The goal of our study is to provide new evidence that helps to close the research gap in customers' affective responses to prices. We assume, as a fundamental concept, that the affective response associated with price fairness perceptions can be driven by biological processes (Küpper (2009); Wang and Dvorak (2010)). Building on previous work (Xia and Monroe (2010); Xia, Monroe, and Cox (2004)), we define price fairness perception, as it functions within the context of customer behavior, as an individual condition that depends on cognitive and affective processes in the customer's brain. Because research in the overlap of neurobiology and price fairness perception is limited, our study addresses this research gap.

Since 2003, the integration of neuroscientific methods, concepts, and theories into economic and management research, which has been labeled as "neuroeconomics", has gained much in importance (Camerer, Loewenstein, and Prelec (2005); Sanfey et al. (2006); Stanton, Day, and Welpé (2010); Zak (2004)). In this research stream, the emerging sub-field of consumer neuroscience assumes that with deeper insights in unconscious, automatic, and biological processes, marketing-relevant behavior such as buying-decisions can be better explained (Achrol and Kotler (2012); Hubert and Kenning (2008); Kenning, Plassmann, and Ahlert (2007); Lee, Broderick, and Chamberlain (2007)). The consumer neuroscience approach has already been applied to the investigation of marketing relevant problems, such as in the field of brand communication (Ambler, Ioannides, and Rose (2000); Deppe et al. (2007); Koenigs and Tranel (2008); Plassmann, Ramsøy, and Milosavljevic (2012)), advertising (Kenning et al. (2007); Plassmann et al. (2007)), and packaging (Hubert et al. 2013; Stoll, Baecke, and Kenning (2008)).

Researchers have also used neuroscientific methods to examine the field of pricing (Knutson et al. (2007); Plassmann, O'Doherty, and Rangel (2007)). Price issues are a basic influencing factor in customer buying decisions, and therefore have an impact on company sales results and profits (Diller (2008); Gabor and Granger (1979); Lichtenstein, Ridgway, and Netemeyer (1993); Pasternack (1985); Rao (1984)). Since the product price is such a major factor in all buying situations, it represents a sacrifice that customers must make if they wish to engage in a purchase transaction. These economic transactions are driven by economic motives as well as by psychological and biological aspects (Riedl and Javor (2012); Sen (2002)).

One critical psychological aspect that is often applied to price perception, and thus one that plays an important role in management research, is fairness (Fehr and Schmidt (1999)). Fairness is especially significant in interpersonal relationships, but it can also play an important role in economic transactions (Husted and Folger (2004)). Price fairness perception is defined as customers' assessment of, and associated emotions toward, whether the difference between a seller's price and a competitor's price is reasonable, acceptable, or justifiable (Kukar-Kinney, Xia, and Monroe (2007); Xia, Monroe, and Cox (2004)). Previous research shows a major influence of price fairness on other marketing

constructs such as customer satisfaction (Bei and Chiao (2001); Seiders et al. (2005)), willingness to pay (Campbell (1999); Kahneman, Knetsch, and Thaler (1986)), purchase intention (Babin, Hardesty, and Suter (2003); Campbell (1999); Kristensen (2000); Kukar-Kinney, Xia, and Monroe (2007); Maxwell (2005)), recommendation and intention to switch the brand (Matzler, Würtele, and Renzl (2006)), and customer loyalty (Bei and Chiao (2001)). These studies show that the combination of prices with fairness perceptions is an important topic for marketing research. In the specific context of customer research, various studies show that price fairness perception can be determined by economic factors as well as by psychological and social components (Campbell (1999); Maxwell (2002)).

However, traditional price fairness research has not yet developed a comprehensive understanding of what drives customers' perceptions of price fairness (Bolton and Alba (2006); Homburg, Hoyer, and Koschate (2005)) and the automatic, unconscious, and biological processes that may provide new insights to price fairness perception have so far been ignored. Studies show that fairness is especially important for interpersonal relationships. For the purposes of marketing and consumer research, it is important to investigate if the concept of fairness is transferable to price issues as well, and if price fairness is a valid construct for use in marketing and consumer research. For example, Yoon et al. (2006) use functional magnetic resonance imaging (fMRI) to examine if the concept of personality is transferable to brands. Hence, the academic void concerning price fairness is twofold. On the one hand, the integration of neuroscientific methods, concepts, and theories can provide deeper insights into automatic and unconscious processes, thus making it possible for researchers to better understand the different drivers of price fairness perceptions. On the other hand, the application of neuroscientific and biological findings can provide deeper insights into the transfer of general ideas and definitions such as fairness to marketing and consumer research (Saad (2008)).

Although most of the studies in the field of consumer neuroscience use neuroscientific methods such as fMRI, there are also studies that draw solely on neuroscientific theories and concepts (e.g., Whadwa, Shiv, and Nowlis, (2008)) without the costs associated with imaging technology (see limitations in Knoch et al. (2006); Koenigs and Tranel (2007); Sanfey et al. (2003)). We use this indirect approach by integrating neuroscientific concepts and theories with marketing research to address this twofold academic void.

First, we develop a study design that builds on neurological and biological evidence and processes on general fairness perception. Our design is one that can be easily transferred into a business and marketing research context.

Second, we influence a biological mechanism of our participants directly (see limitations in Emanuele et al. (2008); Koenigs and Tranel (2007); Sanfey et al. (2003)). We do so in a way that represents a natural manipulation such as most customers are faced with every day (see limitations in Bos, Dijksterhuis, and van Baaren (2012); Crockett et al. (2009)).

Third, we measure participants' reactions in an experimental setting that represents an important environmental influence, price fairness perception, on a selected construct in consumer behavior. Thus, we complement past studies in marketing or other fields (see Crockett et al. (2009); Mishra and Mishra (2010)).

Fourth, we contribute to recent marketing studies that call for using neuroscientific evidence as a source of theoretical insights for the experimental behavioral research that can advance and refine the understanding of economic decision-making (e.g., Achrol and Kotler (2012); Plassmann et al. (2011)).

Our paper is organized as follows. In section 2 we present the theoretical background of our paper. In section 3 we develop our hypotheses. We describe our experiments' set-up and results in section 4. In Section 5 we discuss our results. Section 6 presents the implications of our work and concludes.

2 THEORETICAL BACKGROUND

The construct and theoretical foundation of fairness perception has consistently guided price fairness research and has produced notable results (Bolton, Warlop, and Alba (2003); Campbell (2007); Diller (2008); Dodds, Monroe, and Grewal (1991); Haws and Bearden (2006); Monroe and Xia (2005); Xia and Monroe (2010); Xia, Kukar-Kinney, and Monroe (2010); Xia, Monroe, and Cox (2004)). The term "price fairness" applies to an objective comparison between a seller's price and the price of a comparative party (Xia, Monroe, and Cox (2004)), while "price fairness perception" encompasses a customer's subjective sense of a price as legitimate, right, or just, versus being illegitimate, wrong, or unjust (Xia and Monroe (2010)). Thus, price fairness perception can be construed as the perception of a broader evaluation of the overall merits of a transaction (Cronin, Brady, and Hult (2000); Haws and Bearden (2006)). Several studies in customer research and management deal with the antecedents of price fairness perception, using different theoretical approaches (Babin, Hardesty, and Suter (2003); Bolton and Alba (2006); Campbell (2007); Darke and Dahl (2003); Daskalopoulou and Petrou (2006); Hardesty and Suter (2005); Kukar-Kinney, Xia, and Monroe (2007); Oliver and Shore (2003); Suter and Hardesty (2005); Vaidyanathan and Aggarwal (2003)).

Originally, price fairness perception was grounded in Attribution Theory (Heider (1958); Kelley (1973)), which looks at how individuals attribute causes to events or behavior. Customers' price fairness evaluations develop from the positive or negative attributions they accord to actions in sellers' price policies. Thus, customers' price fairness perception depends on whether the seller's attributes economic need as the reason for setting certain prices or actions. In general, a customer will see a price increase as fairer if the customer can attribute it to external factors over which the provider of a product or service has no influence (Vaidyanat and Aggarwal (2003)). Another theoretical approach to price fairness is Equity Theory (Adams (1965)), which is concerned with determining what

individuals perceive as fair, and how they react to what they think is unfair. To address this question, Equity Theory includes the equity function, which relates the outcomes of exchange partners to their incomes (Adams (1965)). Hence, Equity Theory emphasizes that a main driver of fairness perception is the importance of equality of outcomes between two parties in an exchange (Adams (1965); Güth et al. (2001); Walster, Walster, and Berscheid (1978)). With respect to price fairness perception, Equity Theory assumes that customers adapt their personal idea of a product or service price through the cues about what led to that price in an economic setting (Darke and Dahl (2003); Haws and Bearden (2006); Kukar-Kinney, Xia, and Monroe (2007); Oliver and Shore (2003)).

However, findings by Kahneman, Knetsch, and Thaler (1986) led to the principle of Dual Entitlement, which is by now the most influential theoretical approach to an explanation of price fairness perception (Bolton and Alba (2006); Bolton, Warlop, and Alba (2003); Campbell (1999); Kachelmeier, Limberg, and Schadewald (1991); Kalapurakal, Dickson, and Urbany (1991); Vaidyanat and Aggarwal (2003)). These studies all argue that profit is one of the most critical factors that influence customers' price fairness perception. According to this view, customers will perceive price increases as fair if the company's profit stays constant. Consequently, customers set a benchmark transaction against which they can judge prices as fair or not. This process is highly subjective and depends on the cognitive perception of economic variables by the customers. For example, Bolton, Warlop, and Alba (2003) provide a series of studies showing that customers believe that the selling price of a good or a service is, basically, higher than its fair price. By requiring participants to consider the different costs involved with producing and selling products, they show that many reference points influence customers' price fairness perception, including the cost of goods sold, competitor prices, and past prices. But Bolton, Warlop, and Alba (2003) also show that customers underestimate the impact of inflation, do not consider the full range of vendor costs, and overattribute price differences to profit. Corrective interventions to these false perceptions are only modestly effective, which indicates that the price fairness perceptions of the customers are very robust.

A common principle of all these theoretical approaches is the view that customers' price fairness perception is determined by reasoning that is somewhat complex concerning the antecedents of the final managerial and operational price setting. This reasoning might be the case when customers' product or service perceptions are characterized by customers being deeply involved with that product or service (Herrmann et al. (2007)), for example, consumer durables like vehicles or valuable electronics are typical high involvement products. However, in more ordinary customer situations, such as daily shopping in grocery stores, researchers such as Knox, Walker, and Marshall (1994) do not assume that everyday product perceptions are complex or that they require high involvement. Other researchers emphasize the importance of situational or environmental context variables for price fairness perception (Babin, Hardesty, and Suter (2003); Daskalopoulou and Petrou (2006); Frey and Pommerehne (1993)). For example, Babin, Hardesty, and Suter (2003) and Daskalopoulou and Petrou (2006) find that the colors or furnishings in a store, and other context-dependent variables such as parking lots, influence customers' price fairness

perception. In addition to these external situational influences, price fairness perception is also affected by internal cognitive and affective components (Campbell (2007); Diller (2008)). For example, Xia, Monroe, and Cox (2004) suggest that cognitive states (e.g., comparison processes) and affective emotional states weigh in on the customers' thinking to produce a certain price fairness perception.

Other researchers emphasize the role of affect for evaluation and choice, especially in the field of consumer and marketing research (e.g., Bargh (2002); Damasio (1994); Loewenstein et al. (2001); Michl et al. (2010); Schwarz (2000); Wyer, Clore, and Isbell (1999)). However, up to the present, research on price fairness perception has primarily concentrated on the variables involved in customers' cognitive processes (Haws and Bearden (2006)) and was based on customers' evaluations of goods and services (Xia and Monroe (2010)). As variables to explain potential influences on and of price fairness perception, these studies use factors such as historical prices, risks and costs, a firm's reputation, satisfaction, service quality, role of information, or effort input (Haws and Bearden (2006); Xia, Kukar-Kinney, and Monroe (2010); Xia, Monroe, and Cox (2004)). These approaches have expanded our knowledge about cognitive antecedents of individual price fairness perceptions, but they do not capture the multidimensionality of the concept. Hence, researchers now focus on more generic influences when examining price fairness perception (Xia and Monroe (2010); Xia, Monore, and Cox (2004)). Ignoring the affective components might be one reason why the current constructs and models are not able to explain the whole amount of variance in customer's price fairness perception (see Xia, Monroe, and Cox (2004) for an overview of the empirical results).

Consumer neuroscience integrates neuroscience theories, methods, and findings into marketing and consumer research and can provide deeper insights into consumer behavior and perception (e.g., Plassmann et al. (2011)). In this context, we draw on theories and findings from neurobiology. Although there is no model explicitly named "serotonergic hypothesis" or "theory of fairness perception" or the like, other researchers have developed theories on the basis of neuropsychological and neurochemical processes relevant for human behavior in general (e.g., Abu-Akel (2003); Ashby, Isen, and Turken (1999); Bagozzi et al. (2013)). Within these theoretical accounts from neurobiology, researchers have identified different serotonin levels as one potential influence on behavioral differences in everyday life (e.g., Crockett et al. (2008)). Therefore, our basic hypothesis is that different serotonin levels have an effect on consumer perceptions in economic contexts. Our study bases the functioning of customers' price fairness perception in basic neurobiological processes that can be triggered by glucose, leading to higher serotonin levels.

3 DEVELOPMENT OF HYPOTHESES

Building on results of prior research, we concentrate on the physiological processes that determine price fairness perception. By doing so, we add a new theoretical perspective based on the biology of customers. Hence, we use the administration of glucose to mea-

sure the effect of manipulating the serotonin level on customers' evaluations and perceptions of price fairness. This approach might seem unusual, but the relationship between the serotonin level and price fairness perception becomes clear when we consider the following findings of studies in decision neuroscience:

First, from a neuroscientific perspective, two brain regions, the insula and the medial orbitofrontal cortex (OFC), appear to be important for processing price information. Buying decisions that involve high prices significantly activate the insula, a region that is often linked to anticipating losses and to negative emotions (Knutson et al. (2007)). This finding supports the assumption that high prices may evoke negative emotions. Consequently, activity changes in the insula may indicate a negative price effect by customers. In contrast, high prices can also be perceived as indicators of high quality, and may influence the decision-making process in a positive way (Lichtenstein, Ridgway, and Netemeyer (1993); Völckner (2007)). The OFC seems to play a central role for such a positive price effect in customers (Plassmann et al. (2008)).

Second, various brain regions appear to be particularly important for the perception of (un)fairness. Studies investigating the rejection of unfair offers in the ultimatum game (UG) find that central drivers for (un)fairness include the insula and prefrontal structures such as the OFC, the ventromedial prefrontal cortex (VMPFC), and the dorsolateral prefrontal cortex (DLPFC) (e.g., Crockett (2009); Crockett et al. (2008); Knoch et al. (2006); Koenigs and Tranel (2007); Sanfey et al. (2003)). In the UG, player 1 proposes a way to split a certain amount of money. Player 2 can either accept or reject the offer. If player 2 accepts, then both players earn the money according to the offer of player 1. If the offer is rejected, then neither player receives anything (e.g., Güth, Schmittberger, and Schwarze (1982); Pull (2003)). In contrast to economic theory, unfair offers are often rejected, enhancing the importance of (un)fairness perception for economic transactions (Crockett (2009); Emanuele et al. (2008)). Studies show that activity changes in the insula are associated with the negative emotional response to unfair offers (Crockett (2009); Sanfey et al. (2003); Tabibnia, Satpute, and Lieberman (2008)). Thus, strong activity changes in the insula lead to a higher immediate rejection rate of unfair offers (Sanfey et al. (2003)). Furthermore, the insula reacts more intensely to very unfair offers than it does to less unfair offers (Sanfey et al. (2003); Tabibnia, Satpute, and Lieberman (2008)). The prefrontal cortex seems to play an important role in the regulation of these negative emotions. Here, the OFC and the VMPFC are especially associated with emotional regulation and decision-making. These observations support the idea that it is necessary to override negative emotions before unfair offers can be accepted. In fact, damage in the VMPFC leads to a higher rejection rate of unfair offers, thus enhancing the supposition that this region is important for overriding negative emotions (Koenigs and Tranel (2007)).

Third, the brain structures that are important for the processing of prices and (un)fairness (e.g., the insula and prefrontal structures) are modulated by the neurotransmitter serotonin (Crockett (2009); Robbins (2000); Way et al. (2007)). Accordingly, manipulating

the serotonin level can selectively alter reactions to unfair offers in the UG (Crockett et al. (2008)). A low serotonin level (natural or depleted) leads to a higher rejection rate of unfair offers (Crockett et al. (2008); Emanuele et al. (2008)). This effect can be explained theoretically at least in three ways. One explanation could be that changing the neurotransmission of serotonin affects neural activity in the insula. Thus, a low level of serotonin could lead to an increased reaction to being treated unfairly, and could increase the rejection rate of unfair offers. A second explanation could be that serotonin seems to influence neural activity in prefrontal structures such as the OFC and the VMPFC. Due to its close connection with the VMPFC, the OFC is important for adjusting behavior in relation to rewards and punishments, as in the example of regulating the emotional response downwards. A low level of serotonin might impair this function and lead to a higher rejection rate of unfair offers. A third explanation could be that the level of serotonin affects the connectivity between the prefrontal and subcortical structures. Hence, serotonin could change the influence of activity in one brain region (e.g., the prefrontal structures) on the activity in another region (e.g., the insula) (Crockett (2009)). Furthermore, in one of the first marketing publications on the topic, Mishra and Mishra (2010) demonstrate that a higher serotonin level decreases impulsive behavior. These authors focus on impulsive choices and responses and show that increasing the serotonin level reduces impulsive consumer choice and impulsive responses.

Given this background and building on the previous marketing and neuroscience literature shown in *Table 1*, we investigate whether it is possible to influence price fairness perception and judgement by manipulating the serotonin level through the administration of glucose. We assume that the price fairness perception of customers is reflected in their evaluations of price fairness. Therefore, our central question becomes whether an augmentation in the serotonin level leads to a lower rejection rate of unfair prices, since serotonin produces a lower rejection rate of unfair offers (Crockett et al. (2008); Emanuele et al. (2008)). Until now it has been unclear if glucose intake affects price fairness judgments.

We chose glucose as the right mechanism for our study based on our understanding that serotonin levels can be influenced through the administration of glucose via the glucose-insulin-tryptophan-serotonin-chain (Benton (2002); Crockett (2009); Suckale and Solimena (2008)). One driver of serotonin is the amino acid tryptophan. Raised tryptophan levels are strongly connected to increased levels of serotonin in the brains of humans (Crockett et al. (2008)). In addition, animal studies suggest that tryptophan is affected by insulin (Daniel et al. (1981)), thus leading researchers to hypothesize that this effect is similar in humans (Benton (2002)). With the additional evidence that glucose consumption influences insulin levels, we theorize that the glucose-insulin-tryptophan-serotonin-chain can be used to assess the relationship between the glucose intake and price fairness perception, because the application of sugar activates the glucose-insulin-tryptophan-serotonin-chain and leads to an increased serotonin level in the brain. The augmented serotonin level might invoke various neural activity changes in brain regions such as the insula and the PFC, ultimately influencing price fairness perception. Previ-

Table 1: Important Previous Studies Related To Our Analysis

Author(s)	Objective	Study Design	Method	Number of Subjects	Main Results	Limitations	Future Research
Sanfey et al. (2003)	<ul style="list-style-type: none"> ■ investigation of neural substrates of cognitive and emotional processes 	<ul style="list-style-type: none"> ■ ultimatum game setting 	<ul style="list-style-type: none"> ■ functional magnetic resonance imaging (fMRI) 	19	<ul style="list-style-type: none"> ■ unfair offers made by humans are rejected at a significantly higher rate than are those made by a computer ■ stronger emotional reaction to unfair offers from humans ■ greater activation for unfair offers in bilateral anterior insula, dorsolateral prefrontal cortex (DLPFC), and anterior cingulate cortex (ACC) 	<ul style="list-style-type: none"> ■ no direct biological manipulation of the study participants ■ no application of biological mechanisms during the consideration of neural and behavioral reactions 	<ul style="list-style-type: none"> ■ a direct biological manipulation and an application of biological mechanism should be added in further studies
Knoch et al. (2006)	<ul style="list-style-type: none"> ■ investigation of the effect between a disruption of the right dorsolateral prefrontal cortex (DLPFC) and subjects willingness to reject unfair offers 	<ul style="list-style-type: none"> ■ ultimatum game setting 	<ul style="list-style-type: none"> ■ low-frequency repetitive transcranial magnetic stimulation (rTMS) 	52	<ul style="list-style-type: none"> ■ subjects accept unfair offers after disruption of the right dorsolateral prefrontal cortex (DLPFC) ■ dysfunction of the right dorsolateral prefrontal cortex (DLPFC) has no behavioral effect under computer offer conditions 	<ul style="list-style-type: none"> ■ absence of biological mechanism 	<ul style="list-style-type: none"> ■ further studies should take biological mechanism into account
Koenigs and Tranel (2007)	<ul style="list-style-type: none"> ■ investigation of emotion regulation defects following ventromedial prefrontal cortex (VMPC) damage on irrational economic decision-making in situations of unfair treatment 	<ul style="list-style-type: none"> ■ ultimatum game setting 	<ul style="list-style-type: none"> ■ magnetic resonance (MR)/computerized tomography (CT) 	35	<ul style="list-style-type: none"> ■ damage of ventromedial prefrontal cortex (VMPC) affects economic decision-making ■ subjects with a ventromedial prefrontal cortex (VMPC) damage reject unfair offers at a higher rate 	<ul style="list-style-type: none"> ■ "[study design does not] obtain a direct measure of subjects' emotional responses during performance of the Ultimatum Game task..." ■ "...[effects] may not have the same impact on decision-making in the VMPC patients as in normal individuals." 	<ul style="list-style-type: none"> ■ "...alternative explanations warrant [further] consideration..."
Emanuele et al. (2008)	<ul style="list-style-type: none"> ■ investigation of the effect between serotonin levels and rejection/acceptance of unfair offers 	<ul style="list-style-type: none"> ■ ultimatum game setting 	<ul style="list-style-type: none"> ■ intergroup comparisons, secured by blood samples of the subjects 	60	<ul style="list-style-type: none"> ■ high serotonergic activity positively affects the acceptance of unfair offers 	<ul style="list-style-type: none"> ■ "...[study adds] to the growing evidence that the economic behaviour might be influenced by biological factors, including hormonal and genetic influences." ■ no direct biological manipulation of the study participants 	<ul style="list-style-type: none"> ■ direct biological manipulation should be tested in further studies

Author(s)	Objective	Study Design	Method	Number of Subjects	Main Results	Limitations	Future Research
Crockett (2009)	■ investigation of the effects between serotonin and rejection behavior	■ ultimatum game setting	■ intergroup comparisons after manipulating serotonin level	20	■ lowering serotonin levels increased rejection of low offers ■ lowering serotonin levels did not affect the tendency to accept higher offers	■ "...we speculate that 5-HT modulates a network of regions involved in responding to unfair treatment, including the insula and the ventral PFC. Furthermore, we propose that serotonergic modulation of these regions mediates the link between 5-HT and prosocial behavior."	■ "...[deeper] understanding of the contextual and environmental influences on social decision-making [is necessary], and individual differences in brain chemistry may be a key player in this puzzle."
Mishra and Mishra (2010)	■ investigation of the effects between serotonin and impulsive choice and impulsive response	■ impulsive choice scale and go/no-go task	■ intergroup comparisons after manipulating serotonin level	170 (Study 1) and 54 (Study 2)	■ increasing serotonin level decreased impulsive behavior ■ increasing serotonin level helps participants to perform better because they can better restrain impulsive responses	■ Within the study, blood samples to quantify participants' levels of serotonin were not drawn. "... Even after consuming similar tryptophan-rich foods, people may synthesize serotonin at different rates. Therefore, further research could use blood draws to examine more precisely the influence of serotonin levels on consumers' impulsive behavior."	■ "...Future studies could examine other aspects of consumer behavior and the influence of other neurotransmitters, such as dopamine, on consumer behavior." ■ "...These studies could also observe the effects of other everyday foods that are reported to promote the synthesis of serotonin and how different foods are likely to have a greater or lesser impact on behavior"
Bos et al. (2012)	■ investigation of the effects between blood glucose levels and unconscious and conscious decision-making	■ 2x2 factorial design	■ intergroup comparisons after manipulating blood sugar level	156	■ increased blood sugar level positively affects conscious decision-making ■ lowering blood sugar level affects unconscious decision-making	■ "...participants did not make a choice in this task, but instead only rated the choice options." ■ "...the ingestion of glucose could change mental function indirectly, by giving off signals that the body is "safe" in terms of glucose stores." ■ "...the used task (in the study) is artificial..."	■ deeper understanding of the biological mechanism is necessary

ous research indicates that the administration of a sugared drink can increase energy and that the sugar has a significant influence on affective states, as in the sense of feeling less tense (Benton and Owens (1993); Blouin et al. (1991)). Wang and Dvorak (2010) show that the ingestion of a sugared drink can influence economic decision-making by leading to a reduced future discounting rate by study participants. Bos, Dijksterhuis, and van Baaren (2012) explain how increased energy induced by an increased blood sugar level positively affects conscious decision-making, and that a lower blood sugar level affects unconscious decision-making. These studies make it possible for us to conclude that price fairness perception can be influenced by affective triggers, and that one such trigger can be glucose. Accordingly, our study operationalizes price fairness perception as price fairness evaluations that reflect a customer reaction to given prices instead of monetary offers. According to behavioral experiments related to fairness that operationalize fairness as the share of rejected unfair offers (e.g., Crockett et al. (2008); Emanuele et al. (2008)), we use the rate of rejected unfair prices to assess the price fairness perception of customers. The implication of this approach is that a lower rejection rate of unfair prices indicates a higher degree of price fairness perception in customers. Thus, by combining evidence from decision neuroscience with the concept of price fairness perception in customers, we formulate the following hypotheses related to the effects between glucose consumption and price fairness perception:

- H1.** *Customers' price fairness perception, operationalized as the share of rejected unfair prices, will be lower in the glucose-manipulated group compared to the control group ($H_{1,1}$), and compared to the placebo group ($H_{1,2}$).*

Since price fairness perception is closely connected to customers' evaluations of the prices they pay for products (Maxwell (2002)), a lower share of rejected unfair prices should lead to a higher amount of money spent for a particular product portfolio. We operationalize the money spent as the entire amount of product-price evaluations in our study. The money spent on the whole product portfolio is equivalent to the value of the basket of goods (BG) customers buy on a shopping trip (Leszczyc, Popkowski, and Timmermans (1997)). To further confirm the behavioral economic relevance of a lower share of rejected unfair prices after glucose administration, we hypothesize that the absolute value of the basket of goods (BG) should consistently rise after glucose manipulation:

- H2.** *The value of the basket of goods of the glucose-manipulated group will be higher compared to the value of the basket of goods of the control group ($H_{2,1}$), and compared to the value of the BG of the placebo group ($H_{2,2}$).*

4 EXPERIMENTAL SET-UP AND RESULTS

STUDY 1

4.1 SAMPLE CHARACTERISTICS

Our first study involved participation of 34 undergraduate students ($M = 21$ years; $SD = 1.3$ years) and took place in Fall, 2009. One participant did not provide demographic information and was dismissed from the analysis, leading to a final sample of $N = 33$ participants. We randomly assigned participants into three groups. Participants of the *experimental group* ($M = 20.78$ years; $SD = 1.42$ years; $n = 13$; % male = 30.8; % female = 69.2) were manipulated by using 90 grams of pharmaceutical glucose (D(+)) glucose-monohydrate, according to European Pharmacopoeia 6.0) mixed in a 0.3 liter glass of sparkling water. Glucose operates as the strongest natural stimulus of insulin secretion and causes blood insulin levels to rise from a baseline level when an amount of at least 75 grams is administered (Suckale and Solimena (2008)). The *placebo group* ($M = 21.18$ years; $SD = 1.32$ years; % male = 72.7; % female = 27.3; $n = 11$) drank a 0.3 liter glass of sparkling water with no manipulation. We opted for a placebo group to control positive as well as negative changes in the subjective feeling and physical features that might arise through the symbolic consumption of the drink. The *control group* ($M = 21.11$ years; $SD = 1.17$; % male = 66.7; % female = 33.3; $n = 9$) was not manipulated in any way. We briefed participants in advance with instructions not to eat or drink anything other than water for at least three hours before taking part in the study. This was an essential control condition, as pancreatic cells start to work with meal digestion (Suckale and Solimena (2008)), so eating would distort the observable effects of insulin release in participants. All participants received a reminder of these instructions one day before the study began. Prior to the experiment, all participants signed a written form confirming that he/she had not eaten or drunk anything besides water in the three hours before the study began.

4.2 STUDY DESIGN

The stimulus material for our study comprised a paper-based presentation of 48 convenience goods (colored pictures, prices in euros; example in Appendix A). To assure a wide spectrum of day-to-day products, we created the sample of product images on the basis of inventory turnover rates within the product portfolio of a department store. Participants had to decide, and indicate in a questionnaire, whether they evaluated the given (real) price of a product as “fair”. If participants thought that the price was not fair, they had an option to adjust prices for any product of the product portfolio ($N_{\text{product}} = 48$). Additionally, involvement of participants was checked using the Purchase Decision Involvement (PDI) scale developed by Mittal (1989), which consists of a four-item, seven-point bipolar measure (Appendix B). Using this scale, we were able to control our stimulus material in the sense that it had the same effect on all participants and their frame of mind when confronted with the respective product portfolio (Mittal (1989)). A similar mean PDI

over all participants could thus serve as a measure of similar involvement in the decision process (Mittal (1989)). At the end of the experiment, we asked participants for standard demographic information, including body measurements, to assess critical indicators such as body mass index (BMI). In scientific studies that manipulate insulin levels, BMI is a critical control signifier that is used to assure comparability of participants (Wang and Dvorak (2010)). As an example, significantly heavier participants could distort results due to differing insulin release levels.

To match the hypothesized insulin level of respondents to their respective response behavior shown in *Figure 1*, the study design for every participant precisely followed the insulin-release curve of the metabolism of a healthy adult (Suckale and Solimena (2008)). By following the insulin release curve, we were able to test the differences in price fairness evaluations in both peak periods of insulin release – within the first ten minutes after glucose manipulation (first interval), and after 40 minutes (second interval). In these two peak periods we used the paper-based presentation of 48 grocery goods. To match the biological effects of glucose consumption (Suckale and Solimena (2008)) with the response behavior of the participants, and because of a decrease in the insulin level after the first interval, we allowed a break of 30 minutes. We show this in *Figure 1*. During the break respondents had no opportunity to communicate with each other. Instead, they watched a neutral educational movie about mathematics (Nasoz et al. (2003)), which we chose to avoid activating any processes concerning price fairness evaluations. Immediately after the hypothesized insulin release reached its lowest point, we told participants to continue with the questionnaire (*Figure 1*).

Figure 1: Insulin Curve and Study Design

Study design for every participant precisely followed the insulin release curve of the metabolism of a healthy adult (Suckale and Solimena (2008)) to match the hypothesized insulin level of respondents to their respective response behavior.

4.3 STATISTICAL ANALYSIS

We conduct statistical analyses with IBM SPSS Statistics 19. We analyze our data given by the participants' evaluations within the two peaks (first ten minutes after delay, and after 40 minutes) of the hypothetical insulin release curve (*Figure 1*). For our data analysis we use independent t-tests including Levene's Test to explore equality of means and variances among our study groups (Levene (1960)). We use the Shapiro-Wilk test (1965) to examine the normal distribution condition. This test is generally used for small sample sizes ($n < 50$) (Shapiro and Wilk (1965)). All tests were nonsignificant ($p > 0.05$) for the study groups, leading to the acceptance of equality of variance and normal distribution assumptions.

We computed differences among the experimental group and the two control groups for the entire product-portfolio ($N_{\text{product}} = 48$) and for both peak periods of the hypothetical insulin release.

4.4 RESULTS

In following the higher intensity periods of the insulin release in a healthy adult participant, we find significant differences according to glucose manipulation in contrast to control conditions.

To test our first hypothesis we compare the share of rejected unfair prices (RUP) between the experimental group and the control conditions. Our results confirm Hypothesis 1, showing significant differences between groups (see *Figure 2*). In contrast, we find no significant differences between the control group and the placebo group (control group: $RUP = 0.28$; $SD = 0.09$; placebo group: $RUP = 0.23$; $SD = 0.08$; $t\text{-value} = -1.463$; $p = 0.161$). Overall, there was a significant effect of glucose intake on the share of RUP ($F(2; 30) = 7.964$, $p = 0.002$).

Figure 2: Results for Rejected Unfair Prices (Group Mean) as a Share of the Entire Product-Portfolio in Percent (%)

Product Portfolio (48 products)

Group	n	RUP (min/max)	SD	t-value	Sig. (two-tailed)	Hypothesis
Experimental group	13	0.15 (0.02/0.25)	0.07	3.827	0.001	H _{1,1} confirmed
Control group	9	0.28 (0.19/0.44)	0.09			
Experimental group	13	0.15 (0.02/0.25)	0.07	2.622	0.016	H _{1,2} confirmed
Placebo group	11	0.23 (0.10/0.38)	0.08			

Product Portfolio (48 products)						
Group	n	RUP (min/max)	SD	t-value	Sig. (two-tailed)	Hypothesis
Control group	9	0.28 (0.19/0.44)	0.09	-1.463	0.161	n.a.
Placebo group	11	0.23 (0.10/0.38)	0.08			

n = Number of participants

RUP = Rejected unfair prices (as a share of the entire product-portfolio)

SD = Standard Deviation

min/max = Minimum and Maximum of the value distribution

p* = p-value < 0.10; p** = p-value < 0.05; p*** = p-value ≤ 0.01

Furthermore, the results for the values of the basket of goods confirm the effect predicted in the experimental condition (H2), that glucose consumption leads to a higher absolute value of the basket of goods. As a result, the value of the basket of goods is significantly higher in the experimental group than in control conditions, amounting to an average price difference of 10.21€ and 10.34€, respectively (*Figure 3*). In contrast, the mean value of the basket of goods does not differ significantly between control and placebo groups, but is almost the same in both control conditions (control group: $BG = 60.62$; $SD = 4.55$; placebo group: $BG = 60.39$; $SD = 4.95$; t-value = 0.106; $p = 0.924$). One-way independent ANOVA confirmed these results ($F(2; 30) = 16.917$; $p < 0.001$).

Figure 3: Results for Value of Basket of Goods (Group Mean) in Euros

Product-Portfolio (48 products)						
Group	n	BG (min/max)	SD	t-value	Sig. (two-tailed)	Hypothesis
Experimental group	13	70.83 (64.65/83.63)	5.30	4.700	< 0.001	H _{2,1} confirmed
Control group	9	60.62 (53.08/65.13)	4.55			
Experimental group	13	70.83 (64.65/83.63)	5.30	4.957	< 0.001	H _{2,2} confirmed
Placebo group	11	60.39 (52.26/66.06)	4.95			
Control group	9	60.62 (53.08/65.13)	4.55	0.106	0.924	n.a.
Placebo group	11	60.39 (52.26/66.06)	4.95			

n = Number of participants

BG = Value of the basket of goods in euros

SD = Standard Deviation in euros

min/max = Minimum and Maximum of the value distribution

p* = p -value < 0.10; p** = p -value < 0.05; p*** = p -value ≤ 0.01

In addition, we try to eliminate possible confounders by using two foci. First, the comparability of the insulin release should be assured as a biological precondition, which can be done by comparing the BMI of participants across groups. As is conventional for medical studies, we calculate the BMI as weight in kilograms divided by the square of height in meters (e.g., Flöel et al. (2008)). In most of the medical publications, weight in the normal range concerning BMI is defined as a BMI score between 18.5 and 24.9 (e.g., Calle et al. (2003); World Health Organization (1995)). Our study participants' mean BMI was 21.27 with a standard deviation of 2.29. The difference in BMI between the experimental group and both control groups was not significant ($F(2; 30) = 2.381, p = 0.11$). In addition, none of the study participants reported suffering from any form of diabetes or related pancreatic conditions. Hence, we conclude that the hypothetical insulin release curve for healthy adult participants is applicable to the study sample.

Second, in addition to assuring medical comparability across participants, we check participants' purchase decision involvement (PDI) over all products to ensure that all participants experienced the same effect of visual stimulus material and for the whole product portfolio (Mittal (1989); Appendix B). Given the fact that customer reactions to products such as vehicles or valuable electronics in which they are highly involved differ significantly from products with which they have less involvement (Patterson (2006)), we check the mean involvement of participants for the experimental group and for both control groups. The results show no significant differences, but do reveal a value in the middle of the PDI-range (experimental group: $M_{\text{PDI}} = 4.16$; $SD = 0.6$; control group: $M_{\text{PDI}} = 4.02$; $SD = 0.36$; t -value = 0.642; $p = 0.528$; placebo group: $M_{\text{PDI}} = 3.87$; $SD = 0.59$; t -value = 1.21; $p = 0.24$). We could not determine any confounding effects of stimulus material between the experimental, the placebo and the control group (Appendix C).

STUDY 2

4.5 SAMPLE CHARACTERISTICS

Our second study involved participation of 187 high-school students ($M = 20.6$ years; $SD = 2.67$ years) and took place in Fall 2011. Participants were assigned block-wise to four groups¹. The *Experimental group I* ($M = 21.24$ years; $SD = 1.51$ years; % male = 48.8; % female = 51.2; $n = 80$) drank 0.3 liters of Coca-Cola® (Coke), equalling about 31.8 grams of glucose. Participants of *experimental group II* ($M = 18.71$ years; $SD = 1.57$ years; $n = 28$; % male = 42.9; % female = 57.1) were manipulated using 0.3 liter of Coca-Cola and three mini bars of Dextro Energy®, which is a natural sugar substance also found in fruits and honey, amounting to a final glucose concentration of 81 grams.

We opted for two groups to control both positive and negative changes in the subjective feeling and physical features that may arise through the symbolic consumption of the drink. Additionally, we controlled for the taste of our manipulation using the placebo group. This *placebo group* drank 0.3 liters of Coke Zero® ($M = 21.68$ years; $SD = 1.39$; % male = 61.4; % female = 38.6; $n = 44$), containing no glucose. The *control group* ($M = 19.56$ years; $SD = 1.35$; % male = 64.7; % female = 35.3; $n = 34$) was not manipulated in any way. Keeping in mind the pancreatic cell reaction after meal digestion and the need to test our hypotheses with a larger sample and in a more externally valid setting, we decided to conduct our second study during the assessment process of a German university.

In this setting, two factors converge to create a unique opportunity for this research. First, participants arrived the evening prior to the formal selection procedures and were briefed by the assessment committee that dinner would be provided. Second, we could conduct our experiment at 7 p.m., directly upon arrival of the participants. Thus, we were able to ensure that participants did not have much to eat before the start of our experiment, as they were briefed in advance that dinner would take place at 9 p.m. Finally, although groups arrived at different days in September, October, and November of 2011, the time for the experiment remained the same.

Prior to the experiment, we reminded all participants that study participation was absolutely voluntary and had nothing to do with the university's assessment process.

1 A block-wise assignment was necessary because we manipulated participants with Coca Cola, a drink easily recognizable by its dark brown color.

4.6 STUDY DESIGN

To assure the comparability of results, the stimulus material for Study 2 contained the same paper-based presentation of 48 convenience goods (colored pictures, prices in euros; example in Appendix A) as in Study 1. Due to the time restriction of one hour for Study 2, participants had 32 seconds to answer one page of our questionnaire (containing three items), leading to a response time of 26 minutes for the 48 convenience goods and resembling only the first peak of insulin release. In addition, we asked the participants if they would consider the given product price as fair (measured on a six-point scale from -3 “totally disagree” to 3 “totally agree”).² We used the first ten minutes of the experiment to ask control questions (such as problems with drinks and food containing sugar, and the participants' eating and drinking activities within the last three hours) and for the drinking of Coca-Cola and either Dextro Energy or Coke Zero. The filler task to let the glucose in experimental groups I and II operate contained the PANAS mood scale (Watson, Clark, and Tellegen (1988)) and also the evaluation of the taste of the drinks (for experimental group I and the placebo group). In line with Study 1, we checked the involvement of participants using the Purchase Decision Involvement (PDI) scale developed by Mittal (1989) (Appendix B; we used only items 2 and 4 of the original PDI scale, since they had the best loadings in Study 1, and also due to the time restrictions in Study 2). At the end of the experiment, we asked the participants for standard demographic information, including body measurements, to assess critical indicators such as body mass index (BMI) and another PANAS.

The Study 2 design also matched the hypothesized insulin level of respondents to their respective response behavior (see *Figure 1*). Because of the setting, we tested differences in price fairness evaluations only in the first peak period of insulin release (see *Figure 4*). We argue that this setting enhances the external validity of Study 1 by the way that all participants evaluated the product portfolio without interruption. To further bring the set-up of our experiment into real life, we did not force participants not to have snacks and drinks within three hours before the experiment started. We assume that this condition converges to a more realistic reflection of customers' real shopping behavior. We made sure that only our participants in Study 2 did not have a big meal within three hours before the start of the experiment. Because of the more realistic setting, we were able to introduce more control variables (such as PANAS) and to assure that all of the blocks took place on the same time of the day and in the same physical environment. In addition, due to the nature of applicants for undergraduate studies in Germany, demographics of the different groups were comparable.

2 We thank an anonymous reviewer for pointing us towards the integration of a price fairness perception item in order to increase power of the price fairness perception measurement.

Figure 4: Study Design for Study 2

4.7 STATISTICAL ANALYSIS

We conduct our statistical analyses by using IBM SPSS Statistics 19. We analyze our data given by the participants' evaluations within the first peak of the hypothetical insulin release curve (Figure 4). We compute differences among the experimental, control, and placebo groups for the entire product portfolio ($N_{\text{product}} = 48$) and for the full period of the hypothetical insulin release within the 26-minute interval.

4.8 RESULTS

To test our hypotheses in the setting of Study 2 we again compare the share of rejected unfair prices (RUP) between the experimental groups I and II, and the control and placebo groups. In addition, to strengthen evidence on the glucose intake effect on this construct, we compare the score on price fairness perception (PFP) across these groups. To assess hypothesis 2, we compare the value of the basket of goods, just as we had done for Study 1.

This time, because our exploratory data analyses on the dependent variables for each group reveal the necessity to do so (Appendix D),³ we use the nonparametric counterpart of one-way ANOVA, the Kruskal-Wallis (1952) test, to assess our hypotheses.

We find that the percentage of rejected unfair offers is significantly affected by glucose intake ($H(3) = 6.861, p = 0.076$). Jonckheere's (1954) test reveals a significant trend in the data: as more glucose was administered, the RUP-share decreased ($J = 5301, z = -1.941, r = -0.142, p = 0.025$). For a better visualization of the results, figure 5 shows a means plot with the corresponding t-contrasts between the single groups.

Figure 5: Results for Rejected Unfair Prices (Group Mean) as a Share of the Entire Product Portfolio in Percent (%) for Study 2

³ Appendix D shows that the Kolmogorov-Smirnov (1948) test was not significant for the different groups and dependent variables (with one exception). But the Shapiro-Wilk (1965) test was significant for different groups across variables. Since the latter test is more accurate, we can conclude that the distribution of dependent variables in the four groups is significantly different from normal. The lower part of Appendix D shows, with the help of Levene's (1960) test, that the assumption of homogeneity of variance has been violated, resulting in heterogeneous variances within groups.

Figure 5: *cont.*

t-tests between groups on the dependent variable RUP (95% bias corrected and accelerated confidence intervals reported in parentheses; confidence intervals and standard errors based on 1000 bootstrap samples)								
Group	n	RUP	SD	t-value	Sig.	Bootstrapping		
						MD	SE	Sig.
Control group	34	0.30	0.11	-1.133	0.261	-0.033	0.028	0.244
Placebo group	44	0.33	0.14			(-0.091, 0.025)		
Control group	34	0.30	0.11	0.741	0.461	0.019	0.025	0.467
Experimental group I	80	0.28	0.15			(-0.030, 0.070)		
Control group	34	0.30	0.11	1.720	0.091	0.044	0.025	0.084
Experimental group II	28	0.25	0.08			(-0.005, 0.093)		
Placebo group	44	0.33	0.14	1.923	0.057	0.052	0.027	0.063
Experimental group I	80	0.28	0.15			(0.001, 0.102)		
Placebo Group	44	0.33	0.14	2.971	0.004	0.077	0.027	0.005
Experimental group II	28	0.25	0.08			(0.025, 0.130)		
Experimental group I	80	0.28	0.15	1.116	0.268	0.025	0.022	0.265
Experimental group II	28	0.25	0.08			(-0.018, 0.066)		

n = Number of participants
 RUP = Rejected unfair prices (as a share of the entire product portfolio)
 SD = Standard Deviation
 MD = Mean Difference (Bootstrap)
 SE = Standard Error (Bootstrap)
 p* = p-value < 0.10; p** = p-value < 0.05; p*** = p-value ≤ 0.01 (always two-tailed)

Because we know that t-tests on every pair of groups inflate the probability of Type I errors (familywise error), we perform a bootstrapping on every contrast. In addition, Appendix E shows the results of the Mann-Whitney (1947) tests (nonparametric counterpart of the independent *t*-test) for the contrasts.

We find that price fairness perception (PFP) is also significantly affected by glucose intake ($H(3) = 9.331, p = 0.026$). For PFP, Jonckheere's (1954) test does not indicate a significant trend in the data: as more glucose is administered, the PFP does not change in a certain direction ($J = 5589, z = 0.959, r = 0.073, p = 0.177$). Figure 6 provides the means plot and *t*-test values).

For Hypothesis 2, the value of the basket of goods (BG) is significantly affected by glucose intake ($H(3) = 12.428, p = 0.006$). Furthermore, Jonckheere's (1954) analysis shows a significant trend in the data: as more glucose is administered, the value of BG increases as hypothesized ($J = 7293, z = 3.019, r = 0.221, p = 0.002$). Figure 7 gives an overview of the means plot with the associated *t*-contrasts.

Figure 6: Results for Price Fairness Perception (Group Mean) as Aggregated Measure over the Entire Product Portfolio for Study 2

Figure 6: cont.

t-tests between groups on the dependent variable PFP (95% bias corrected and accelerated confidence intervals reported in parentheses; confidence intervals and standard errors based on 1000 bootstrap samples)								
Group	n	PFP	SD	t-value	Sig.	Bootstrapping		
						MD	SE	Sig.
Control group	32	0.87	0.79	0.140	0.889	-0.026	0.187	0.886
Placebo group	37	0.84	0.73			(-0.385, 0.429)		
Control group	32	0.87	0.79	0.978	0.330	0.173	0.170	0.304
Experimental group I	76	0.70	0.86			(-0.164, 0.510)		
Control group	32	0.87	0.79	-1.973	0.054	-0.345	0.175	0.047
Experimental group II	28	1.21	0.55			(-0.685, -0.007)		

t-tests between groups on the dependent variable PFP (95% bias corrected and accelerated confidence intervals reported in parentheses; confidence intervals and standard errors based on 1000 bootstrap samples)								
Group	n	PFP	SD	t-value	Sig.	Bootstrapping		
						MD	SE	Sig.
Placebo group	37	0.84	0.73	0.899	0.371	0.147	0.157	0.355
Experimental group I	76	0.70	0.86			(-0.165, 0.465)		
Placebo Group	37	0.84	0.73	-2.251	0.028	-0.371	0.156	0.023
Experimental group II	28	1.21	0.55			(-0.669, -0.024)		
Experimental group I	76	0.70	0.86	-3.615	0.001	-0.518	0.142	0.002
Experimental group II	28	1.21	0.55			(-0.800, -0.260)		

n = Number of participants
 PFP = Price Fairness Perception
 SD = Standard Deviation
 MD = Mean Difference (Bootstrap)
 SE = Standard Error (Bootstrap)
 p* = p-value < 0.10; p** = p-value < 0.05; p*** = p-value ≤ 0.01

Figure 7: Results for Value of Basket of Goods (Group Mean) in Euros for Study 2

Figure 7: *cont.*

t-tests between groups on the dependent variable BG (95% bias corrected and accelerated confidence intervals reported in parentheses; confidence intervals and standard errors based on 1000 bootstrap samples)

Group	n	BG	SD	t-value	Sig.	Bootstrapping		
						MD	SE	Sig.
Control group	34	68.04	8.15	0.163	0.871	0.383	2.387	0.859
Placebo group	44	67.65	12.54			(-4.716, 5.311)		
Control group	34	68.04	8.15	-3.363	0.001	-6.746	2.002	0.004
Experimental group I	80	74.78	12.87			(-10.48, -2.416)		
Control group	34	68.04	8.15	-2.767	0.008	-7.037	2.707	0.018
Experimental group II	28	75.07	11.81			(-12.57, -2.122)		
Placebo group	44	67.65	12.54	-2.978	0.003	-7.129	2.312	0.003
Experimental group I	80	74.78	12.87			(-11.55, -2.728)		
Placebo Group	44	67.65	12.54	-2.503	0.015	-7.420	2.829	0.013
Experimental group II	28	75.07	11.81			(-13.26, -2.186)		
Experimental group I	80	74.78	12.87	-0.105	0.917	-0.291	2.566	0.907
Experimental group II	28	75.07	11.81			(-5.730, 5.097)		

n = Number of participants

BG = Value of the basket of goods in euros

SD = Standard Deviation

MD = Mean Difference (Bootstrap)

SE = Standard Error (Bootstrap)

p* = p-value < 0.10; p** = p-value < 0.05; p*** = p-value ≤ 0.01

We control for more possible confounders, as in Study 1, because of the modified research setting. First, we check for differences in BMI between the experimental groups and control groups. An assessment of the means and standard deviations shows that the BMI values across the four groups are within acceptable boundaries of the normal range of BMI (see *Table 2* for *t*-contrasts; a normal BMI is considered to lie between 18.5 – 24.9). By observing the distribution of BMI values within the normal range across groups, we conclude that the within-group BMI values are acceptable and should have no confounding influence for the hypothetical insulin release.

Table 2: Analysis And Descriptives For Potential Confounders: BMI

t-tests between groups on the dependent variable BMI (95% bias corrected and accelerated confidence intervals reported in parentheses; confidence intervals and standard errors based on 1,000 bootstrap samples)								
Group	n	BMI (normal range: 18.5 – 24.9)		t-value	Sig.	Bootstrapping		
		SD	SD			MD	SE	Sig.
Control group	34	21.96	2.08	-1.735	0.087	-1.041	0.567	0.077
Placebo group	42	23.00	2.95			(-2.124, 0.073)		
Control group	34	21.96	2.08	-0.214	0.831	-0.109	0.468	0.823
Experimental group I	76	22.07	2.61			(-0.994, 0.761)		
Control group	34	21.96	2.08	1.491	0.141	0.791	0.534	0.148
Experimental group II	28	21.17	2.08			(-0.285, 1.892)		
Placebo group	42	23.00	2.95	1.770	0.079	0.932	0.545	0.084
Experimental group I	76	22.07	2.61			(-0.138, 1.974)		
Placebo Group	42	23.00	2.95	2.844	0.006	1.832	0.593	0.008
Experimental group II	28	21.17	2.08			(0.767, 2.946)		
Experimental group I	76	22.07	2.61	1.640	0.104	0.900	0.492	0.079
Experimental group II	28	21.17	2.08			(-0.009, 1.736)		

n = Number of participants

RUP = Rejected unfair prices (as a share of the whole product-portfolio)

SD = Standard Deviation

MD = Mean Difference (Bootstrap)

SE = Standard Error (Bootstrap)

Second, we check the PDI category for all participants. One-way ANOVA indicates no significant effect of PDI across groups ($F(3; 182) = 1.146, p = 0.332$). Hence, we cannot detect a confounding effect of the stimulus material across groups that is comparable to the results extracted in Study 1.

Third, and because of the new setting using Coca-Cola in the experimental group and Coke Zero in the placebo group, we check for a potential influence of taste (with an item on a seven-point Likert scale from 1 = “This Coke tastes fresher than the original” to 7 = “This Coke does not taste fresher than the original”) of the respective drink. Because we ask this control only in experimental group I (manipulation only by Coca-Cola) and the placebo group, we use an independent t-test to assess group differences. Our results show no significant difference between groups ($M_{\text{Coke Zero}} = 6.05$ ($SD = 1.28$); $M_{\text{Coke}} = 5.66$ ($SD = 1.20$); $t\text{-value} = 1.633, p = 0.106$).

Finally, we could argue that the effect of getting something to drink changes the mood of study participants. That is why we use PANAS before the study participants started to answer the product-related questions, but after the experimental and placebo groups consumed Coca-Cola. After completing the product questionnaire, we asked PANAS again. Our results show that PANAS across groups does not differ before starting to answer the product questions ($F(3; 174) = 0.817, p = 0.486$). The same logic holds for PANAS across groups after the answering ended ($F(3; 179) = 0.859, p = 0.464$). That is, an aggregated measure of participants' mood showed no significant difference between groups, neither directly after glucose intake, nor after the answering of product related questions.

5 DISCUSSION

We conduct two empirical studies in which we apply neurobiological theories and results on serotonin processes, price perception, and fairness in a social context. Through these studies we are able to investigate the effect of glucose intake on the price fairness perception and the value of a corresponding basket of goods. We hypothesize that it is possible to influence related brain regions (e.g., insula, prefrontal areas) with the administration of glucose through the glucose-insulin-tryptophan-serotonin-chain (Benton (2002); Crockett et al. (2008); Daniel et al. (1981)). We are not able to show either which brain regions are involved in price fairness perception, nor, equally important, do we measure the relationship between glucose, insulin, tryptophan and serotonin. Nevertheless, we build on this evidence and these linkages from the current literature to extend consumer and business research.

First, concerning customers' price fairness perception operationalized as the share of rejected unfair prices, we assumed that this share would be lower in the glucose-manipulated group compared to our control and placebo groups. Second, for the basket of goods, we assumed that the value of the basket of goods of the glucose-manipulated group would be higher compared to the value of the basket of goods of the control and the placebo groups. Within an experimental (Study 1) and more natural set-up (Study 2), our results provide evidence that our hypotheses can be confirmed and thus, biological factors seem to influence the price fairness perception of customers.

In Study 1 we used pharmaceutical glucose (D(+)) glucose-monohydrate) as a strong natural stimulus of insulin secretion (Suckale and Solimena (2008)). The results of Study 1 confirm both of our hypotheses. First, the glucose-manipulated experimental group judged prices to be fairer (as evidenced by the finding that their share of rejected unfair offers was lower) compared to the control and placebo groups. Second, the total amount of the value of the basket of goods was significantly higher in the experimental group compared to the control and placebo groups. In Study 2, which replicates Study 1, but in a more realistic context and with a larger sample size, we administered glucose in form of Coca-Cola and Dextro Energy. Similar to Study 1, we observe that for our experimental groups glucose consumption affected the price fairness perception and value of

the basket of goods. However, because of nonsignificant effects for experimental group I we do not see a linear effect of glucose consumption on price fairness perception. First, we measure only the effect in experimental group II, which consumed both Coca-Cola and Dextro Energy, on the share of rejected unfair offers and the price fairness perception. Participants who consumed both Coca-Cola and Dextro Energy had a lower share of rejected unfair prices and judged the prices to be fairer. This finding indicates that to affect price fairness perception, a certain amount of glucose has to be consumed. Second, in both experimental group I, which drank Coca-Cola, and experimental group II, which consumed both Coca-Cola and Dextro Energy, the value of a basket of goods was significantly higher compared to the control and placebo groups.

Taking these findings into account, our results complement and validate previous studies from decision neuroscience (Crockett (2009); Crockett et al. (2008); Knoch et al. (2006); Sanfey et al. (2003)) that investigate the neural correlates of (un)fairness perception in a social context.

Even though some studies have already shown that (un)fairness perception can be influenced by biological factors in a social context, our study is among the first to apply this idea in a setting, where people have to deal with evaluations of objects (i.e., FMCG) compared to evaluations of peoples' actions (i.e., intersubjective evaluation of an offer in the ultimatum game). On that basis not only do we replicate previous findings, but we also show that the principles underlying intersubjective fairness evaluations can be transferred to fairness evaluations of offers. Furthermore, we provide evidence that even a relatively low intake of glucose, as well as a higher-glucose mixture of Coca-Cola and dextrose, lead to a different price perception and so may also influence the buying behavior. Additionally, in many current studies authors mainly describe the construct of "perceived price fairness" from a theoretical perspective, where the idea of fairness from an interpersonal interaction is transferred to a non-personal interaction between customers and firms by the use of price signals. Our results broaden the construct of price fairness perception by showing that PFP can also be influenced by biological factors. This finding enhances the potential of our study to provide practical insights on how biological factors influence the price fairness perception of customers.

6 IMPLICATIONS, FURTHER RESEARCH, AND CONCLUSION

Our study enables consumer researchers to better understand what drives consumers' buying decisions, especially the influence of specific biological variables, and leads to complementary findings important for marketing theory and practice. The implications resulting from our findings can be classified according to implications for theory building in marketing and consumer research, as well as implications for customers, society, and companies.

First, we show that the hypothesized serotonergic process influences customers' price fairness perceptions. Having identified a biological driver of customer price fairness perception we have reason to believe that a broader integration of neuropsychological and/or neurochemical theories could be fruitful for future theory building in marketing and consumer research. In this theoretical context we show that the construct of fairness perception between subjects can be transferred to fairness perceptions of product prices. Hence, our work enables us to identify a new layer of constructs relevant in marketing and consumer research, the consumers' neurobiology. At the same time, we acknowledge issues concerning inequalities between the fields of neuroscience and consumer research. Natural sciences show effects on the basis of accepted biological mechanisms. These mechanisms are not explicitly termed "theory" in most cases. On the opposite, social sciences have to build basic theoretical models, which were formerly not used to the wording of neuroscience (Camerer et al. (2013)). But if the researcher accepts that theorizing from biology could be basically relevant to social science, then new research questions open up that could advance the field of marketing and consumer research. For this paper and its basic hypothesis on the influence of serotonin on price fairness perception, the serotonin effect is likely to be relevant in other contexts that are both contemporary and relevant to all customers in their everyday lives. Since an interplay of serotonergic and dopaminergic processes has been shown to affect mentalizing capacities of humans in general (Abu-Akel (2003)), this connection might be a starting point researchers could use to better understand not only price fairness perceptions, but also other constructs that influence consumer behavior. For example, the interplay between serotonin and dopamine processes might also influence customer reactions to sales staff.

Second, our findings on implications for customers can help consumers to better understand their perceptual drivers of buying decisions in retail markets, such as discounters, supermarkets, drugstores, or even in online contexts. For example, we know that some customers use price as an indicator of product quality or prestige, so that higher prices may be associated with greater likelihood of purchase (Völckner and Hofmann (2007)). However, most customers tend to view high prices negatively, and attempt to reduce the price they pay by using various shopping strategies (Lichtenstein, Ridgway, and Netemeyer (1993); Sternquist, Byung, and Jin (2004)). If the price fairness perception can be altered through the intake of glucose, it is probable that consumers' buying decisions can also be influenced by physiological factors (Mishra and Mishra (2010)).

Third, from the viewpoint of society, our results open up important new strategies, particularly for groups that are engaged in consumer policy and protection, e.g. groups trying to deal with the negative consequences of compulsive addictive buyer behavior (Mishra and Mishra (2010); Scherhorn, Reisch, and Raab (1990)). Since biological processes might influence customers unconsciously in the short term, customer protection policies might have a different agenda for conveying information to customers regarding the kind of altered shopping behavior that follows biological stimuli of customers. In the long term, these influences become even more interesting, as long-lasting constructs such as lifestyle factors (Flöel et al. (2008)) could systematically alter customers' behavior in

economic transactions. Hence, further research should investigate how lifestyle factors that could influence the serotonin level, such as obesity, diabetes or an unbalanced diet, might alter consumers' buying behavior due to a different price perception.

Fourth, from the perspective of companies it is especially important that researchers keep in mind that consumers' price fairness perception is not a static construct, but influenced by many and varied biological and situational factors. The customer does not seem to have a fixed internal reference price that he or she uses to evaluate given prices as a result of a cognitive evaluation process. Instead, the internal fair reference price can be influenced by neurobiological factors as well as other situational factors (Daskalopoulou and Petrou (2006); Frey and Pommereh (1993)). Especially for a frequently purchased product with a relatively static price, such as those items in our product-portfolio, the reference price could be the level of past prices. This reference would be strongly activated during purchase, and in this case would exert a significant effect on price evaluations (Danziger and Segev (2006)). The neurobiological effect reported here appears to alter the activation of fair reference prices in the short term. This alteration is probably triggered by the emergence of a fair evaluation boost evoked by activity changes in different brain areas. This increase influences not only price fairness perception, but also concrete price fairness evaluations. It follows that even though the price is one of the strongest marketing-mix instruments, and one that influences the buying decision of a customer to a high degree, the perception of the price is influenced by biological and situational factors that affect customers in the field. There is also evidence that customers' willingness to pay is influenced by neurobiological factors (Plassmann et al. (2007)).

Therefore, our research findings might illustrate preliminary impact for marketing practice in shopping places in a business to consumer (B2C)-context. Specific biological influences on consumers, triggered either by their nutritional habits in advance of their shopping trip or by offers from the retailer, might have a practical impact on this informational cue and might thereby significantly change the perceived price fairness. The information that the internal reference price and hence the concrete price evaluation could be influenced might open up new promotional strategies, especially for retail practitioners who are actively considering their sales opportunities at the physical as well as the electronic point of sale. Personalized pricing strategies, which so far are found mostly in online environments, might include new dimensions of customer information as determinants of their price setting. Further research has to investigate how physiological processes, behavior and price fairness perception interact.

Fifth, from a broader perspective, both price fairness perception and also fairness in general play a central role in many of a firm's transactions, such as negotiations, sustainable production, or the conclusion of contracts. Even though the standard economic model does not include fairness in the profit-seeking behavior of the firm, behavioral economics shows that profit-maximizing firms also have an incentive to respect fairness perceptions (Kahneman, Knetsch and Thaler (1986)). Hence, fairness perceptions might help otherwise contentious factions to come to a mutual agreement in negotiations, and can help

to determine whether a particular compromise is satisfactory and thus will be honored in the long run (Albin (1993)). For example, fairness might be of particular importance for labor disputes where disharmony can lead to expensive strikes (Thompson and Loewenstein (1992)). Within the context of labor negotiations, managerial practice could also take into account biological factors such as the serotonin level, which might also influence negotiators' fairness perception. Our findings might also be used for business to business (B2B)-contexts, since not only customers are confronted with the influence of their biology on perception and decision-making. For example, Levi, Li, and Zhang (2010) show that young CEOs are more combative in nature when it comes to mergers and acquisitions. Levi, Li, and Zhang (2010) base this altered decision-making on different testosterone levels. Hence, our findings might explain certain behaviors and outcomes that have occurred in B2B negotiations.

The idea of integrating biological components in customer research can be combined with other research designs to extend the value of our results. As the estimated effects of glucose consumption could confirm our assumption that glucose stimulates the monoamine serotonin, a consequent change in neural activation must follow. The effects are likely due to activation in neural areas of emotion regulation, which further research could profitably investigate. For example, using medical procedures to check blood insulin levels (Flöel et al. (2008)) could determine more reliable insights of the hypothetical glucose-insulin-tryptophan-serotonin chain and its effects on distinctive brain areas—and, consequently, on customer behavior.

Furthermore, the frame of our study was confined to fast-moving consumer goods (FMCG), activating no high-involvement situations for the participants. Continued research should consider whether our results are applicable to high-involvement goods with comparably high prices, such as cars, furniture, or luxury goods. Moving the study beyond a sample consisting solely of students to cross-sectional studies integrating varied age categories could shed further light on the effects of biological components in different age groups. Specifically, behavioral evidence from a concrete buying situation could have value for explaining customer behavior in real-life situations. In addition future research should investigate whether other components, e.g., odours, can also influence price fairness perception. Using various imaging technologies (e.g., EEG) could help to connect central processing of olfaction in humans with the evaluation of fair and unfair price offers. Another research area might address situational factors such as the momentary emotional well-being that seems to play an important part in evaluating product prices of any kind. Given the real and recognizable day-to-day variations in emotional well-being that all persons experience (Reis et al. (2000)), the effect of these fluctuations on economic evaluation and perception, in connection with biological correlates, might be a focus of future study.

Since our study assumes that the glucose effect holds for a limited time frame and that it is potentially based on foregone conclusions on eating habits and other customer characteristics, we urge that readers interpret our results cautiously. Further research on the con-

crete underlying processes and robustness of effects is needed before concrete managerial implications might be deduced and implemented in organizational processes in the field.

In general conclusion, the integration of biological components into the broader view of consumer behavior could have some exciting potential for future research designs, with our study representing a significant first step in this direction. Although research at the nexus of neuroscience, psychology and economics is only at its beginning, our study indicates the new and complementary insights for consumer research in an economic context through the application of biological mechanisms on consumers' perception – and in this case the specific phenomenon of price perception.

APPENDIX A

Questionnaire Using The Example Of One Single Product Evaluation⁴

ja!™ Whole milk bar of chocolate (100 grams) ← Product description

← Product picture

Price: 0.39€

← Product price

1. Would you buy the product for this price?

1 Yes 2 No

2. Would you evaluate the given product price as “fair”?

1 Yes 2 No

If you don't think that this product price is fair, please specify the price below, which you would consider as being fair:

_____ €

⁴ Note: All items were asked in German and translated into English for appendix A & B.

APPENDIX B

Purchase Decision Involvement (PDI)

- 1. In selecting from many types and brands of this product available in the department store, would you say that:**

I would not care at all as to which one I buy 1 2 3 4 5 6 7 I would care a great deal as to which one I buy

- 2. Do you think that the various types and brands of this product available in the department store are all very alike or are all very different?**

They are alike 1 2 3 4 5 6 7 They are all different

- 3. How important would it be to you to make a right choice of this product?**

Not at all important 1 2 3 4 5 6 7 Extremely important

- 4. In making your selection of this product, how concerned would you be about the outcome of your choice?**

Not at all concerned 1 2 3 4 5 6 7 Very much concerned

Scale adopted from Mittal (1989) and modified with regard to the product-portfolio used in the experimental study. The four questions in the PDI-Scale have been asked for every single product in the product-portfolio in Study 1.

APPENDIX C

Purchase Decision Involvement (PDI): Statistics (Study 1)

PDI over all products (48 products) and study participants (N = 33)					
Item	N	M	SD	Cronbach's (1951) Alpha	
PDI 1	33	4.26	0.75	0.808	
PDI 2	33	3.54	0.73		
PDI 3	33	4.31	0.60		
PDI 4	33	4.00	0.59		
PDI overall	33	4.03	0.54		
Results for PDI overall (experimental group against control and placebo group)					
Group	n	M	SD	t-value	Sig. (two-tailed)
Experimental group	13	4.16	0.60	0.642	0.528
Control group	9	4.02	0.36		
Experimental group	13	4.16	0.60	1.208	0.240
Placebo group	11	3.87	0.59		
Control group	9	4.02	0.36	0.671	0.511
Placebo group	11	3.87	0.59		
Results from one-way ANOVAs for PDI 1 – PDI 4					
Dependent variable	df		F	Sig. (two-tailed)	
PDI 1	2, 30		1.049	0.363	
PDI 2	2, 30		0.693	0.508	
PDI 3	2, 30		0.958	0.395	
PDI 4	2, 30		0.123	0.885	
n = Number of participants					
M = Mean value over all products and participants in the respective group					
SD = Standard Deviation					

APPENDIX D

Tests of Normality and Homogeneity of Variance for Dependent Variables in Study 2

Variable	Group	Kolmogorov-Smirnov (1948)		Shapiro-Wilk (1965)	
RUP		Statistic	Sig.	Statistic	Sig.
	Control group	0.131	0.176	0.957	0.232
	Placebo group	0.095	0.200	0.953	0.118
	Experimental group I	0.088	0.200	0.954	0.008
	Experimental group II	0.149	0.114	0.939	0.103
PFP		Statistic	Sig.	Statistic	Sig.
	Control group	0.153	0.055	0.938	0.064
	Placebo group	0.117	0.200	0.986	0.912
	Experimental group I	0.080	0.200	0.974	0.129
	Experimental group II	0.117	0.200	0.964	0.424
BG		Statistic	Sig.	Statistic	Sig.
	Control group	0.108	0.200	0.944	0.098
	Placebo group	0.108	0.200	0.963	0.260
	Experimental group I	0.079	0.200	0.964	0.029
	Experimental group II	0.187	0.013	0.833	<0.001
Based on...		Levene's (1960) Test of homogeneity of variance			
RUP		Statistic		Sig.	
	...Mean	5.250		0.002	
	...Median	5.018		0.002	
	...Median with adjusted df	5.018		0.002	
	...trimmed Mean	5.070		0.002	
PFP		Statistic		Sig.	
	...Mean	2.995		0.032	
	...Median	2.958		0.034	
	...Median with adjusted df	2.958		0.034	
	...trimmed Mean	3.029		0.031	
BG		Statistic		Sig.	
	...Mean	3.408		0.019	
	...Median	3.182		0.025	
	...Median with adjusted df	3.182		0.026	
	...trimmed Mean	3.337		0.021	

APPENDIX E

Mann-Whitney (1947) Tests for Dependent Variables in Study 2

Mann-Whitney (1947) tests					
Group	RUP-Median	<i>U</i>	<i>z</i>	<i>r</i>	<i>Sig.</i>
Control group	0.29	630.00	-1.191	-0.135	0.236
Placebo group	0.33				
Control group	0.29	1200.50	-0.989	-0.093	0.162
Experimental group I	0.27				
Control group	0.29	380.50	-1.355	-0.172	0.089
Experimental group II	0.26				
Placebo group	0.33	1365.00	-2.065	-0.185	0.019
Experimental group I	0.27				
Placebo Group	0.33	409.00	-2.396	-0.282	0.008
Experimental group II	0.26				
Experimental group I	0.27	1080.00	-0.281	-0.027	0.391
Experimental group II	0.26				
Group	PFP-Median	<i>U</i>	<i>z</i>	<i>r</i>	<i>Sig.</i>
Control group	0.75	577.50	-0.175	-0.021	0.432
Placebo group	0.83				
Control group	0.75	1064.50	-1.019	-0.098	0.155
Experimental group I	0.67				
Control group	0.75	333.50	-1.700	-0.219	0.045
Experimental group II	1.28				
Placebo group	0.83	1235.00	-1.046	-0.098	0.149
Experimental group I	0.67				
Placebo Group	0.83	341.50	-2.339	-0.290	0.009
Experimental group II	1.28				
Experimental group I	0.67	673.00	-2.866	-0.281	0.002
Experimental group II	1.28				
Group	BG-Median	<i>U</i>	<i>z</i>	<i>r</i>	<i>Sig.</i>
Control group	68.36	713.00	-0.353	-0.040	0.364
Placebo group	68.21				
Control group	68.36	932.50	-2.648	-0.248	0.004
Experimental group I	73.24				
Control group	68.36	333.50	-2.016	-0.256	0.022
Experimental group II	73.21				

Mann-Whitney (1947) tests					
Placebo group	68.21	1237.00	-2.731	-0.245	0.003
Experimental group I	73.24				
Placebo Group	68.21	433.00	-2.114	-0.249	0.017
Experimental group II	73.21				
Experimental group I	73.24	1093.00	-0.189	-0.018	0.426
Experimental group II	73.21				

RUP = Rejected unfair prices (as a share of the whole product-portfolio)

PFP = Price Fairness Perception

BG = Value of basket of goods

U = Test statistic for the Mann-Whitney (1947) test

z = z -score

r = Effect size

Sig. = p -value (one-tailed significance computed with the exact test method)

REFERENCES

- Abu-Akel, Ahmad (2003), The Neurochemical Hypothesis of 'Theory of Mind', *Medical hypotheses* 60 (3), 382–86.
- Achrol, Ravi S. and Philip Kotler (2012), Frontiers of the Marketing Paradigm in the Third Millennium, *Journal of the Academy of Marketing Science* 40 (1), 35–52.
- Adams, Stacy J. (1965), Inequity in Social Exchange, in Leonard Berkovitz (ed.), *Advances in Experimental Social Psychology*, New York, 267–99.
- Albin, Cecilia (1993), The Role of Fairness in Negotiations, *Negotiation Journal* 9 (3), 223–44.
- Ambler, Tim, Andreas Ioannides, and Steven Rose (2000), Brands on the Brain: Neuro-Images of Advertising, *Business Strategy Review*, 11 (3), 17.
- Ashby, F. Gregory, Alice M. Isen, and U. Turken (1999), A Neuropsychological Theory of Positive Affect and Its Influence on Cognition, *Psychological Review* 106 (3), 529–50.
- Babin, Barry J., David M. Hardesty, and Tracy A. Suter (2003), Color and Shopping Intentions: The Intervening Effect of Price Fairness and Perceived Affect, *Journal of Business Research* 56 (7), 541–51.
- Bagozzi, Richard P., Willem J. M. I. Verbeke, Roeland C. Dietvorst, Frank D. Belschak, Wouter E. van den Berg, and Wim J. Rietdijk (2013), Theory of Mind and Empathetic Explanations of Machiavellianism – A Neuroscience Perspective, *Journal of Management* 39 (7), 1760–98.
- Bargh, John A. (2002), Losing Consciousness: Automatic Influences on Consumer Judgment, Behavior, and Motivation, *Journal of Consumer Research* 29 (September), 280–85.
- Bei, Lien-Ti and Yu-Chung Chiao (2001), An Integrated Model for the Effects of Perceived Product, Perceived Service Quality and Perceived Price Fairness on Consumer Satisfaction and Loyalty, *Journal of Consumer Satisfaction, Dissatisfaction and Complaining Behavior* 14, 125–40.
- Benton, David and Deborah Owens (1993), Is Raised Blood Glucose Associated with the Relief of Tension?, *Journal of Psychosomatic Research* 37 (7), 723–35.
- Benton, David (2002), Carbohydrate Ingestion, Blood Glucose and Mood, *Neuroscience and Biobehavioral Reviews* 26, 293–308.

- Blouin, Arthur G., Jane H. Blouin, Jan T. Braaten, G. Sarwar, Tamara Bushnik, and Jennifer Walker (1991), Physiological and Psychological Responses to a Glucose Challenge in Bulimia, *International Journal of Eating Disorders* 10 (3), 285–96.
- Bolton, Lisa E. and Joseph W. Alba (2006), Price Fairness: Good and Service Differences and the Role of Vendor Costs, *Journal of Consumer Research* 33 (2), 258–65.
- Bolton, Lisa E., Luk Warlop, and Joseph W. Alba (2003), Consumer Perceptions of Price (Un)Fairness, *Journal of Consumer Research* 29 (4), 474–91.
- Bos, Maarten W., Ap Dijksterhuis, and Rick van Baaren (2012), Food for Thought? Trust Your Unconscious When Energy Is Low, *Journal of Neuroscience, Psychology, and Economics* 5 (2), 124–30.
- Calle, Eugenia E., Carmen Rodriguez, Kimberly Walker-Thurmond, and Michael J. Thun (2003), Overweight, Obesity, and Mortality from Cancer in a Prospectively Studied Cohort of U.S. Adults, *New England Journal of Medicine* 348, 1625–38.
- Camerer, Colin, George Loewenstein, and Drazen Prelec (2005), Neuroeconomics: How Neuroscience Can Inform Economics, *Journal of Economic Literature* 43, 9–64.
- Camerer, Colin, Alec Smith, Camelia M. Kuhnen, Donald T. Wargo, Gregory Samanez-Larkin, Read Montague, Dino J. Levy, David Smith, Dar Meshi, Peter H. Kenning, John Clithero, Bernd Weber, Todd Hare, Scott Huettel, Camilla Josephson, Mathieu d'Acremont, Daria Knoch, Ian Krajbich, Benedetto De Martino, Peter N. C. Mohr, Jan Barton, Marja-Liisa Halko, Christina F. Chick, Lorena Gianotti, and Hauke R. Heekeren (2013), Correspondence: Are Cognitive Functions Localizable? Colin Camerer et al. versus Marieke van Rooij and John G. Holden, *Journal of Economic Perspectives* 27 (2), 247–50.
- Campbell, Margaret C. (1999), Perceptions of Price Unfairness: Antecedents and Consequences, *Journal of Marketing Research* 36 (2), 187–99.
- Campbell, Margaret C. (2007), Says Who?! How the Source of Price Information and Affect Influence Perceived Price (Un)fairness, *Journal of Marketing Research* 44 (May), 261–71.
- Crockett, Molly J. (2009), The Neurochemistry of Fairness: Clarifying the Link between Serotonin and Prosocial Behavior, *Values, Empathy, and Fairness across Social Barriers: Ann. New York Academy of Sciences* 1167, 76–86.
- Crockett, Molly J., Luke Clark, Golnaz Tabibnia, Matthew D. Lieberman, and Trevor W. Robbins (2008), Serotonin Modulates Behavioral Reactions to Unfairness, *Science* 320, 1739.
- Cronbach, L. J. (1951), Coefficient Alpha and the Internal Structure of Tests, *Psychometrika* 16, 297–334.
- Cronin, Joseph, Michael K. Brady, and Tomas M. Hult (2000), Assessing the Effects of Quality, Value and Customer Satisfaction on Consumer Behavioral Intentions in Service Environments, *Journal of Retailing* 76 (2), 193–218.
- Damasio, Antonio R. (1994), *Descartes' Error: Emotion, Reason and the Human Brain*, New York: Putnam.
- Daniel, Peter M., E. R. Love, S.R. Moorhouse, and Oliver E. Pratt (1981), The Effect of Insulin upon the Influx of Tryptophan into the Brain of the Rabbit, *The Journal of Physiology* 312, 551–62.
- Danziger, Shai and Ruthie Segev (2006), The Effects of Informative and Non-Informative Price Patterns on Consumer Price Judgments, *Psychology and Marketing* 23 (6), 535–53.
- Darke, Peter R. and Darren W. Dahl (2003), Fairness and Discounts: The Subjective Value of a Bargain, *Journal of Consumer Psychology* 13 (3), 328–38.
- Daskalopoulou, Irene and Anastasia Petrou (2006), Consumers' Expenditures and Perceived Price Fairness, *International Journal of Social Economics* 33 (11), 766–80.
- Deppe, Michael, Wolfram Schwindt, Anna Pieper, Harald Kugel, Hilke Plassmann, Peter Kenning, Katja Deppe, and Bernd E. Ringelstein (2007), Anterior Cingulate Reflects Susceptibility to Framing During Attractiveness Evaluation, *Neuroreport* 18 (11), 1119–23.
- Diller, Hermann (2008), Price Fairness, *Journal of Product and Brand Management* 17 (5), 353–5.

- Dodds, William B., Kent B. Monroe, and Dhruv Grewal (1991), Effects of Price, Brand, and Store Information in Buyer's Product Evaluations, *Journal of Marketing Research* 28 (2), 307–19.
- Emanuele, Enzo, Natascia Brondino, Marco Bertona, Simona Re, and Diego Geroldi (2008), Relationship between Platelet Serotonin Content and Rejections of Unfair Offers in the Ultimatum Game, *Neuroscience Letters* 437, 158–61.
- Fehr, Ernst and Klaus M. Schmidt (1999), A Theory of Fairness, Competition, and Cooperation, *The Quarterly Journal of Economics* 114 (3), 817–68.
- Flöel, Agnes, A. Veronca Witte, Hubertus Lohmann, Heike Wersching, Bernd E. Ringelstein, Klaus Berger, and Stefan Knecht (2008), Lifestyle and Memory in the Elderly, *Neuroepidemiology* 38, 39–47.
- Frey, Bruno S. and Werner W. Pommerehne (1993), On the Fairness of Pricing – An Empirical Survey Among the General Population, *Journal of Economic Behavior* 20 (3), 295–307.
- Gabor, A. and C. W. J. Granger (1979), Price Sensitivity of the Consumer, *Management Decisions* 17 (8), 569–75.
- Güth, Werner, Manfred Königstein, Judit Kovács, and Enikő Zala-Mező (2001), Fairness Within Firms: The Case of One Principal and Multiple Agents, *Schmalenbach Business Review* 53, 82–101.
- Güth, Werner, Rolf Schmittberger, and Bernd Schwarze (1982), An Experimental Analysis of Ultimatum Bargaining, *Journal of Economic Behavior & Organization* 3 (4), 367–388.
- Hardesty, David M. and Tracy A. Suter (2005), E-Tail and Retail Reference Price Effects, *Journal of Product & Brand Management* 14 (2), 129–36.
- Haws, Kelly L. and William O. Bearden (2006), Dynamic Pricing and Consumer Fairness Perceptions, *Journal of Consumer Research* 33 (December), 304–11.
- Heider, F. (1958), *The Psychology of Interpersonal Relations*, New York: John Wiley.
- Herrmann, Andreas, Lan Xia, Kent B. Monroe, and Frank Huber (2007), The Influence of Price Fairness on Customer Satisfaction: An Empirical Test in the Context of Automobile Purchases, *Journal of Product and Brand Management* 16 (1), 49–58.
- Homburg, Christian, Wayne D. Hoyer, and Nicole Koschate (2005), Customers' Reactions to Price Increases: Do Customer Satisfaction and Perceived Motive Fairness Matter?, *Journal of the Academy of Marketing Sciences* 33 (Winter), 36–49.
- Hubert, Marco, Mirja Hubert, Arnd Florack, Marc Linzmajer, and Peter Kenning (2013), Neural Correlates of Impulsive Buying Tendencies during Perception of Product Packaging, *Psychology & Marketing* 30 (10), 861–73.
- Hubert, Mirja and Peter Kenning (2008), A Current Overview of Consumer Neuroscience, *Journal of Consumer Behaviour* 7 (4/5), 272–92.
- Husted, Bryan W. and Robert Folger (2004), Fairness and Transaction Costs: The Contribution of Organizational Justice Theory to an Integrative Model of Economic Organization, *Organization Science* 15 (6), 719–29.
- Jonckheere, A. R. (1954), A Distribution-free K-Sample Test against Ordered Alternatives, *Biometrika* 41, 133–145.
- Kachelmeier, Steven J., Stephen T. Limberg, and Michael S. Schadewald (1991), Fairness in Markets: A Laboratory Investigation, *Journal of Economic Psychology* 12 (3), 447–64.
- Kahneman, Daniel, Jack L. Knetsch, and Richard H. Thaler (1986), Fairness and the Assumptions of Economics, *The Journal of Business* 59 (4), 285–300.
- Kalapurakal, Rosemary, Peter R. Dickson, and Joel E. Urbany (1991), Perceived Price Fairness and Dual Entitlement, *Advances in Consumer Research* 18 (1), 788–93.
- Kelley, Harold H. (1973), The Process of Causal Attribution, *American Psychologist* 28, 107–128.
- Kenning, Peter, Hilke Plassmann, Harald Kugel, Wolfram Schwindt, Anna Pieper, and Michael Deppe (2007), Neural Correlates of Attractive Ads, in J. Koschnik (ed.), *Focus-Jahrbuch 2007, Schwerpunkt: Neuroökonomie, Neuromarketing, Neuromarktforschung*, Munich: FOCUS Magazin Verlag, 287–98.

- Kenning, Peter, Hilke Plassmann, and Dieter Ahlert (2007), Consumer Neuroscience – Implikationen neurowissenschaftlicher Forschung für das Marketing, *Marketing ZFP* 29 (1), 57–68.
- Knoch, Daria, Alvaro Pascual-Leone, Kaspar Meyer, Valerie Treyer, and Ernst Fehr (2006), Diminishing Reciprocal Fairness by Disrupting the Right Prefrontal Cortex, *Science* 314, 829–32.
- Knox, Simon, David Walker, and Charles Marshall (1994), Measuring Consumer Involvement with Grocery Brands: Model Validation and Scale-Reliability Test Procedures, *Journal of Marketing Management* 10, 137–52.
- Knutson, Brian, Scott Rick, G. Elliott Wimmer, Drazen Prelec, and George Loewenstein (2007), Neural Predictors of Purchase, *Neuron* 53 (January), 147–56.
- Koenigs, Michael and Daniel Tranel (2007), Irrational Economic Decision-Making after Ventromedial Prefrontal Damage: Evidence from the Ultimatum Game, *The Journal of Neuroscience* 27 (4), 951–6.
- Koenigs, Michael and Daniel Tranel (2008), Prefrontal Cortex Damage Abolishes Brand-Cued Changes in Cola Preference, *Social Cognitive and Affective Neuroscience* 3 (1), 1–6.
- Kristensen, Henrik (2000), Does Fairness Matter in Corporate Takeovers?, *Journal of Economic Psychology* 21 (1), 43–6.
- Kruskal, William H. and W. Allen Wallis (1952), Use of Ranks in One Criterion Variance Analysis, *Journal of the American Statistical Association* 47, 583–621.
- Küpper, Hans-Ulrich (2009), Autonomy as a Principle of Economics Research – Relations Between Decision Theory, Ethics and Neurobiology, *Zeitschrift für Betriebswirtschaft* 79 (6), 781–800.
- Kukar-Kinney, Monika, Lan Xia, and Kent B. Monroe (2007), Consumers' Perceptions of the Fairness of Price-matching Refund Policies, *Journal of Retailing* 83 (3), 325–37.
- Lee, Nick, Amanda J. Broderick, and Laura Chamberlain (2007), What is 'Neuromarketing'? A Discussion and Agenda for Future Research, *International Journal of Psychophysiology* 63 (2), 199–204.
- Leszczyc, Peter, T. L. Popkowski, and Harry J. P. Timmermans (1997), Store-Switching Behavior, *Marketing Letters* 8 (2), 193–204.
- Levene, Howard (1960), Robust Tests for Equality of Variances, in Ingram Olkin, Harold Hotelling et al. (eds.), *Contributions to Probability and Statistics: Essays in Honor of Harold Hotelling*, Stanford: Stanford University Press, 278–92.
- Levi, Maurice, Kai Li, and Feng Zhang (2010), Deal or No Deal: Hormones and the Mergers and Acquisitions Game, *Management Science* 56 (9), 1462–83.
- Lichtenstein, Donald R., Nancy M. Ridgway, and Richard G. Netemeyer (1993), Price Perceptions and Consumer Shopping Behavior: a field study, *Journal of Marketing Research* 30, 232–45.
- Loewenstein, Georg F., Elke U. Weber, Christopher K. Hsee, and Ned Welch (2001), Risk as Feelings, *Psychological Bulletin* 127 (2), 267–86.
- Mann, Henry B. and Donald R. Whitney (1947), On a Test of Whether One of Two Random Variables is Stochastically Larger than the Other, *Annals of Mathematical Statistics* 18, 50–60.
- Matzler, Kurt, Andreas Würtele, and Birgit Renzl (2006), Dimensions of Price Satisfaction: a Study in the Retail Banking Industry, *International Journal of Bank Marketing* 24 (4), 216–31.
- Maxwell, Sarah (2002), Rule-based Price Fairness and Its Effect on Willingness to Purchase, *Journal of Economic Psychology* 23, 191–212.
- Maxwell, Sarah (2005), Hyperchoice and High Prices: an Unfair Combination, *Journal of Product & Brand Management* 14 (7), 448–54.
- Michl, Theresa, Isabell M. Welp, Matthias Spörrle, and Arnold Picot (2010), Der Einfluss affektiver Zustände auf den strategischen Entscheidungsfindungsprozess, in Georg Schreyögg and Peter Conrad (eds.), *Managementforschung* 20, Wiesbaden: Gabler, 79–112.

- Mishra, Arul and Himanshu Mishra (2010), We Are What We Consume: The Influence of Food Consumption on Impulsive Choice, *Journal of Marketing Research* 47, 1129–37.
- Mittal, Banwari (1989), Measuring Purchase-Decision Involvement, *Psychology & Marketing* 6, 147–62.
- Monroe, Kent B. and Lan Xia (2005), Special Session Summary: The Many Routes To Price Unfairness Perceptions, *Advances in Consumer Research* 32, 387–90.
- Nasoz, Fatma, Kaye Alvarez, Christine L. Lisetti, and Neal Finkelstein (2003), Emotion Recognition from Physiological Signals for Presence Technologies, *International Journal of Cognition, Technology, and Work – Special Issue on Presence* 6 (1), 1–32.
- Oliver, Richard L. and Mikhael Shore (2003), Digital Redemption of Coupons: Satisfying and Dissatisfying Effects of Promotion Codes, *Journal of Product and Brand Management* 12 (2), 121–34.
- Pasternack, Barry A. (1985), Optimal Pricing and Return Policies for Perishable Commodities, *Marketing Science* 4 (2), 166–76.
- Patterson, Paul G. (2006), Expectations and Product Performance as Determinants of Satisfaction for a High-involvement Purchase, *Psychology & Marketing* 10 (5), 449–65.
- Plassmann, Hilke, Peter Kenning, Anna Pieper, Wolfram Schwindt, Harald Kugel, and Michael Deppe, (2007), Neural Correlates of Ad Liking, *Proceedings of the Society for Consumer Psychology Conference*, Las Vegas, 155.
- Plassmann, Hilke, John O'Doherty, and Antonio Rangel (2007), Orbitofrontal Cortex Encodes Willingness to Pay in Everyday Economic Transactions, *Journal of Neuroscience* 27 (37), 9984–88.
- Plassmann, Hilke, John O'Doherty, Baba Shiv, and Antonio Rangel (2008), Marketing Actions can Modulate Neural Representations of Experienced Pleasantness, *Proceedings of the National Academy of Science* 105 (3), 1050–54.
- Plassmann, Hilke, Thomas Z. Ramsay, and Milica Milosavljevic (2012), Branding the Brain: A Critical Review and Outlook, *Journal of Consumer Psychology* 22 (1), 18–36.
- Plassmann, Hilke, Carolyn Yoon, Fred Feinberg, and Baba Shiv (2011), Consumer Neuroscience, in Richard P. Bagozzi and Ayalla Ruvio (eds.), *Wiley International Encyclopedia of Marketing*, Vol. 3, West Sussex, UK: John Wiley & Sons, 115–22.
- Pull, Kerstin (2003), Ultimatum Games and Wages: Evidence of an “Implicit Bargain”?, *Schmalenbach Business Review* 55, 161–71.
- Rao, Vithala R. (1984), Pricing Research in Marketing: The State of the Art, *The Journal of Business* 57 (1), 39–60.
- Reis, Harry T., Kennon M. Sheldon, Shelly L. Gable, Joseph Roscoe, and Richard M. Ryan (2000), Daily Well-Being: The Role of Autonomy, Competence, and Relatedness, *Personality and Social Psychology Bulletin* 26 (4), 419–35.
- Riedl, René and Andrija Javor (2012), The Biology of Trust: Integrating Evidence from Genetics, Endocrinology, and Functional Brain Imaging, *Journal of Neuroscience, Psychology, and Economics* 5 (2), 63–91.
- Robbins, T. W. (2000), Chemical Neuromodulation of Frontal-executive Functions in Human and Other Animals, *Experimental Brain Research* 133, 130–8.
- Saad, Gad (2008), The Collective Amnesia of Marketing Scholars Regarding Consumers' Biological and Evolutionary Roots, *Marketing Theory* 8 (4), 425–48.
- Sanfey, Alan G., George Loewenstein, Samuel M. McClure, and Jonathan D. Cohen (2006), Neuroeconomics: Cross-Currents in Research on Decision-Making, *Trends in Cognitive Sciences* 10 (3), 108–16.
- Sanfey, Alan G., James K. Rilling, Jessica A. Aronson, Leigh E. Nystrom, and Jonathan D. Cohen (2003), The Neural Basis of Economic Decision-making in the Ultimatum Game, *Science* 300, 1755–6.
- Scherhorn, Gerhard, Lucia A. Reisch, and Gerhard Raab (1990), Addictive Buying in West Germany: An Empirical Study, *Journal of Consumer Policy* 13 (4), 355–87.
- Schwarz, Norbert (2000), Social Judgment and Attitudes: Warmer, More Social, and Less Conscious, *European Journal of Social Psychology* 30 (March-April), 149–76.

- Seiders, Kathleen, Glenn B. Voss, Dhruv Grewal, and Andrea L. Godfrey (2005), Do Satisfied Customers Buy More? Examining Moderating Influences in a Retailing Context, *Journal of Marketing* 69 (4), 26–43.
- Sen, Amartya (2002), *Rationality and Freedom*, Cambridge, MA: Belknap.
- Shapiro, Sam S. and Martin Bradbury Wilk (1965), An Analysis of Variance Test for Normality (Complete Samples), *Biometrika* 52 (3/4), 591–611.
- Smirnov, Nikolai V. (1948), Table for Estimating the Goodness of Fit of Empirical Distributions, *Annals of Mathematical Statistics* 19, 279–81.
- Stanton, Angela A., Mellani Day, and Isabell M. Welpel (eds.) (2010), *Neuroeconomics and the Firm*, Cheltenham, UK: Edward Elgar.
- Sternquist, Brenda, Sang-Eun Byung, and Byoung-ho Jin (2004), The Dimensionality of Price Perceptions: A Cross-Cultural Comparison of Asian Consumers, *International Review of Retail, Distribution & Consumer Research* 14 (1), 83–100.
- Stoll, Marco, Sebastian Baecke, and Peter Kenning (2008), What They See is What They Get? An fMRI-Study on Neural Correlates of Attractive Packages, *Journal of Consumer Behaviour* 7 (4–5), 342–59.
- Suckale, Jakob and Michele Solimena (2008), Pancreas Islets in Metabolic Signaling – Focus on the β -cell, *Frontiers in Bioscience* 13, 7156–71.
- Suter, Tracy A. and David M. Hardesty (2005), Maximizing Earnings and Price Fairness Perceptions in Online Consumer-to-consumer Auctions, *Journal of Retailing* 81 (4), 307–17.
- Tabibnia, Golnaz, Ajay B. Satpute, and Matthew D. Lieberman (2008), The Sunny Side of Fairness: Preference for Fairness Activates Reward Circuitry (and Disregarding Unfairness Activates Self-control Circuitry), *Psychological Science* 19, 339–47.
- Thompson, Leigh and George Loewenstein (1992), Egocentric Interpretations of Fairness and Interpersonal Conflict, *Organizational Behavior and Human Decision Processes* 51, 176–92.
- Vaidyanathan, Rajiv and Praveen Aggarwal (2003), Who Is the Fairest of Them All? An Attributional Approach to Price Fairness Perceptions, *Journal of Business Research* 56 (6), 453–63.
- Völckner, Franziska (2007), The dual role of price: Decomposing Consumers' Reactions to Price, *Journal of the Academy of Marketing Science* 36 (3), 359–77.
- Völckner, Franziska and Julian Hofmann (2007), The Price-perceived Quality Relationship: A Meta-analytic Review and Assessment of Its Determinants, *Marketing Letters* 18 (3), 181–96.
- Wadhwa, Monica, Baba Shiv, and Stephen M. Nowlis (2008), A Bite to Whet the Reward Appetite: The Influence of Sampling on Reward-Seeking Behaviors, *Journal of Marketing Research* 45 (4), 403–13.
- Walster, Elaine, William G. Walster, and Ellen Berscheid (1978), *Equity: Theory and Research*, Boston: Allyn and Bacon.
- Wang, Xiao-Tian and Robert D. Dvorak (2010), Sweet Future: Fluctuating Blood Glucose Levels Affect Future Discounting, *Psychological Science* 21 (2), 183–8.
- Watson, David, Lee Anna Clark, and Auke Tellegen (1988), Development and Validation of Brief Measures of Positive and Negative Affect: The PANAS Scales, *Journal of Personality and Social Psychology* 54 (6), 1063–70.
- Way, Baldwin M., Goran Lacan, Lynn A. Fairbanks, and William P. Melega (2007), Architectonic Distribution of the Serotonin Transporter Within the Orbitofrontal Cortex of the Vervet Monkey, *Neuroscience* 148 (4), 937–48.
- World Health Organization Expert Committee (1995), Physical Status: The Use and Interpretation of Anthropometry: Report of a WHO Expert Committee, *World Health Organization* 854, 1–452.
- Wyer, Robert S., Gerald L. Clore, and Linda M. Isbell (1999), Affect and Information Processing, *Advances in Experimental Social Psychology* 31, 1–77.

- Xia, Lan and Kent B. Monroe (2010), Is a Good Deal Always Fair? Examining the Concepts of Transaction Value and Price Fairness, *Journal of Economic Psychology* 31, 884–94.
- Xia, Lan, Kent B. Monroe, and Jennifer L. Cox (2004), The Price Is Unfair! A Conceptual Framework of Price Fairness Perceptions, *Journal of Marketing* 68 (October), 1–15.
- Xia, Lan, Monika Kukar-Kinney, and Kent B. Monroe (2010), Effects of Consumers' Efforts on Price and Promotion Fairness Perceptions, *Journal of Retailing* 86 (1), 1–10.
- Yoon, Carolyn, Angela H. Gutchess, Fred Feinberg, and Thad A. Polk (2006), A Functional Magnetic Resonance Imaging Study of Neural Dissociations between Brand and Person Judgments, *Journal of Consumer Research* 33 (1), 31–40.
- Zak, Paul J. (2004), Neuroeconomics, *Philosophical Transactions of the Royal Society B* 359 (1451), 1737–48.