J. of the Acad. Mark. Sci. (2011) 39:813–827
DOI 10.1007/s11747-010-0215-4

ORIGINAL EMPIRICAL RESEARCH

How does product program innovativeness affect customer satisfaction? A comparison of goods and services

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Received: 10 November 2009 / Accepted: 2 August 2010 / Published online: 22 September 2010

Abstract This article attempts to provide deeper insights into the link between the innovativeness of a company's offered goods/services and customer satisfaction. This study proposes an inverted U-shaped relationship between the innovativeness of the offered goods and customer satisfaction. For the innovativeness of services, information economics and services marketing literature indicate an inverted S-shaped relationship. Two separate studies conducted for goods and services confirm the proposed nonmonotonic effects of the investigated relationships. Both studies use dyadic data from marketing managers to assess innovativeness and from customers to indicate customer satisfaction.

Keywords Innovativeness of goods and services · Customer satisfaction · Nonmonotonic effects

Increased environmental complexity and dynamism increasingly urge customers to use innovative products to adapt their behaviors to recent developments. In turn, practitioners increasingly emphasize the innovativeness of products as an important means to fulfill customer needs and thus contribute to customer satisfaction (e.g., Christensen et al. 2005). Offering an innovative product program further signals to customers that the company intensively tries to fulfill customers' needs by making continuous investments into innovation. Customers also may perceive innovative products as more durable, because they represent the most recent functional and/or technological developments. Similarly, customers should consider an innovative company capable of fulfilling their needs in the long-run, which again generates customer satisfaction. With regard to the importance of product innovativeness for customer satisfaction, Michel et al. (2008, p. 50) even point out, "At its core, innovation really is: finding new ways to co-solving customer problems…. After all, customers do not seek products; they seek satisfaction."

Despite the relevance of product innovativeness for customer satisfaction, theory-based and empirically grounded research on this link is scarce. Product program innovativeness (e.g., Atuahene-Gima 1996; Hauser et al. 2006) and customer satisfaction mainly appear in two separate streams in marketing research (e.g., Fornell et al. 2010; Homburg and Stock 2004, 2005; Stock 2005; Tuli and Bharadway 2009). The few existing studies that contain data about both constructs do not attempt to explain theoretically why and how these constructs may relate, and they provide mixed results. For example, several studies report a positive relationship between innovativeness and customer satisfaction (Langerak et al. 2004; Luo and Bhattacharya 2006; Tatikonda and Montoya-Weiss 2001) or customer loyalty (Wallenburg 2009). Homburg and Stock (2004) find that the correlation between innovativeness and customer satisfaction is not significant. Athanassopoulos et al. (2001) even report a negative correlation between product innovativeness and customer loyalty (i.e., intention to switch and word of mouth).

These mixed findings indicate that product innovativeness is associated with varied customer responses. Triggered by high failure rates of newly introduced products, a

The author thanks Gisela Bieling, Joe P. Cannon, Christian Homburg, Martin Klarmann, Lisa Scheer, Björn Six, and Nicolas Zacharias for their valuable comments. In addition, the author thanks three anonymous *JAMS* reviewers for their valuable comments and their helpful suggestions.

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debate has been started about whether product innovativeness might create too much challenge for customers, such that "complexity can turn customers away" (Calantone et al. 2006, p. 408; Thompson et al. 2005). Companies need to learn more about both positive and negative customer responses to product innovativeness and thus understand how increased product innovativeness might contribute—or not—to customer satisfaction. Thus, investigations of linear effects, which suggest greater innovativeness equals higher customer satisfaction, cannot cover the complexity involved in the relationship. To depict both positive and negative effects of product innovativeness on customer satisfaction in parallel, we must consider possible nonmonotonic relationships. For example, the inverted U-shaped relationship between product newness and market performance was proposed by Meyer and Roberts (1986) more than 20 years ago, yet marketing research has not empirically examined the nonmonotonic effects of innovativeness.

Furthermore, this complex relationship may vary for goods and services. Therefore, another important conceptual issue relates to the separation of the innovativeness of services and goods, which likely have differential effects on customer satisfaction (e.g., Atuahene-Gima 1996; Lievens and Moenaert 2000; Vargo and Lusch 2004). Strategies developed for goods are inappropriate for services because of their particularities, such as intangibility and inseparability (e.g., Zeithaml et al. 2009). Yet still, research offers "little explicit coverage … on *service* innovations" (Bitner et al. 2008, p. 66). In particular, the differential effects of the innovativeness of goods versus services on customer satisfaction have not been examined, to the best of our knowledge.

To address the gaps in extant literature, this study extends previous research in several ways. First, we examine the highly important but largely unexplored relationship between product innovativeness and customer satisfaction. We focus particularly on product program innovativeness, which refers to a company's ability to generate a range of goods or services that are new and meaningful to customers and that differ from existing alternatives (e.g., Garcia and Calantone 2002; Gumusluoglu and Ilsev 2009; Luo and Bhattacharya 2006). By studying this relationship, we expand the understanding of customers' reactions to product program innovativeness, which is critical for the successful launch of innovative products (Hauser et al. 2006).

Second, we consider the functional structure of the relationship between product program innovativeness and customer satisfaction. We thus attempt to determine whether the relationship is linear or if there are significant nonmonotonic effects. We add to extant knowledge derived from linear analyses by considering that product innovativeness may not only positively affect customer satisfaction.

Third, we present a comparative study of the differential effects of goods versus services innovativeness on customer satisfaction. Goods-based innovations are proposed to exert an inverted U-shaped effect on customer satisfaction. For the relationship between the innovativeness of services and customer satisfaction, we propose an inverted S-shaped function. We focus on the innovativeness of interpersonal services, which require "close, personal contact between customers and employees" (Meuter et al. 2005, p. 61). Unlike the delivery of goods, customer contact employees in service sectors are important intermediaries between the service innovation and its end users (e.g., Abramovici and Bancel-Charensol 2004).

Our broad-scale empirical analysis relies on two studies across several manufacturing and services industries. Both studies include dyadic data from marketing managers, who assess product program innovativeness, and their customers, who provide the data regarding customer satisfaction.

Conceptual background

In hypothesizing about the functional structure of the relationship between the innovativeness of a company's product program and customer satisfaction, we draw on information economics as an overarching theory (e.g., Philips 1988; Stigler 1961). It is based on two major premises that can explain positive and negative effects of product program innovativeness and customer satisfaction.

First, interacting parties, such as the company and the customer, strive for utility maximization (Heide and Wathne 2004); for this study, we are particularly interested in utility from the customer perspective. Customers build expectations about the utility they may derive from an exchange relationship with a company. The higher their expected utility, the higher is their satisfaction. In this context, information economics identifies signaling as a promising activity that companies can use to demonstrate their ability to fulfill their customers' expectations. Increased environmental dynamism urges customers to use innovative products to adapt their behaviors to recent developments. Thus, product innovativeness is an important signal to customers that a company is able to fulfill customer needs and expectations. This signal increases the utility that customers can expect from the exchange relationship. Fulfilling customer expectations about physical goods and/or services leads to customer satisfaction (e.g., Oliver 1997; Shankar et al. 2003).

Second, information economics predicts that customers assess their exchange relationship with a company on the basis of the allocation of information between the two parties (Spence 1973). A customer's lack of information about a company's products implies an information

asymmetry (e.g., Kirmani and Rao 2000). Information asymmetry creates uncertainty for the customer, particularly for products whose output is difficult to assess—such as the innovativeness of goods and/or services (e.g., Castaño et al. 2008; Heide 2003). Increased uncertainty in terms of innovative products harms the customer's conviction that the company can fulfill his or her expectations and consequently has a negative effect on satisfaction.

Information economics provides deeper insights into the opposing effects of product program innovativeness on customer satisfaction. On the one hand, product program innovativeness provides a signal that shows the company is able to fulfill customer expectations, which increases customer satisfaction. On the other hand, increased product program innovativeness increases the customer's information asymmetry and thus uncertainty about a company's ability to fulfill his or her expectations, which decreases customer satisfaction.

Hypotheses development

The dependent variable in our study is customer satisfaction, the most important customer-related performance indicator for product innovativeness (Langerak et al. 2004). Customer satisfaction captures customers' overall evaluations of a company's product program and the degree to which the company can fulfill their expectations (e.g., Anderson et al. 2004; Spreng et al. 1996). Because it is examined whether the relationship between innovativeness and customer satisfaction differs for goods and services, separate hypotheses are proposed next.

Innovativeness of goods and customer satisfaction

It is proposed that the innovativeness of goods has a nonlinear, inverted U-shaped relationship with customer satisfaction. Two mechanisms that may affect customer responses to innovative goods are distinguished: increased expected utility, signaled by product program innovativeness, and customer uncertainty, caused by information asymmetry due to the innovativeness of goods.

Positive Effect of the Innovativeness of Goods The positive effect of the innovativeness of goods arises from the utility that customers can expect to obtain from these innovations. Companies can signal their ability to satisfy current and future customer needs by introducing innovative goods. The innovativeness of these goods increases customers' expected utility and satisfaction. This notion is consistent with findings in consumer research that reveal increased expected utility associated with new goods positively affects customers' attitudes (e.g., Davis 1989; Davis et al. 1989; Wang et al. 2008).

It is further proposed that the positive effect of the innovativeness of goods on customer satisfaction, due to increased expected utility, is a concave function. Specifically, the expected utility associated with the innovativeness of goods should increase less than proportionally, mirroring the law of diminishing marginal utility (e.g., Fidler and Johnson 1984; Jedidi and Zhang 2002). Because customers anticipate increased saturation, they expect a lesser utility increase as innovativeness increases (e.g., Thompson et al. 2005). Thus, incremental utility decreases with the level of innovativeness (Fig. 1, Panel A).

Negative Effect of the Innovativeness of Goods The innovativeness of goods may negatively affect customer satisfaction through customers' lack of information about the company's products (e.g., Kirmani and Rao 2000). An increase in the innovativeness of goods typically is associated with a larger number and variety of offered goods, which means greater complexity in the product program. The resulting increase in customer uncertainty harms customers' perceptions that the company can fulfill their expectations (e.g., Magnusson et al. 2003). Thus, customer uncertainty associated with increased product program innovativeness negatively affects customer satisfaction.

A convex curve is proposed; the greater the innovativeness of goods, the higher is the complexity that customers confront. This complexity arises from the increased number of choices offered, as well as the greater innovativeness of the goods. Prior research in consumer psychology suggests that "as the number of choices keeps growing, negative effects of having a multitude of options begin to appear. As the number of choices grows further, negatives escalate until we become overloaded" (Schwartz 2004, p. 2). That is, the greater the innovativeness of goods, the more likely customers are to become overwhelmed by the related complexity (e.g., Schwartz 2004; Schwartz et al. 2002), which produces uncertainty about whether the company will be able to fulfill the customers' needs. Thus, customer uncertainty rises more than proportionally with the innovativeness of goods.

In summary, customers experience two opposing partial effects that refer to the expected utility and uncertainty associated with product program innovativeness and that should both affect satisfaction. The trade-off between these partial effects generates an inverted U-shaped relationship between the innovativeness of goods (IG) and customer satisfaction (CS), as depicted in Fig. 1, Panel A. In this figure, IG_0 denotes the level of innovativeness of offered goods at which customer satisfaction achieves its highest level; CS_0 indicates the level at which IG is equal to IG_0.

To the left of the optimal point (i.e., $IG < IG_0$), increasing innovativeness of the offered goods increases

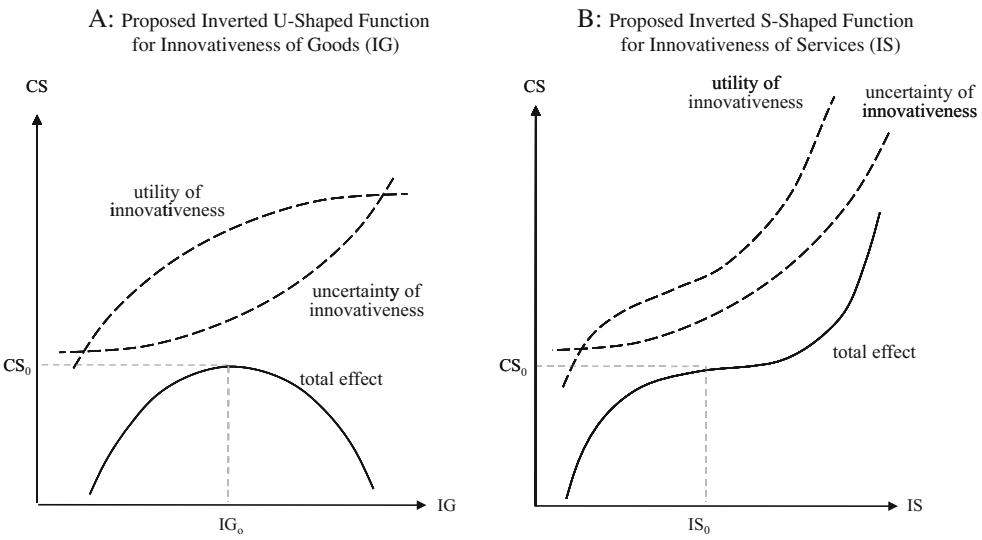

Fig. 1 Alternative functional structures of the relationship between product program innovativeness and customer satisfaction

Note: IG=innovativeness of goods; IS=innovativeness of services.

customer satisfaction. Below this level of innovativeness, the slope of the utility-related curve is higher than the slope of the uncertainty-related curve. In other words, customers' expected utility associated with the innovativeness of goods increases more than their uncertainty. This scenario contributes to the customer's conviction that a company can fulfill expectations and thus increases customer satisfaction.

The curve reflecting the innovativeness-satisfaction relationship changes in direction though when the uncertainty curve rises more steeply than the utility curve. In this situation, customers expect to become increasingly overwhelmed by complexity of the company's offered goods. Above a certain level, the innovativeness of goods further increases customers' uncertainty about the company's ability to fulfill their expectations, such that to the right side of the optimal point (i.e., $IG > IG_0$), innovativeness becomes counterproductive for customer satisfaction. Thus, we hypothesize:

H1: The innovativeness of the offered goods has an inverted U-shaped relationship with customer satisfaction.

Innovativeness of services and customer satisfaction

In terms of the link between innovativeness of services and customer satisfaction, an inverted S-shaped relationship is proposed, as depicted in Fig. 1, Panel B. Consistent with the hypothesis regarding the innovativeness of goods, the discussion of service innovativeness concentrates on the opposing mechanisms of expected utility and uncertainty.

Positive Effect of the Innovativeness of Services Regarding the innovativeness of services, the curve of customers' expected utility should follow an inverted S-shaped function. Drawing on literature in the field of innovation management and services marketing, it is proposed that customers' utility consists of two parts, basic and add-on relational utility. Thus, customers' expected total utility from service innovativeness comprises expected basic and expected add-on relational utility, both of which depend on what customers have experienced in former exchange relationships with service providers.

Basic utility relates to the core of the product and comprises such issues as solving a particular problem customers have and doing things customers would not have been able to do before (Eyal et al. 2004). Add-on relational utility emerges from social and emotional support within the exchange relationship with the company (e.g., Bitner et al. 1998; Chandrashekaran and Sinha 1995; Hoeffler 2003; Homburg et al. 2007b; Sheth 1981). Social support refers to helpful social interactions with customer contact employees (Karasek and Theorell 1990); it might involve a convenient atmosphere and intellectual stimulation during the interaction or even extend into "commercial friendships" between employees and customers (Bitner et al. 1998, p. 102; Heide and Wathne 2004; Price et al. 1996). Furthermore, customers can receive emotional support in the form of a transfer of positive emotions from employees (e.g., Pugh 2001).

Regarding the expected basic utility of the innovativeness of services, a similar functional structure is proposed as for goods: a diminishing marginal basic utility as the customer anticipates increased saturation. The similarities of goods and services in terms of the fulfillment of basic utilities repeatedly have been addressed in services marketing literature (e.g., Alam 2006; Ali et al. 1995; Shugan 2007).

Customers also should expect an add-on relational utility from an exchange relationship with a service company that reflects the particularities of services, namely, their intan-

gibility and inseparability (e.g., Lievens and Moenaert 1999, 2000). Intangibility means that services "cannot be seen, felt, tasted or touched in the same way goods can be sensed" (Zeithaml et al. 1985, p. 33), so it requires intensive information exchanges between service employees and customers (Lievens and Moenaert 2000). Inseparability "refers to the simultaneity and interconnectedness of service performance and use" (Berry et al. 2002, p. 5), which relates to the essence of most services, namely, the interaction between customers and service employees during the service delivery (e.g., Gummesson 2002).

Furthermore, services marketing literature has repeatedly emphasized the interactive character of services (Droege et al. 2009). In many cases, it even holds that the "interaction *is* the service from the customer's point of view" (Bitner et al. 1990, p. 71). Consistently, personal interactions between service employees and customers have been associated with add-on relational utility (e.g., Basuroy et al. 2006; Iyengar et al. 2007).

This add-on relational utility should become more important when service innovativeness increases. The inseparability of the production and consumption of interpersonal services implies that "front office personnel play a prominent role in the success … of the innovation" (Abramovici and Bancel-Charensol 2004, p. 63). The greater the service innovativeness, the more intense the interaction between service employees and customers must be for effective service delivery. Therefore, customers' perceived utility of social and emotional support during the service delivery should increase as well (Bonnin et al. 2005). Beyond the inflection point, a company's signaled basic utility, through its service innovativeness, may be enriched by the add-on utility that the service employees provide. The combination of basic and add-on utility also may alter the concave into a convex utility-related curve, past a medium level of service innovativeness. Customers can anticipate the basic and add-on utility of service innovativeness on the basis of their prior experiences with other service providers.

Negative Effect of the Innovativeness of Services A convex curve for customer uncertainty regarding service innovativeness is suggested. Similar to the discussion of goods, it is proposed that greater innovativeness of services means customers become more overwhelmed by the complexity, which leads to extremely high uncertainty about the company's ability to fulfill their needs. Thus, customer uncertainty rises more than proportionally with increasing innovativeness of services.

The trade-off between the opposing partial effects—that is, the expected total utility and uncertainty of service innovativeness—generates an inverted S-shaped relationship between the innovativeness of services (IS) and customer satisfaction (CS). This proposed functional structure is depicted in Fig. 1, Panel B. In this case, IS_0 denotes the level of the innovativeness of the offered services at which the curve moves from concave to convex, and CS_0 denotes the level at which IS equals IS_0. To the left of the inflection point (i.e., $IS < IS_0$), increasing innovativeness increases customer satisfaction less than proportionally. To the right of the inflection point (i.e., $IS > IS_0$), the innovativeness of the offered services increases customer satisfaction more than proportionally. Therefore, it is proposed:

H2: The relationship between the innovativeness of the offered services and customer satisfaction follows an inverted S-shaped function, which is first concave and then convex.

In addition to these core constructs, several control variables are considered that may affect the innovativeness of the offered goods/services on the one hand and correlate with customer satisfaction on the other. Specifically, we note the quality of the offered goods/services (e.g., Anderson et al. 1994; Liao and Chuang 2004; Shankar et al. 2003) and the quality and frequency of customer interactions (e.g., Goff et al. 1997; Pugh 2001) which have been identified as important antecedents of customer satisfaction Furthermore, product program innovativeness may vary for companies of different sizes (Subramaniam and Youndt 2005) or across industries (OECD 2008).

Methodology

Data collection and sample

To investigate the differential effects of the innovativeness of goods/services on customer satisfaction, we conducted two studies: one focused on the manufacturing industry, and another based on companies in the services sector.

Study 1: Dyadic Data from the Manufacturing Sector For our first study, we contacted 700 marketing managers of manufacturing companies with personalized letters and asked for their participation. These managers represented several manufacturing industries (e.g., chemical and pharmaceutical, machinery, electronic appliances, automotive, plastics) that generally represent different levels of innovativeness, according to published innovation indices (OECD 2008), which ensures certain variance in this construct. The 174 marketing managers who agreed to participate then received calls to schedule telephone interviews, whether immediately or at a later time. Five weeks later, this procedure had yielded 153 completed interviews (response rate of 21.85%).

To test for nonresponse bias, we collected additional data by telephone from 70 nonrespondents (i.e., 10% of the contacted 700 marketing managers) regarding the items that we used to capture the innovativeness of the offered goods and company and demographic characteristics (Homburg et al. 2007a). For these constructs, we did not find any significant differences between the means in our original sample and the nonrespondent sample.

The marketing managers assessed the innovativeness of their offered goods and identified 10 typical customers with varying levels of customer satisfaction (i.e., the questionnaires ask for one-third with high satisfaction, one-third with medium satisfaction, and one-third with low satisfaction). As a reward for participation, we offered the managers individualized feedback about their customers' satisfaction relative to that of customers of other companies within the same or other industries. We emphasized that the feedback and participation in this study would make sense only if they honestly provided data from customers with different levels of satisfaction. Of the 153 marketing managers, 121 agreed to do so.

In the next step, we randomly selected three customers from among those identified by each marketing manager and contacted them via telephone. After informing them that they had been identified by the marketing manager of the initial company, we asked them to participate in the study. To secure honest responses, we assured these customers that their assessments would be used exclusively for research purposes and forwarded only anonymously to the company affiliated with the marketing manager. Those customers who agreed to participate indicated their satisfaction level with the identifying firm. Furthermore, they assess the quality of the offered goods/services and the quality and frequency of their interactions. We obtained 234 usable customer responses, for an effective sample of 107 dyadic cases, with an average of 2.19 customers per company. The sample includes several manufacturing industries, including electronic appliances (24.8%), automotive (24.3%), machinery (22.4%), chemical and pharmaceutical (16.8%), and plastics (11.7%). A comparison of the dyads' industry proportions with the industry proportions in the original sample indicates few differences.

Study 2: Dyadic Data from the Services Sector For Study 2, we followed the same procedure: We first selected industries with different levels of innovativeness to gain sufficient variance (OECD 2008), then identified industries in which we expected some interaction between service employees and customers, because our study centers on interpersonal services.

This study focuses on service offerings in which the service is the product offered for sale or offerings dominated by services (Bitner et al. 2000). To capture services offerings, we selected the banking and insurance sector and the communication sector. The offerings dominated by services occur for example in the retail sector. These industries appear frequently in extant services marketing literature (e.g., Bitner et al. 2000; Homburg et al. 2007b; Lado et al. 1999; Li et al. 2005; Lievens and Moenaert 2000). We contacted 700 marketing managers of companies from different services industries and obtained agreement from 157 marketing managers (142 completed interviews; response rate of 20.29%). Nonresponse bias was tested by the same procedure we used in the manufacturing study, based on 70 telephone interviews with nonrespondents. The data did not indicate any serious nonresponse bias concerns.

Of the 142 marketing managers, 115 identified ten typical customers; we again randomly selected and contacted three customers per firm through a telephone survey. We obtained 228 usable responses from these service customers, for an effective sample of 96 dyadic cases, with an average of 2.38 customers per company. The sample features several services industries: banking and insurance (48.8%), communication (27.8%), retailing (18.3%), and others, such as IT sector (5.1%). The distribution of industries in the effective sample of services companies matched the distribution of the original sample relatively well.

Measure development and assessment

We mostly used multi-item scales to measure the relevant constructs in our study, with the exception of the quality of the offered goods/services and frequency of customer interaction. Whenever possible, we used existing measures for the constructs. To obtain initial guidance in our selection of participants and scales, we interviewed 17 marketing managers. The interviews indicated that marketing managers tend to be particularly intimate with their company's product programs and highly involved in the generation of new products, a claim well supported by marketing literature (Hauser et al. 2006; Szymanski et al. 2007). Therefore, we assessed innovativeness on the basis of the data from marketing managers, consistent with extant literature that assesses the innovativeness of product programs based on marketing manager ratings (Atuahene-Gima et al. 2005; Deshpandé et al. 1993). We also asked the marketing managers for qualitative feedback about the clarity and appropriateness of the items. On the basis of this qualitative feedback, we added or reworded several items.

During the interviews, the marketing managers emphasized the importance of the customers' perspective to understand customer reactions to product program innovativeness. Marketing literature also claims that the success of

innovations depends on customer acceptance (Hauser et al. 2006). Therefore, we measure customer satisfaction from the customer perspective, which also enables us to avoid the problem of common method bias (e.g., Podsakoff et al. 2003). For example, marketing managers who perceive their product program as highly innovative might rate customer satisfaction higher than would marketing managers who consider their company's products less innovative, because of their generally positive perception of their company.

We undertake further scale development related to our control variables. Detailed information is depicted in the Appendix. The use of single-item measures for the control variables in our model is consistent, on a general level, with the vast majority of extant research that employs single-item measures for the control variables in strategic management settings (Boyd et al. 2005).

We also conducted a quantitative purification of the items. First, to test the reliability and validity of the measures, we followed the standard procedures recommended by Gerbing and Anderson (1988). Second, an exploratory factor analysis of each construct indicated the unidimensionality and underlying factor structure. Third, we ran confirmatory factor analyses with LISREL VIII (Jöreskog and Sörbom 1982). When necessary, we purified the item pools. As we show in the Appendix, the coefficient alpha values clearly exceed the threshold value of .7 recommended by Nunnally (1978). Confirmatory factor analysis appears superior to more traditional criteria (e.g., Cronbach's alpha) in the context of scale validation, because of its less restrictive assumptions (Gerbing and Anderson 1988). Composite reliability represents the shared variance among a set of observed variables measuring an underlying construct (Fornell and Larcker 1981). Generally, a composite reliability of at least .6 is desirable (Bagozzi and Yi 1988); every factor in our study meets this requirement. The extracted values of the average variance also provide satisfactory results.

An examination of Table 1 reveals that the diagonal elements representing the square roots of the average variance extracted for each construct are significantly greater than the off-diagonal elements. This finding satisfies Fornell and Larcker's (1981) criterion for discriminant validity.

To determine whether an aggregation of assessments among a group of customers of a particular company is appropriate, we use the index of within-group interrater reliability (r_{wg}) established by James et al. (1984). As we show in Table 1, median r_{wg} values exceed the proposed minimum of .7 for the relevant constructs (Burke et al. 1999; George and Bettenhausen 1990). These results justify aggregating the customer responses for each company, similar to previous literature (e.g., Carson et al. 2007). Consequently, we average the customer responses for each company into a single group composite value for our subsequent data analysis (van Bruggen et al. 2002).

Results

Relationship between goods innovativeness and customer satisfaction

Regarding the relationship between the innovativeness of goods (IG) and customer satisfaction (CS), we propose an inverted U-shaped function. We test the hypothesis with the following squared regression model:

$$CS_i = b_0 + b_1 IG_i + b_2 IG^2{}_i + r_i \quad (1)$$

where CS_i is the customer satisfaction of the ith customer, and IG_i is the perceived innovativeness of the offered goods of the ith marketing manager. The model contains three fixed effects (intercept [b_0] and two slope parameters [b_1, b_2] for IG). Finally, r_i is the random error associated with the ith marketing manager.

We employ a multistep hierarchical regression analysis (Aiken and West 1991) with a linear and squared term for IG to test H1. The initial regression includes only the control variables and the linear term for IG (Model 1). The squared term pertaining to IG appears in Model 2. The negative sign for the coefficient of the squared term indicates an inverted U-shaped relationship between IG and CS (Cohen et al. 2003).

For interpretation purposes, we mean center the constituent variables, because the items rely on a Likert-scale (e.g., Irwin and McClelland 2001). To overcome potential problems due to multicollinearity (Aiken and West 1991), we ran stability tests (Echambadi and Hess 2007; Homburg et al. 2007a). The parameter estimates remained stable, so multicollinearity does not appear to be a problem. As we show in Table 2, along with our overall results, the squared model explains 38% of the variance in CS.

Regarding the linear term of IG in the squared model (see Column 2, Table 2), we observe a significant positive effect (b_1=.14; p<.05), whereas the squared effect on CS is negative (b_2=−.19; p<.05). The results of the F-test for the change in R^2 indicate that the inclusion of the squared term yields a significantly better specified model than the model without the squared term, such that adding the squared term for IG to the equation increases R^2 by 37.9%. In a third model, we integrate a cubic term to exclude the possibility of a cubic function (see Column 3, Table 2). The cubic coefficient is not significant (b_3=.07; n.s.). Therefore, the results indicate that the relationship between IG and CS takes an inverted U-shaped form, as we predicted in H1

Table 1 Correlation matrix and descriptive statistics of measures

Variables	r_{wg}	1	2	3	4	5	6	7
Study 1: Manufacturing industry								
(1) Innovativeness of the offered goods	–	**.71**						
(2) Customer satisfaction	.72	.09	**.75**					
(3) Quality of the offered goods	.74	.06	.66*	**N/A**				
(4) Quality of customer interaction	.71	.18*	.15*	.23*	**.81**			
(5) Frequency of customer interaction	.76	.11	.17*	.14*	.37*	**N/A**		
(6) Complexity of goods	.73	.59*	−.18*	.19*	.13*	−.17*	**.72**	
(7) Company size (number of employees)	–	−.01	.05	.06	−.03	−.19*	.03	**N/A**
Mean		4.05	3.69	3.76	3.61	2.56	3.61	–
Standard deviation		.71	.79	.89	.65	.67	.67	–
Study 2: Services industry								
(1) Innovativeness of the offered services	–	**.70**						
(2) Customer satisfaction	.76	.21*	**.80**					
(3) Quality of the offered services	.73	.18*	.19*	**N/A**				
(4) Quality of customer interaction	.80	.51*	.39*	.53*	**.77**			
(5) Frequency of customer interaction	.72	.31*	.20*	.44*	.49*	**N/A**		
(6) Complexity of services	.77	.62*	−.23*	.33*	−.35*	−.28*	**.75**	
(7) Company size (number of employees)	–	.01	.02	.05	−.01	.09	.06	**N/A**
Mean		4.11	3.79	3.99	4.01	3.72	3.67	–
Standard deviation		.55	.82	.89	.63	.75	.86	–

Diagonal elements in bold indicate the square roots of the average variance extracted for constructs measured with multiple items

*$p<.05$

(Fig. 2, Panel A). According to the squared regression function, the extremes also fall within the range of interest, such that this function reaches its maximum at a medium level of IG.

In line with information economics, our findings indicate that the innovativeness of goods increases customer satisfaction to a certain degree, but beyond that level, it appears to turn customers away (Calantone et al. 2006), and customer satisfaction decreases. The significance of this finding becomes even more obvious when we note that the data for the independent and dependent variables come from different sides of the dyad, that is, marketing managers and customers.

In addition to IG, the regression models contain the control variables as independent variables; we provide these results in Table 2. Specifically, for quality of the offered goods, quality of customer interaction, and frequency of customer interaction, we find significant positive effects. However, the effects of company size and the industry dummies on customer satisfaction are not significant.

A critical issue in studying complex relationships relates to the stability of the parameter estimates. This stability depends largely on the relationship between the sample size and the number of parameters to be estimated (Baumgartner and Homburg 1996). To analyze the stability of our results and ensure that removing a few observations would not radically change our findings, we conducted multiple stability tests. In these tests, we randomly eliminated 10% of the observations and reran the analyses with the reduced sample. We conducted 10 such independent tests. In every case, we can confirm the results of our hypotheses testing, with only very minor changes in the estimated parameters.

Relationship between service innovativeness and customer satisfaction

Regarding the functional structure of the relationship between service innovativeness (IS) and CS, we proposed in H2 an inverted S-shaped function, which we test with the following cubic regression model:

$$CS_i = b_0 + b_1 IS_i + b_2 IS^2{}_i - b_3 IS^3{}_i + F_i \quad (2)$$

where CS_i is the satisfaction of the ith customer, IS_i is the perceived innovativeness of the offered services of the ith marketing manager, and r_i is the random error associated with the ith marketing manager. The model contains four fixed effects (intercept [b_0] and three slope parameters [b_1, b_2, b_3] for IS). We provide the estimation results in Table 3.

Table 2 Model estimation results for innovativeness of the offered goods and customer satisfaction

	Linear Model (M1)	Squared Model (M2)	Cubic Model (M3)
Constant	2.11*	1.94*	2.00*
Innovativeness of the offered goods	.18*	.14*	.16*
Innovativeness of the offered goods squared	–	−.19*	−.19*
Innovativeness of the offered goods cubed	–	–	.07
Control variables			
Quality of the offered goods	.31*	.25*	.25*
Quality of customer interaction	.19*	.21*	.24*
Frequency of customer interaction	.14*	.12*	.15*
Company size	.01*	.02*	.01*
Chemical and pharmaceutical	−.02	.01	−.02
Machinery	−.01	−.01	−.03
Electronic appliances	.01	−.02	−.01
Automotive	−.02	−.01	−.03
R^2	.29*	.40*	.41*
Adj. R^2	.28*	.38*	.38*
F-Value	25.44*	27.89*	29.63*
N	107	107	107
Incremental R^2	.29*	.11*	.01
F_I	–	17.23**	1.57

Non-standardized regression coefficients. F_I = F-Value of incremental R^2

*p<.05

The linear, squared, and cubic terms all are relevant for testing the proposed inverted S-shaped relationship between IS and CS. This type of relationship receives support if the coefficient for the squared term is negative and the coefficient for the cubic term is positive (Cohen et al. 2003).

In the cubic model (see Model 3, Table 3), the linear effect of IS on CS is positive and significant (b_1=.15; p<.05), whereas the squared term is negative (b_2=−.35; p<.05). Moreover, the coefficient b_3 is positive (b_3=.27; p<.05), which implies that the effects of IS on CS increase at the margins, in support of the inverted S-shaped function we describe in H2. The cubic model also contributes significantly more to the explanation of CS than does the squared model, as indicated by the F-test. The inclusion of the cubic term leads to a significantly increased R^2 by 9%. The cubic model explains 43% of the variance in CS. By identifying the extremes of the cubic regression function, we find that the extremes also appear within the range of interest. Consequently, the null hypothesis—that an additional predictor of the cubic model does not exceed the contribution of the squared model—must be rejected; the cubic model significantly improves our prediction.

In addition to IS, the regression models contain the control variables as independent variables; we provide these results in Table 3. The quality of the offered services, quality of customer interaction, and frequency of customer interaction positively affect customer satisfaction, but the effects of company size and the industry dummy variable are not significant.

Overall, these findings support H2. The function is concave for low service program innovativeness and convex for high service program innovativeness; an inflection point marks the point at which the function switches from concave to convex (Fig. 2, Panel B). The functional structure of the relationship between IS and CS follows our reasoning, based on information economics and services marketing literature. Similar to IG, IS generally serves as a signal of the company's ability to generate new and beneficial services. Customers' expected basic utility decreases with the innovativeness of the service program. However, for highly innovative services, basic utility can be enriched by the add-on relational utilities associated with interactions with service employees. The great importance of add-on relational

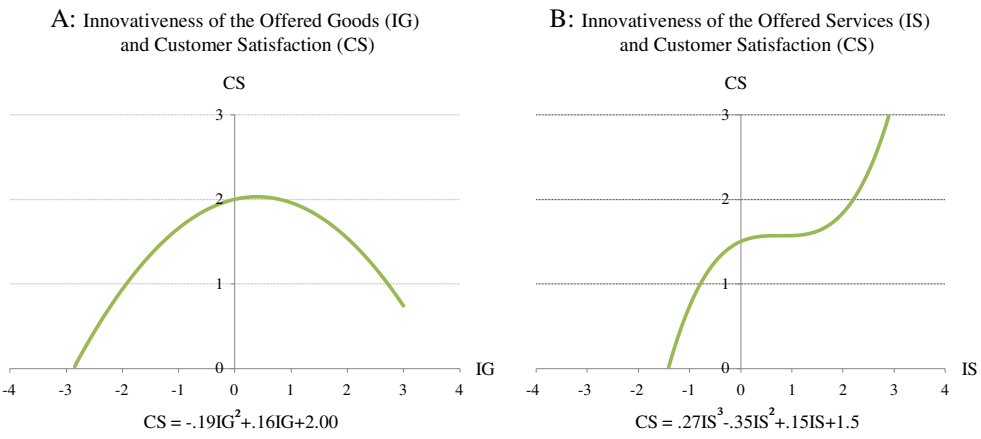

Fig. 2 Regression results on functional structures of the relationship between product program innovativeness and customer satisfaction

Table 3 Model estimation results for innovativeness of the offered services and customer satisfaction

	Linear Model (M1)	Squared Model (M2)	Cubic Model (M3)
Constant	2.26*	2.32*	1.50*
Innovativeness of the offered services	.13*	.18*	.15*
Innovativeness of the offered services squared	–	−.10*	−.35*
Innovativeness of the offered services cubed	–	–	.27*
Control variables			
Quality of the offered services	.30*	.48*	.46*
Quality of customer interaction	.47*	.31*	.26*
Frequency of customer interaction	.24*	.25*	.27*
Company size	.04	−.03	−.02
Banking and insurance	.03	.04	.05
Communication	.07	.05	.02
Retailing	−.03	−.04	.02
R^2	.57*	.61*	.66*
Adjusted R^2	.32*	.34*	.43*
F-Value	52.29*	37.65*	20.47*
N	96	96	96
Incremental R^2	.57*	.04*	.05*
F_I	–	1.96	19.29*

Non-standardized regression coefficients. F_I = F-Value of incremental R^2

*$p<.05$

utility for service innovations also receives confirmation from the strong positive correlation between IS and the quality ($r=.51$, $p<.05$) and frequency ($r=.31$, $p<.05$) of the customer interaction, as we show in Table 1.

Discussion

Research issues

Despite the extant claim that "the success of innovations depends ultimately on consumers accepting them" (Hauser et al. 2006, p. 688), customer responses to product innovativeness are less than evident in prior research (Szymanski et al. 2007). To help reduce this research gap, we consider the relationship between product program innovativeness and customer satisfaction. These constructs mostly have been studied in separate research streams and confirmed in terms of their performance implications, but seldom have they been linked together. Therefore, an initial contribution is the integration of two marketing research streams.

The few existing studies linking innovativeness and customer-related outcomes exclusively investigate linear effects and thus follow a "the more, the better" logic that assumes all product innovations are welcomed by customers. Yet empirical findings on customer responses to innovativeness are mixed and suggest product innovativeness actually prompts both positive and negative customer responses (Calantone et al. 2006; Thompson et al. 2005).

From an empirical perspective, our study contributes to extant research by investigating nonmonotonic relationships between product program innovativeness and customer satisfaction. The consideration of nonmonotonic effects between product program innovativeness and customer satisfaction indicates that linear analyses fall short in capturing the complexity of the relationship between product program innovativeness and customer satisfaction. Specifically, our results reveal that customer satisfaction does not increase proportionally to the increase of innovativeness.

Extant research dealing with customer responses to product innovations also neglects different customer responses to goods and services, which is surprising considering their frequent distinction in services marketing literature (e.g., Zeithaml et al. 2009). This study expands extant research by providing insights into the differential effects of the innovativeness of goods and services on customer satisfaction. In terms of the former, our results indicate that goods can be too innovative. In contrast, service innovativeness increases are essentially associated with increases in customer satisfaction. Even for high innovativeness, the customers' expected utility exceeds uncertainty due to the customers' anticipated add-on relational utility with interactive services as opposed to goods.

From a conceptual perspective, extant research notes that product innovativeness is associated with both customer utility and customer uncertainty, but no theoretical justification for these two conceptualized effects has been provided, to the best of our knowledge. We contribute to extant research by providing an explanation for the nonmonotonic effects of innovativeness and customer satisfaction. Drawing on information economics, we suggest that the opposing (i.e., positive and negative) effects of expected utility and uncertainty constitute this relationship. That is, according to information economics, the positive effect reflects expected customer utility, and the negative effect arises from customer uncertainty.

Managerial implications

Generating innovative products appears to remain a holy grail for ensuring sustained competitive advantage and

customer satisfaction. Our study offers particular insights into the relationship between product program innovativeness and customer satisfaction. First, managers who are responsible for introducing new products cannot simply offer ever more innovations and assume this will lead to ever-increasing customer satisfaction. Instead, this relationship is nonlinear for both goods and services. Although certainly companies should not work to become less innovative, they should be particularly sensitive to their customers' expectations regarding utility and uncertainty when increasing their innovativeness.

Second, our study provides insights for managers regarding the similarities and differences of innovative goods and services. Similar effects on customer satisfaction are revealed for innovativeness increases below a certain level when customers' expected utility exceeds uncertainty. Thus, below a certain level of innovativeness, goods and services companies should invest in the anticipated customer utility. To increase the customers' awareness of product program innovativeness, companies can carry out systematic, target-oriented communication activities that increase customers' awareness of product program innovativeness (e.g., Schatzel and Calantone 2006; Wieseke et al. 2008).

Above a certain level of innovativeness, goods and services companies should invest into a decrease of customer uncertainty. In this context, companies could just simplify the offer. For example, the Cisco Consumer Business Group equips its very small Flip Video Cameras with only three buttons in order to reduce complexity for the customers. For high levels of innovativeness, differences for goods and services are revealed due to different kinds of customer utility anticipated with goods and services. Unlike goods, even high service innovativeness is exclusively associated with positive effects due to an anticipated add-on relational utility emerged from the interaction between service employees and customers. Thus, companies should invest in the interaction between service employees and customers.

Limitations and areas for further research

Our research represents a first step in the study of the relationship between product program innovativeness and customer-related constructs and therefore suggests several areas for further research. In particular, we argue theoretically about the opposing expected utility and uncertainty of innovativeness to shed light on the underlying mechanisms of the hypothesized nonlinear effects. In our empirical study, we mainly provide evidence about the total effect, including the trade-off between expected utility and uncertainty. Additional research should explore in greater depth the processes that lead to the nonlinear effects. Furthermore, the major purpose of information economics is to shed light on information asymmetry as the mechanism underlying economic exchange relationships. Accordingly, this study strives to explain the nature of the relationship between product program innovativeness and customer satisfaction without explicitly measuring the mechanism. Further research might explain and measure the role of information exchange based on another theoretical perspective.

Further research also might examine potential moderators that could affect the relationship between product program innovativeness and customer satisfaction. The relationship between innovativeness and customer satisfaction may be affected by the companies' marketing, in particular, communication, of the product program. A company's communication about its product innovations makes it easier to understand the company's new products, as well as the particular benefits of the innovation. Furthermore, the type of collaboration might be relevant for the strength of the relationship between innovativeness and customer satisfaction. For example, the use of interorganizational teams in which members of the company and customers are involved (Stock 2006) might improve the interorganizational communication as well as the customers' awareness of a company's innovativeness and thus, affect the innovativeness-satisfaction relationship.

This study focuses on customer satisfaction as the dependent variable, so that we can provide a deeper understanding of the customer-related consequences of product program innovativeness. Research also could investigate nonmonotonic relationships between product program innovativeness and other nonfinancial (e.g., employee commitment) and financial (e.g., market share, profitability) outcomes. Additional research might explore the relationship between the product program innovativeness and other customer-related constructs too. For example, it would be worthwhile to study the impact of product program innovativeness on customers' adoption behavior. Our results indicate that differences between goods and services should be expected.

Furthermore, this study relies on cross-sectional data collected at one point in time. Thus, our conclusions are mainly based on the association between product program innovativeness and customer satisfaction. Although extant marketing and innovation research commonly assumes causal relationships based on cross-sectional data, such data limit our ability to make these causal inferences. Research could investigate the innovativeness-satisfaction link using longitudinal data to avoid this limitation. Furthermore, it would be interesting to study customer reactions to the innovativeness of a company's product program from a dynamic perspective to determine whether these reactions change over time.

Appendix

Measures and items

Product program innovativeness (Ali et al. 1995) *[a] The following questions relate to your company's product program, i.e., the entire range of goods [services], offered by your company. Our offer …

(Study 1: α=.81; CR=.84; AVE=.51; Study 2: α=.77; CR=.78; AVE=.49)

… is highly innovative compared to other goods [services] in the market.

… is frequently updated with new goods [services].

… provides new alternatives for the customers.

… is frequently supplemented with new features [elements] for the customers.

… differs from competing alternatives in the market.

… frequently comprises new goods [services] which are meaningful to the customers.

Customer satisfaction *(*Cannon and Perreault 1999*)* *[b]

The following questions relate to your overall satisfaction with the company's product program, i.e., the complete range of goods [services], offered by the company. (Study 1: α=.94; CR=.95; AVE=.64; Study 2: α=.91; CR=.92; AVE=.57)

We are very pleased with the goods [services] which this company delivers.

The goods [services] fulfill our expectations.

This company is first choice for us for the purchase of these goods [services].

On an overall basis, this company fulfills our expectations.

On an overall basis we are satisfied with this company.

Quality of the offered goods (Fornell et al. 1996) **[b] **[services]** (Zeithaml et al. 1996)

Relative to other companies, please evaluate the performance of this company with respect to the quality of the goods [services].

Quality of customer interaction (Cannon and Homburg 2001) **[b] (Study 1: α=.97; CR=.98; AVE=.65; Study 2: α=.93; CR=.95; AVE=.59). Relative to other companies, please evaluate the interaction with respect to...

… employees' customer orientation.

… flexibility of the employees in dealing with customers.

… openness in providing information to customers.

… openness to suggestions from customers.

Frequency of Customer Interaction (Homburg and Stock 2004; Murray et al. 1995) **[b]

How often do you interact with this company on average?***[a]

Length of Relationship (Stock and Hoyer 2005) **[b]

How long does the relationship to this specific company exist? (_____ years; _____ month)

Complexity of the product program (Achrol and Stern 1988) *[b] The following questions relate to the company's whole product program, i.e., the entire range of goods [services], offered by your company. (Study 1: α=.75; CR=.77; AVE=.51; Study 2: α=.77; CR=.78; AVE=.53)

The goods [services] of this company are highly complex.

The goods [services] of this company are not easy to understand.

The quality of the goods [services] is difficult to assess.

The utility of this company's goods [services] becomes visible only after a certain time.

Company Size How many employees work in your company?****[a]

* Five-point Likert-type scale, anchored at "strongly agree" and "strongly disagree."

** Five-point Likert-type scale, anchored at "much better" and "much worse."

*** Scale, anchored at "1=daily; 2=once per week; 3=once per month; 4=several times a year; 5=once per year"

**** Scale, anchored at "<100 employees; 100–500 employees; 500–1,000 employees; 1,000–2,500 employees; 2,500–5,000 employees; 5,000–10,000 employees; 10,000–20,000 employees; 20,000–50,000 employees; 50,000–100,000 employees; >100,000 employees"

[a] Measured on the basis of marketing manager survey

[b] Measured on the basis of customer survey

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