Original Article

Nonlinear effects between satisfaction and loyalty: An empirical study of different conceptual relationships

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Ho Huy Tuu

is Lecturer in Consumer Behavior and Marketing Research at Nhatrang University, Vietnam. His main research interests include consumer satisfaction/loyalty, perceived risk and attitude strength.

Svein Ottar Olsen

is Professor in Marketing at Tromsø University Business School, University of Tromsø, Norway. His main research interests include consumer satisfaction/loyalty, convenience orientation, food attitude and behaviour, attitude and habit strength, cross culture and survey research. He has published in a number of marketing journals included, *Journal of the Academy of Marketing Science*, *Journal of International Business Studies*, *International Journal of Marketing*, *European Journal of Marketing*, *Psychology and Marketing*, *International Marketing Review*, *Journal of Consumer Behaviour* and others.

ABSTRACT This study uses multiple regression analysis to test nonlinear relationships between consumer satisfaction and loyalty across different conceptual contexts and three empirical studies of Vietnamese consumers. The study fills several gaps in the present literature. First, it provides an overall view of the nonlinearity and dynamics in the relationship between satisfaction and loyalty in different hierarchies within one product category. Second, this study is, to our knowledge, the first to illustrate the nonlinear effect of transaction-specific satisfaction on intentional loyalty. Third, by estimating a wide range of competitive models, it helps to detect the specification of the nonlinear effect of satisfaction on loyalty across different conceptual relationships. Finally, this study is among very few studies to provide formal comparisons between a linear model and different nonlinear models and emphasizes using nonlinear functions to predict consumers' behavioural loyalty. Therefore, this study provides a deeper insight into the possible nonlinearities, reflecting how the changes in satisfaction impact on loyalty, by which it helps marketers and managers to give more accurate predictions to improve consumer loyalty in different contexts including marketing a new product.

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INTRODUCTION

Satisfaction plays a central role in forming, explaining and predicting customer loyalty.¹

Traditionally, the satisfaction–loyalty relationship is assumed to be symmetric linear,² but recent studies have suggested using more complex nonlinear models^{3–8} because the linear model may generate systematically biased estimates.⁹ However, a wide range of suggested conceptualized functional forms and empirical findings in the present literature on the nonlinear effects of

Correspondence: Ho Huy Tuu
Faculty of Economics, University of Nhatrang,
N-02 Nguyen Dinh Chieu, Nhatrang, Khanhhoa, Vietnam
E-mail: tuu_hohuy@yahoo.com

satisfaction on different aspects of loyalty generates a mixed and inconclusive view of whether the effect of satisfaction on loyalty exhibits diminishing or increasing returns. For example, Mittal and Kamakura⁷ find that intentional loyalty shows diminishing returns, but that repurchase loyalty exhibits increasing sensitivity towards satisfaction. Repurchase loyalty is also found to display decreasing sensitivity to satisfaction.¹⁰ Thus, the issue of whether the nonlinear nature of the satisfaction–loyalty relationship is consistent under different conceptualized functional forms has not been fully explored.

In addition, while managers and marketers obviously want to know how their efforts to improve satisfaction increase customer loyalty/retention, formal comparisons of the performance of nonlinear relative to linear models are still very limited.^{10–12} Consequently, it seems worthwhile to extend the existing work on specifying and comparing different functional forms of the satisfaction–loyalty relationship so that managers are better informed about strategies for measuring, monitoring and prioritizing programmes aimed at improving customer satisfaction and business performance.⁴

The formation of satisfaction and loyalty is dynamic and develops over different stages from the first experience with the product or service to a stage where consumers have developed strong ties with the object after repeated experiences over years.^{13–15} Thus, the literature suggests different conceptualizations of both satisfaction and loyalty. For example, it is accepted that a distinction can be made between transaction-specific satisfaction and cumulative satisfaction^{6,16} and between intentional and behavioural loyalty.^{17,18} Because most studies in this area involve different established products and services, they use cumulative satisfaction in satisfaction–loyalty models.^{3,7,12,19}

In addition, although loyalty has been formally defined as repeated action over time,^{20–22} most studies measure loyalty as repurchase intentions.^{3,4,14,19} Recent studies²³ suggest that satisfaction is differently related to intentional

versus behavioural loyalty or retention.^{7,24,25} In other words, the mixed findings about the functional form of the relationships between satisfaction and loyalty can differ because the different studies use different conceptual definitions of satisfaction (for example, transaction-specific versus cumulative) and loyalty (for example, intentional versus behavioural). Thus, this study aims to discuss and test the nonlinear nature of the satisfaction–loyalty relationship under different conceptual relationships. For example, it compares the nonlinear effect of transaction-specific versus cumulative satisfaction on intentional versus behavioural loyalty.

The relationship between satisfaction and loyalty also differs between products and services, as well as within products/services and product/service categories.³ For example, Streukens and de Ruyter¹² find that for fast food nonlinear and linear models perform equally well, but for supermarkets and dry cleaning the linear model performs significantly better than most nonlinear models. In order to control for differences caused by the differences in products, this study will extend previous studies^{8,13} by comparing different conceptual relationships within one product category that we believe covers mostly similar benefits or needs.

In the next parts, we will provide a general picture of the nonlinearity of the satisfaction–loyalty relationship, make distinctions between different approaches to satisfaction and loyalty, review the relevant theories, develop hypotheses, describe the analytical procedures and discuss the findings.

THEORETICAL FRAMEWORK

A comprehensive review is presented in Table 1 involving the most important studies investigating nonlinearity in the satisfaction–loyalty relationship. Although our review indicates that the possible conceptual relationships between these two constructs are diversified depending on how the constructs are measured, generally there are four conceptual relationships (R1 to R4) as shown in Figure 1. The following discusses the different facets of satisfaction and loyalty before reviewing the forms of those relationships.

Table 1: Conceptual relationships and functional forms between satisfaction and loyalty

Literature and hypotheses	Conceptual relationships				Nonlinear forms			Effect	
	R1	R2	R3	R4	Quadratics	Cubic	Others	Decreasing return	Increasing return
<i>Literature review</i>									
Homburg <i>et al</i> ⁶	—	—	X	—	—	X	—	—	X
Agustin and Singh ^{a,3}	—	—	X	—	X	—	—	X	—
Anderson and Sullivan ²⁴	—	—	—	X	—	—	X	X	—
Oliva <i>et al</i> ³⁸	X	—	—	—	—	X	—	—	X
Jones and Sasser ⁹	X	—	—	—	X	—	—	—	X
Soderlund ³¹	X	—	—	—	X	—	—	—	X
Ngobo ²⁵	X	—	—	—	—	X	—	—	X
Anderson and Mittal ⁴	X	—	—	—	—	—	X	—	X
Hubert <i>et al</i> ³⁷	X	—	—	—	—	X	—	—	X
Mittal <i>et al</i> ¹¹	X	—	—	—	—	—	X	X	—
Bowen and Chen ³⁶	X	—	—	—	—	X	—	X	—
Mittal and Kamakura ⁷	X	—	—	—	X	—	—	X	—
Mittal and Kamakura ⁷	—	X	—	—	X	—	—	—	X
Bowman and Narayandas ⁵	—	X	—	—	—	—	X	—	X
Coyne ³²	—	X	—	—	—	X	—	X	—
Ngobo ²⁵	—	X	—	—	—	X	—	X	—
Bolton ¹³	—	X	—	—	X	—	—	X	—
Gomez <i>et al</i> ¹⁰	—	X	—	—	X	—	—	X	—
Van Doorn and Verhoef ¹⁹	—	X	—	—	—	—	X	X	—
<i>Proposed hypotheses</i>									
Hypothesis 1	X	—	—	—	X	X	—	—	X
Hypothesis 2	—	X	—	—	X	X	—	X	—
Hypothesis 3	—	—	X	—	X	X	—	—	X

^aUse the arbitrary-transaction-specific satisfaction which means that satisfaction is measured in a context of a specific transaction toward an established service or product.

Notes: R1=Cumulative satisfaction and intentional loyalty; R2=Cumulative satisfaction and behavioural loyalty; R3=Transaction-specific satisfaction and intentional loyalty; R4=Transaction-specific satisfaction and behavioural loyalty.

Figure 1: The conceptual relationships between satisfaction and loyalty.

Transaction-specific and cumulative satisfaction

Previous research has defined a variety of forms of consumer satisfaction.¹⁵ Multiple interpretations of satisfaction come from differences such as: the type of response (for example, cognitive, affective and emotional),²⁶ the time of evaluation (for example, pre- versus post-consumption; transaction versus cumulative satisfaction),^{27,28} the object of evaluation (for example, a brand, product,

service or category)²⁹ and the psychological process used to construe the response (for example, disconfirmation of expectations, overall attitudes).¹⁵ For example, Shiv and Huber³⁰ studied ‘anticipated satisfaction’ where consumers assess their expectations of satisfaction before making their final choice (for example, ‘Imagining that you will buy and consume this product, how satisfied will you be ...’). Most studies investigating nonlinearity in the satisfaction–loyalty link approach consumer satisfaction as cumulative constructs,^{7,12,19} and only a few studies define satisfaction in a specific exchange transaction.^{3,24} This study defines transaction-specific satisfaction as an overall affective evaluation of consumers’ first consumption experience with a (new) product,^{6,24,26} while cumulative satisfaction is defined as consumers’ overall affective evaluations of their accumulated experiences of a product over time.^{15,23,29} Thus, both definitions deal with post-consumption

experiences compared with pre-consumption experiences or anticipation.³⁰

Intentional and behavioural loyalty

Loyalty has been defined and measured in many different ways, but the most common definitions of loyalty are associated with consumers' behavioural responses over time^{20–22} to include both intentional and behavioural components of loyalty.¹⁸ In the literature on nonlinearity, most studies measure loyalty as (re)purchase intentions,^{3,11,14,31} word of mouth³¹ or willingness to pay.⁶ A few studies measure loyalty as (re)purchase behaviours³² or as a combination of intentional versus behavioural loyalty/retention.^{7,24,25} Although intentional loyalty and behavioural loyalty are suggested to be related, some researchers have made a conceptual distinction between them.^{7,17} While behavioural loyalty focuses on the results or outcomes of loyalty, such as repeat purchase, intentional loyalty focuses on the cognitive basis of loyalty and isolates purchases driven by a strong attitude.¹⁷ Thus, this study measures consumer loyalty as the intention to buy and as repurchase behaviours over time. For patrimonial reasons, we do not make any distinction between repurchase and purchase intention in this study.

Nonlinear forms of the satisfaction–loyalty relationship

The nonlinear effect of satisfaction on loyalty may occur because high satisfaction is believed to meet not only the most basic needs (for example, hunger/food, thirsty/water, and so on), but also higher-level needs (for example, safety, affection, self-actualization, and so on) in Maslow's hierarchy of needs³³ when consumers pursue a certain goal.^{3,34} From this perspective, at high levels of satisfaction that are beyond some points of basic need fulfilment, if consumers pursue an increase in the fulfilment of higher-level needs, satisfaction would have an increasing return effect on loyalty.³ By contrast, if consumers pursue an increase in the fulfilment of basic needs, satisfaction would have a decreasing return effect on loyalty.³

A wide range of functional forms is suggested to explain the nonlinear effect of satisfaction on

loyalty.¹² However, it is most common to use a quadratics, a cubic or a combined quadratics and cubic function to describe the nonlinear nature of the effect of satisfaction on loyalty as either a decreasing (inverted U-shape or S-shape) or increasing return (U-shape or inverted S-shape).^{3,6,7,12,31} Even though the present literature suggests several other functional forms of the satisfaction–loyalty relationship, such as piece-wise linear or spine regression models,^{5,12} they have been applied less frequently.³⁵ Therefore, the functional forms depicted in Figure 2 are the most used and form our approach.

Table 1 provides a brief review of the literature presenting the relationship between conceptual relationships and the forms used to describe the satisfaction–loyalty relationship. The bottom of the table also presents the proposed hypotheses to be tested.

Forms of relationship between cumulative satisfaction and loyalty

Our review (Table 1) does not confirm whether cumulative satisfaction has an increasing return or decreasing return on intentional loyalty. However, while a few studies suggest that cumulative satisfaction has a decreasing return on intentional loyalty,^{7,11,36} most studies find an increasing incremental effect of cumulative satisfaction on intentional loyalty.^{4,9,25,31,37,38} The following hypothesis is suggested:

Hypothesis 1: Cumulative satisfaction has an effect with an increasing return on intentional loyalty.

Similarly, the nonlinear effect of cumulative satisfaction on behavioural loyalty is either an increasing return or a decreasing return. Except for Mittal and Kamakura⁷ and Bowman and Narayandas,⁵ most previous studies show a decreasing return effect of cumulative satisfaction on behavioural loyalty.^{10,13,19,25,32} It is argued that the nonlinear effect of cumulative satisfaction on intentional versus behavioural loyalty is different because the satisfaction threshold that is needed for subjects to express a favourable intent is different from the level of satisfaction that is needed for

Figure 2: The possible functional forms of the satisfaction–loyalty relationship.

Notes: (a) Quadratic effect with a decreasing return of satisfaction on loyalty in inverted-U shaped form; (b) Cubic effect with a decreasing return of satisfaction on loyalty in S-shaped form; (c) Quadratic effect with an increasing return of satisfaction on loyalty in U-shaped form and (d) Cubic effect with an increasing return of satisfaction on loyalty in inverted-S shaped form.

subjects to engage in the corresponding behaviour.^{7,25} The hypothesis is as follows:

Hypothesis 2: Cumulative satisfaction has an effect with a decreasing return on behavioural loyalty.

Forms of relationship between transaction-specific satisfaction and loyalty

Only three studies are found to include the nonlinear effect of transaction-specific satisfaction on intentional/behavioural loyalty.^{3,6,24} The findings are mixed. While Anderson and Sullivan²⁴ and Agustin and Singh³ suggest a decreasing return effect, Homburg *et al*⁶ find an increasing return effect of transaction-specific satisfaction and loyalty. Two of those studies^{3,24} investigate the relationship between transaction-specific satisfaction and loyalty towards established products or services. Thus, the transaction-specific satisfaction in those studies is arbitrary and may not be very different from cumulative satisfaction because the halo effects³⁹ as well as past experiences are not controlled.⁸ By contrast, Homburg *et al*⁶ perform an experiment that suggests that first-transaction-specific satisfaction has an increasing

incremental effect on respondents' willingness to pay for a new product (a CD tutorial). Our study defines and measures satisfaction as consumers' first experience with a new product and suggests the following hypothesis:

Hypothesis 3: Transaction-specific satisfaction has an effect with an increasing return on intentional loyalty.

The relationship between transaction-specific satisfaction and behavioural loyalty is influenced by individual (for example, mood or emotion) and contextual (for example, having a meal at home or at a restaurant) factors. For example, Bloemer and de Ruyter⁴⁰ and de Ruyter and Bloemer⁴¹ find that this relationship varies with the levels of positive moods experienced and with the types of low- versus high-involvement service. Thus, this study will not perform any tests of the fourth relationship (R4) in Figure 1.

Linear versus nonlinear effects

Hypotheses H1 to H3 deal with the nonlinear forms of the relationship between satisfaction and loyalty. A few studies conduct a formal comparison between the linear and nonlinear effects of

satisfaction on loyalty. The results are also mixed here. For example, Mittal *et al*¹¹ find that the nonlinear model with decreasing returns does not show a significantly better fit than a linear model. Similarly, Ngobo²⁵ provides empirical support for the superiority of the cubic model with decreasing returns, as compared with the quadratic and linear models. He also indicates that the quadratic model explained more variance in loyalty when compared with a linear model. By contrast, Gomez *et al*¹⁰ show that sales performance displays a decreasing return to satisfaction, but the linear model performs better than the nonlinear one. Streukens and de Ruyter¹² have similar findings. Because the nonlinear forms have several possible outcomes (see Figure 2) compared with the linear solution, this study suggests the following:

Hypothesis 4: Nonlinear functions are more capable of explaining the effect of satisfaction on loyalty across different conceptual relationships.

METHODS

Samples

The study uses three samples of Vietnamese consumers with different measures of satisfaction and loyalty involving fish products. Sample 1 is formed by the data of an experiment involving the testing of a new fish product (canned mackerel). A total of 120 students (80 females and 40 males) aged from 20 to 22 from the Economics Faculty, Nhatrang University, Vietnam volunteered to participate. In this study, transaction-specific satisfaction and intentional loyalty were measured after the students had their first tasting and consuming experience with the product. This experiment deals with H3 and R3 in Figure 1.

Sample 2 consists of the data from 387 consumers collected at five local markets in Hanoi city, Vietnam, by a survey questionnaire administered using 'face-to-face' interviews focusing on cumulative satisfaction and intentional and behavioural loyalty. This sample deals with H1 and H2. The evaluative object in this study is 'marine fish', which is a very common

product category in Hanoi, Vietnam. The typical respondents are female (64.5 per cent), married (74.9 per cent), educated for up to 15 years (69.2 per cent) and their average age is 43 years, ranging from 20 to 79.

Sample 3 is a field survey including 392 households in Nhatrang, Vietnam, in which the person who is responsible for preparing everyday main meals for their family answered a survey questionnaire with similar measures to those in Sample 2 but focusing on fish in general. This sample is used for retesting H1 and H2. The typical respondents are female (71.2 per cent), married (59.4 per cent), educated for up to 15 years (75.0 per cent) and their average age is 33 years, ranging from 18 to 78.

Measures

Transaction-specific satisfaction (Sample 1) is measured by two items: 'Overall, after eating this product, it makes me feel: (1) Dissatisfied/Satisfied; (2) Unpleasant/Pleasant' ($\alpha = 0.92$). Thus, the evaluation was made after the respondents' consumption experiences⁴² and is in that respect not a pre-consumption satisfaction experience similar to pre-purchase/consumption satisfaction in an arbitrary transaction.³ The respondents were asked to indicate *cumulative satisfaction* in the form: 'Overall, when I eat marine fish/fish (Samples 2 and 3, respectively) for everyday main meals, I feel: (1) Dissatisfied/Satisfied; (2) Unpleasant/Pleasant' ($\alpha = 0.94/0.94$, respectively, for Sample 2 and Sample 3).^{3,11} These items are measured on a 7-point bipolar scale and then averaged into an index of overall satisfaction.¹⁶

To measure *intentional loyalty*, two items on a 7-point semantic scale are used with the following question in the experiment (Sample 1): 'How likely is it that you will buy or want to choose to eat this product again if it is available in the market during the next month with a given price unit of 7.500 VND' and 'How likely is it that you will buy or want to eat "marine fish" (Sample 2) or "fish" (Sample 3) as an everyday main meal during the next 3 days'. These two items are as follows: (1) I intend to buy ... and (2) I want to eat ... rated on a scale from (1) 'very unlikely' to (7) 'very likely'.¹² The

Cronbach alpha for those measures varies from 0.89 (Sample 3) to 0.95 (Sample 2).

Finally, behavioural loyalty (Samples 2 and 3) is one item measuring consumption frequency in the form: 'Could you please estimate how many times you have eaten "marine fish"/"fish" during the last 14 days not including today:____'.²¹

RESULTS

Hypotheses 1, 2 and 3 are tested by a multivariate regression in which the quadratic and cubic products of satisfaction play a role as independent variables of satisfaction. We estimate four nested models: a linear (M1), a quadratics (M2), a cubic (M3) and a combined quadratics and cubic model (M4) across three samples with different measures of satisfaction and loyalty. In this way, it is possible to detect the true specification of the nonlinear nature of the relationship between satisfaction and loyalty as well as allowing us to compare different nonlinear functions.¹² All the models fit with the data [$P(F) < 0.001$] and multicollinearity is not problematic (all VIF < 8.0).⁴³ Note that the combined quadratics and cubic model (M4) contains the most important information for testing our hypotheses, because it overcomes the problem of biased estimates due to misspecification.⁴⁴ Therefore, the conclusions are entirely based on this model (M4) while other models (M2 and M3) provide additional information. Table 2 shows the estimated results of unstandardized coefficients, *t*-values and fit statistics.

Hypothesis 1 proposed that cumulative satisfaction has a nonlinear effect with an increasing return on intentional loyalty. This hypothesis calls for either a positive quadratic effect or a positive cubic effect or both of cumulative satisfaction on intentional loyalty (see Figures 2a, 2b). However, the estimated results from Model M4 – Samples 2 and 3 indicate that the coefficients between cubic satisfaction and intentional loyalty are significantly negative ($b_3 = -0.06/-0.03$, $P < 0.05$), but the coefficients between quadratic satisfaction and intentional loyalty are also negative but not significant ($b_2 = -0.02/-0.03$, $P > 0.10$). Similar results are

also found with Models M3 and M2 – Samples 2 and 3 where the coefficients between cubic satisfaction and intentional loyalty are significantly negative ($b_3 = -0.05/-0.02$, $P < 0.01$), while the coefficients between quadratic satisfaction and intentional loyalty are positive but not significant ($b_2 = 0.02/0.04$, $P > 0.10$). These results thus reject Hypothesis 1, but reveal a cubic model with a decreasing return of cumulative satisfaction on intentional loyalty in an S-shaped form.

Therefore, the true specification of the nonlinear relationship between accumulative satisfaction and intentional loyalty is determined by Model M3 (see Figure 3a for the cases of marine fish and fish in general).

Hypothesis 2 suggested that cumulative satisfaction has a decreasing return on behavioural loyalty. It calls for either a negative quadratic or a cubic effect or both of cumulative satisfaction on behavioural loyalty (see Figures 2c, 2d). The results from Model M4 – Samples 2 and 3 indicate that the coefficients between quadratic satisfaction and behavioural loyalty are significantly positive ($b_2 = 0.07/0.18$, $P < 0.05$), while the coefficients between cubic satisfaction and behavioural loyalty are not significant ($b_3 = 0.00/-0.04$, $P > 0.10$). Similar results are also found with Model M2 – Samples 2 and 3 where the coefficients between quadratic satisfaction and behavioural loyalty are significantly positive ($b_2 = 0.07/0.26$, $P < 0.05$). In Model M3, only one piece of empirical evidence supports Hypothesis 2 where the coefficient between cubic satisfaction and behavioural loyalty is significantly negative for Sample 3 ($b_3 = -0.09$, $P < 0.001$) and nonsignificantly negative for Sample 2 ($b_3 = -0.01$, $P > 0.10$). Because the cubic effects are not significant in Model M4 – Samples 2 and 3, these results reject Hypothesis 2 but reveal a positive quadratic effect of cumulative satisfaction on behavioural loyalty in a U-shaped form. Thus, the nonlinear relationship between cumulative satisfaction and behavioural loyalty should be truly specified by Model M2 (see Figure 3b).

Hypothesis 3 proposed that transaction-specific satisfaction has a nonlinear effect with an increasing return on intentional loyalty. It calls

Table 2: Testing linear and nonlinear relationships across samples

Coefficients	Linear model (M1)			Quadratics model (M2)			Cubic model (M3)			Quadratics-Cubic model (M4)		
	$L=b_0+b_1S$			$L=b_0+b_1S+b_2S^2$			$L=b_0+b_1S+b_3S^3$			$L=b_0+b_1S+b_2S^2+b_3S^3$		
	Sample 1	Sample 2	Sample 3	Sample 1	Sample 2	Sample 3	Sample 1	Sample 2	Sample 3	Sample 1	Sample 2	Sample 3
	N=120	N=387	N=392	N=120	N=387	N=392	N=120	N=387	N=392	N=120	N=387	N=392
<i>Intentional loyalty as dependent variable</i>												
b_1	0.58*** (7.8)	0.58*** (11.1)	0.71*** (16.6)	0.61*** (8.1)	0.59*** (10.9)	0.75*** (15.2)	0.86*** (5.2)	0.93*** (7.6)	0.84*** (11.9)	0.81*** (4.9)	0.95*** (7.5)	0.87*** (10.9)
t	—	—	—	0.10*	0.02 NS	0.04 NS	—	—	—	0.08*	—0.02 NS	—0.03 NS
b_2	—	—	—	(2.1)	(0.7)	(1.5)	—	—	—	(1.7)	(-0.5)	(-0.7)
t	—	—	—	—	—	—	—0.05*	—0.05***	—0.02***	—0.04 NS	—0.06***	—0.03**
b_3	—	—	—	—	—	—	(-1.9)	(-3.2)	(-2.3)	(-1.4)	(-3.1)	(-2.0)
t	—	—	—	—	—	—	35.8	26.3	42.3	37.3	26.4	42.4
R^2 (%)	33.9	24.4	41.5	36.3	24.5	41.8	32.6	68.6	142.6	23.0	45.7	95.1
F (DF ₁ , DF ₂)	60.4 (1, 118)	124.2 (1, 385)	276.4 (1, 390)	33.3 (2, 117)	62.2 (2, 384)	139.7 (2, 389)	(2, 117) S-shape	(2, 384) S-shape	(2, 389) S-shape	(3, 116) U-shape	(3, 383) S-shape	(3, 388) S-shape
Form	—	—	—	U-shape	—	U-shape	H3: Not	H1: Not	H1: Not	H3: Sup.	H1: Not	H1: Not
Hypothesis	—	—	—	H3: Sup.	H1: Not	H1: Not	H3: Not	H1: Not	H1: Not	H3: Sup.	H1: Not	H1: Not
<i>Behavioural loyalty as dependent variable</i>												
b_1	1.48*** (11.3)	0.64*** (9.1)	1.74*** (11.7)	—	0.67*** (9.3)	1.74*** (11.7)	—	0.72*** (4.3)	2.05*** (9.5)	—	0.65*** (3.8)	1.89*** (7.8)
t	—	—	—	—	0.07*	0.26***	—	—	—	—	0.07*	0.18*
b_2	—	—	—	—	(1.8)	(3.5)	—	—	—	—	(1.7)	(1.7)
t	—	—	—	—	—	—	—	—0.01 NS	—0.09***	—	0.00 NS	—0.04 NS
b_3	—	—	—	—	—	—	—	(-0.5)	(-3.3)	—	(0.1)	(-0.8)
t	—	—	—	—	—	—	—	17.9	26.6	—	18.5	26.9
R^2 (%)	—	17.8	24.5	—	18.5	26.6	—	41.8	70.5	—	28.9	47.7
F (DF ₁ , DF ₂)	—	83.6 (1, 385)	126.6 (1, 390)	—	43.5 (2, 384)	71.3 (2, 389)	—	(2, 384) U-shape	(2, 389) S-shape	—	(3, 383) U-shape	(3, 388) U-shape
Form	—	—	—	—	U-shape	U-shape	—	—	—	—	—	—
Hypothesis	—	—	—	—	H2: Not	H2: Not	—	H2: Not	H3: Sup.	—	H2: Not	H2: Not

Notes: b_0 is not reported; * $P < 0.05$; ** $P < 0.01$; *** $P < 0.001$; NS: nonsignificant; all VIP $P < 8.0$; Sup.: Supported; Not: Not supported.

Figure 3: The forms of the nonlinear relationships between satisfaction and loyalty.

Notes: (a) Nonlinearity between satisfaction and intentional loyalty and (b) Nonlinear between satisfaction and behavioural loyalty.

Table 3: Comparisons of the predictive power of a linear model with nonlinear models across samples

Comparisons A–B ^a	Sample 1 (N=120)		Sample 2 (N=387)		Sample (N=392)	
	Z ^b -value (P-value)	Conclusion	Z-value (P-value)	Conclusion	Z-value (P-value)	Conclusion
<i>Intentional loyalty as dependent variable: Hypothesis 3 – Partially supported</i>						
Linear–Quadratics	13.2 (0.000)	A>B	0.0 (0.982)	A=B	9.5 (0.000)	A>B
Linear–Cubic	10.7 (0.000)	A>B	–1.2 (0.109)	B=A	23.7 (0.000)	A>B
Linear–Qua/Cubic	18.5 (0.000)	A>B	–1.3 (0.096)	B=A	26.1 (0.000)	A>B
<i>Behavioural loyalty as dependent variable: Hypothesis 3 – Supported</i>						
Linear–Quadratics	—	—	–8.9 (0.000)	B>A	–5.6 (0.000)	B>A
Linear–Cubic	—	—	–0.7 (0.477)	A=B	–4.3 (0.000)	B>A
Linear–Qua/Cubic	—	—	–8.9 (0.000)	B>A	–6.3 (0.000)	B>A

^aComparison of Model A with Model B; if $z/\psi < \psi/0$ Model B performs better (B>A), if $z/\psi > \psi/0$ Model A performs better (A>B).

^bSee Streukens and de Ruyter¹² (p. 110) for more details of the Z-transformed formulation.

for either a positive quadratics effect or a positive cubic effect or both of first-transaction satisfaction on intentional loyalty (see Figure 2c and 2d). This hypothesis is supported by the data. Specifically, in Model M2 – Sample 1 the coefficient between quadratic satisfaction and intentional loyalty is found to be significantly positive ($b_2 = 0.10$, $P < 0.05$). In Model M3 – Sample 1 the coefficient between cubic satisfaction and intentional loyalty is significantly negative ($b_3 = -0.05$, $P < 0.10$). However, in Model M4 – Sample 1, while the coefficient between quadratic satisfaction and intentional loyalty is still significantly positive ($b_2 = 0.08$, $P < 0.05$), the coefficient between cubic satisfaction and intentional loyalty is negative but not significant ($b_3 = -0.04$, $P > 0.10$). Thus, we have strong empirical evidence to conclude that transaction-specific satisfaction has a nonlinear effect with an increasing return on intentional

loyalty in a U-shaped form. This means that the true specification of the nonlinear relationship between transaction-specific satisfaction and intentional loyalty is based on Model M2 (see Figure 3a for the case of canned mackerel).

Hypothesis 4 stated that the nonlinear functional forms would be more capable of explaining the effect of satisfaction on loyalty. To test this hypothesis, we use a method applied by Streukens and de Ruyter.¹² Table 3 presents the comparisons of the different functional forms.

Based on the results presented in Table 3, we find that in 15 cases tested, five cases indicate that the nonlinear functions perform better than the linear function (A < B: $z < 0$ and $P < 0.10$), six cases support the better performance of the linear function (A > B: $z > 0$ and $P < 0.10$) and four cases are not significantly different between the linear and nonlinear forms (A = B: $z > 0$ or < 0 and $P > 0.10$). For intentional loyalty as the

dependent variable, Samples 1 and 3 support the use of a linear function ($A > B$), but Sample 3 shows no difference in the use of linear versus nonlinear functions ($A = B$). However, when behavioural loyalty is treated as a dependent variable, both Sample 2 and Sample 3 almost support the use of a nonlinear function ($B > A$). Thus, these results only support Hypothesis 3 partially or generally the nonlinear functional forms do not appear to have superior explanatory power to the linear model.

DISCUSSIONS AND IMPLICATIONS

This study tests different conceptual relationships by different functional forms across three different product hierarchies within one product category. Thus, it provides an overall view of the nonlinearity and illustrates the dynamic nature of the satisfaction–loyalty relationship. Especially, it is to our knowledge the first study to illustrate the nonlinear effect of satisfaction with the first transaction-specific consumption experiences on intentional loyalty. The estimation of a wide range of competitive models¹² also helps to overcome the problem of misspecification⁴⁴ as well as providing a comparison between the linear model and different nonlinear models used to depict the satisfaction–loyalty relationship.¹² The results reveal a quadratic effect with an increasing return of cumulative satisfaction on behavioural loyalty and of transaction-specific satisfaction on intentional loyalty, but indicate a cubic effect with a decreasing return of cumulative satisfaction on intentional loyalty.

Theoretical discussion and implications

Our findings are consistent with some previous studies supporting a decreasing marginal effect of cumulative satisfaction on intentional loyalty,^{7,11,36} but opposite to others favouring an increasing marginal effect of cumulative satisfaction on intentional loyalty.^{4,9,25,31,38} The results also indicate an increasing incremental effect of cumulative satisfaction on behavioural loyalty, as shown in some previous studies.^{5,7,37} Compared with a few studies^{7,25} including both intentional and behavioural loyalty in relation to cumulative

satisfaction, our findings are similar to those of Mittal and Kamakura⁷ but inconsistent with Ngobo's²⁵ findings. However, this study provides a more comprehensive and consistent picture of the nonlinear effect of satisfaction on loyalty than most previous studies. This is because this study explores the possible nonlinearities in the satisfaction–loyalty relationship at different product levels within one product category rather than testing this relationship across products and/or services^{4,11} or using data of one product or service.^{7,10,27,38}

It is noteworthy that the nonlinear effect with an increasing return of transaction-specific satisfaction on intentional loyalty is found first. This finding supports the propositions that for a new offering the 'delight' effect or 'exceeding expectations' could explain a nonlinear effect with an increasing return of satisfaction on loyalty.^{4,9,25} This finding is also consistent with Homburg *et al.*'s⁶ findings confirming an increasing effect of first-transaction-specific satisfaction on willingness to pay. However, our study differs from theirs on at least two points. First, in their study, satisfaction is based on cognitive and emotional evaluations (that is, pre-consumption evaluations) for an exclusive new product (a CD tutorial), while satisfaction in this study is affective pleasure responses based on post-consumption experience (after consuming/eating the product). Second, the lack of competitive products in their study may influence the respondents' willingness-to-pay judgments by elevating themselves the price of the new product corresponding to high satisfaction levels manipulated. Our study avoids this effect by measuring loyalty based on purchase intentions and willingness to continue the consumption of the product with a given price unit and also does not limit consumers in considering alternatives (for example, canned products) that are always available in the markets. Thus, this study provides additional empirical evidence to illustrate the nonlinearity of the satisfaction–loyalty relationship in the context of marketing a new product.

The empirical evidence showing discrepancies in different conceptual relationships between satisfaction and loyalty may reveal different

underlying psychological mechanisms. It may be that the formation of transaction-specific satisfaction with a new product could be affected by 'delight' or 'exceeding expectations' as in the above discussions to generate an increasing marginal effect on loyalty.^{6,9,25} By contrast, a nonlinear effect of cumulative satisfaction on loyalty towards well-established products may be influenced by different factors, such as inertia, negative and positive experiences, trust or the perceived risks of the products or particular goal pursued by consumers^{3,6,19,27} or may be simply due to response biases between the different consumers with different characteristics.⁷ For example, a decreasing return effect of cumulative satisfaction on intentional loyalty may occur because consumers in this market may always be pursuing the most basic need (for example, hunger/nutritious food)³³ in their repurchase intention regardless of their high levels of satisfaction towards marine fish.³ By contrast, an increasing return effect of cumulative satisfaction on behavioural loyalty could provide additional evidence that the high consumption frequencies of the product may not only fulfil their hunger for food, but also meet their higher-level needs, such as the needs for safety or bodily fitness.^{3,33,34}

Finally, this study provides formal comparisons between a linear model and different nonlinear models, as very few studies have accomplished.^{10–12,25} The findings are generally consistent with most previous studies supporting the use of a linear model or equal performance between nonlinear and linear models in explaining intentional loyalty from satisfaction.^{10–12}

However, our findings show the superiority of nonlinear functions relative to the linear function in predicting behavioural loyalty from satisfaction.²⁵ It may be that this study uses the food contexts (fish) in a developing country (Vietnam), in which the strong negative effects of 'distrust' or 'perceived risk'⁴⁵ may explain the dominating asymmetric effect of satisfaction on behavioural loyalty.^{3,4,12} Our findings, thus, emphasize using nonlinear functions in predicting consumers' behavioural loyalty,²⁵ but not intentional loyalty¹² in similar situations. The results of these comparisons also partly reflect the reason why

most previous studies suggest a linear form rather than nonlinear ones to explain the satisfaction–loyalty relationship,^{10–12} especially when loyalty is measured as repurchase intentions.^{11,12} However, in most cases, as in this study, the relationship between satisfaction and loyalty is complex nonlinear. Furthermore, the nonlinear relationship between satisfaction and behavioural loyalty is superior relative to the linear relationship. It may be that consumers often tend to save their mental efforts²³ by using a simple linear way of forming their intentions, but their actual actions are frequently very different and more complicated than their thinking/intentions.⁷

Our approach allows us to detect the true specification as well as indicating some exceptions in the satisfaction–loyalty relationship. As shown in the above discussions, first-transaction-specific satisfaction was confirmed to have a positive quadratic effect (see Sample 1, M2 and M4 in Table 2), but if the cubic model was used (M3), transaction-specific satisfaction could have a negative cubic effect on intentional loyalty. Similarly, our findings confirmed a positive quadratic effect of cumulative satisfaction on behavioural loyalty (see Sample 3, M2 and M4 in Table 2), but the results also revealed a negative cubic effect of cumulative satisfaction on behavioural loyalty (see Sample 3, M3). Therefore, as several previous studies,^{10,11} this study suggests that competitive models should be used to detect the true specification of the satisfaction–loyalty relationship.

Managerial implications and limitations

Our study has several managerial implications. First, marketers and managers should be aware of possible nonlinearities when predicting loyalty based on satisfaction^{3,19} because the prediction of loyalty based on a traditional linear model could generate biases.⁹ However, our study does not emphasize the use of a specific form but an effort to detect a true function with a superior predictive power in a range of competitive models. Second, our findings show the complex nature of the satisfaction–loyalty relationship, in

which an increased unit of satisfaction at different levels of satisfaction can generate an unequal increase in loyalty. Thus, assessing how the changes in satisfaction impact on loyalty can help inform more accurate executive decisions to improve consumer loyalty. This is important especially when the considered products are marketed in different satisfaction segments where the satisfaction–loyalty relationship is proved to be segment-specific nonlinearities.⁴⁶ Third, this study supports an increasing incremental relationship between transaction-specific satisfaction and intentional loyalty with the first experience of a new product. Therefore, once again the insurance of providing excessive quality to fulfil consumers' expectations can play a critical role in marketing a new product successfully.¹⁴ It is also worth noting that cumulative satisfaction has a decreasing return effect on intentional loyalty, but an increasing return effect on behavioural loyalty. Thus, if managers' and marketers' interest is in predicting how loyalty will change in response to successive changes in cumulative satisfaction, the use of intentional or behavioural loyalty alone could be misleading.⁷ In addition, a marketing strategy that aims to determine the area of satisfaction to generate maximum loyalty should be interesting rather than focusing on maximizing consumer satisfaction.

Finally, some limitations should be noted. Our study only covers products within one category (fish) and context (Vietnam), where branding is very uncommon. Data from other categories of products, services or brands could lead to an interesting extension and increase the validity of our models. Both satisfaction and loyalty can be divided into more specific conceptual varieties such as pre-purchase or anticipated satisfaction,³⁰ customer share,^{19,46} loyalty commitment¹⁸ or word of mouth.³¹ Future studies could extend to test other possible conceptual relationships. Next, the results presented here are based on self-reported measures of satisfaction and loyalty; hence erroneous inferences can be produced if common method variance inflates estimates of the association between them,⁴⁷ so objective measures of loyalty⁴⁷ and/or manipulated satisfaction⁶ may

give better results. As in the above discussions, several variables may explain the nonlinear effect of satisfaction on loyalty; thus the investigation of these moderator variables in relation to the nonlinear effect of satisfaction on loyalty may provide a fruitful avenue for future research.¹⁹ Finally, it would be interesting to extend our study to a longitudinal study⁴⁶ involving a product at different stages in its life cycle.

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