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# Asymmetric and Nonlinear Impact of Attribute-Level Performance on Overall Customer Satisfaction in the Context of Car Servicing of Four European Automotive Brands in Slovenia

**Slavko Ažman[1], Boštjan Gomišček[2]**

[1]Porsche Slovenija d.o.o., Bravničarjeva cesta 5, Ljubljana, Slovenija,
slavko.azman@porsche.si
[2]University of Maribor, Faculty of Organizational Sciences, Kidričeva 55a, Kranj, Slovenija,
bostjan.gomiscek@fov.uni-mb.si

The paper examines the nonlinearity and asymmetry between the satisfaction with individual attributes of the service and overall satisfaction in the context of passenger car servicing in Slovenia. The data set that was analysed was acquired from a regular survey on customer satisfaction with vehicle repair and maintenance services of four European automotive brands in Slovenia, carried out in 2005 and 2006 through 12,941 computer-assisted telephone interviews. Specifically, this study utilizes regression analysis in order to test the asymmetry and nonlinearity of the link between the attribute-level performance and overall satisfaction.

The results show that the influence of dissatisfaction is different from the influence of satisfaction, and that the influence of satisfaction on overall satisfaction is greater than the influence of dissatisfaction. The results also show that nonlinearity is applicable to certain attributes of vehicle servicing, but not to all.

We can sum up that precise knowledge of the correlation between the attribute-level performance of vehicle servicing and overall service satisfaction is important. Results show that caution must be employed in the evaluation of the importance of individual attributes on overall satisfaction, since the importance can change depending on the level of satisfaction. It appears that focusing on improving satisfaction is more important than focusing on lessening dissatisfaction. Results also show that the improvement of attribute-level performance offers diminishing returns; therefore, selective investment in activities for increasing customer satisfaction is sensible if satisfaction levels are already relatively high.

**Key words:** service quality, customer satisfaction, automotive industry, asymmetry, nonlinearity.

## 1 Introduction

Business systems are facing global competition in a quickly changing business environment, in which the most successful companies are those that know their customers well and constantly adapt to their needs and expectations (Carpinetti, Buosi and Gerólamo, 2003).

The key role of orientation towards customers and the improvement of customer-related processes is underlined by several studies (Terziovski et al., 2002; Abdolazimian and Mansouri, 2008). As reported by Sychovicz (2008), 67% of companies, among 202 companies from 19 European countries included in a survey, are focused on customer-oriented processes.

The usual measures of customer satisfaction involve a survey with a set of statements related to different dimensions of satisfaction, as well as a statement related to the overall customer satisfaction.

While overall satisfaction is crucial for loyalty and profitability, only questions about individual attributes of service serve as a basis for consideration about necessary changes and improvements. Numerous authors (Anderson and Sullivan,

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1993; Mittal et al., 1998; Anderson and Mittal, 2000; Matzler et al., 2004; Chueng and Lee, 2009) found that the correlation between attribute-level performance and overall satisfaction is not necessarily linear and symmetrical. Since the results of these studies are relatively dissimilar, we could assume that the cause lies in the specifics of different industries and that there is no universal connection

This paper, therefore, investigates the nature of the correlation between individual attributes of satisfaction and overall satisfaction in the context of passenger car servicing in Slovenia.

The aim of the study is to determine whether the correlation between attribute-level performance of vehicle service and overall satisfaction (satisfaction with the service as a whole) is nonlinear and asymmetric. This paper also addresses the question whether the influence of satisfaction with an individual attribute on overall satisfaction remains constant or changes depending on the level of satisfaction with said attribute, and whether the satisfaction with an individual attribute influences the overall satisfaction differently than dissatisfaction with the same attribute.

## 1.1 Service quality and customer satisfaction

Scholarly service management literature provides several concepts regarding customers' reaction to service. Two of the most common concepts are "perceived service quality" and "customer satisfaction". On the most general level both perceived service quality and customer satisfaction are concepts relating to customers' assessment of the received service. Results of empirical studies show that these are two distinct constructs (Oliver, 1997; Taylor and Baker, 1994) and that there exists a causal relationship between them (Cronin and Taylor, 1992; Gotlieb et al., 1994; Spreng and Mackoy, 1996; Salini and Kenett, 2009). Some authors use these two concepts interchangeably (Iacobuci et al., 1994; Mittal et al., 1998; Oliver, 1997; Parasuraman et al., 1994; Taylor and Baker, 1994), even though they are aware of certain differences between them.

Oliver (1997) lists the following differences between the perceived service quality and customer satisfaction:

- Perceived service quality judgments are evaluations of specific cues or attributes, whereas satisfaction judgments are more global.
- Expectations of perceived service quality are based on perceptions of 'excellence', whereas satisfaction judgments include referents such as need and equity or fairness.
- Perceived service quality judgments are more cognitive, whereas satisfaction judgments are more affective and emotional reactions.

When distinguishing both constructs, the time dimension is also important, which shows clearly in the definition of both constructs, as seen by Lovelock and Wright (1999).

Lovelock and Wright (1999) define customer satisfaction as a 'short term emotional reaction to a specific service performance' and perceived service quality as 'customer's long-term, cognitive evaluations of a company's service delivery'.

They postulate that satisfaction depends on the experience, but this is not necessarily true for the perceived service quality, which can also be dependent on marketing and word of mouth. After each experience with the service, the customers evaluate their level of satisfaction or dissatisfaction. This piece of information is used to refresh their image of the perceived service quality. From this, we can see that satisfaction influences the perceived quality and not vice versa.

To a certain extent, this assumption is confirmed by Oliver's (1997) studies on the direction of influence between the constructs of perceived service quality and customer satisfaction. He finds that the direction of influence depends on the level of measurement. On the level of individual transaction he found a strong influence in the direction from quality to satisfaction, whereas on the level of bigger transactions the exact opposite was apparent, that is, the influence of satisfaction on perceived service quality. He claims the reason for longer-term influence on perceived service quality is that satisfaction influences quality expectations in the long term.

Service quality and service satisfaction are therefore related and closely connected, but nevertheless different concepts. They differ mainly in terms of service-related experience, degree of expectation, component efficiency level and the stability of relationship between the customer and service provider (Snoj and Mumel, 2001).

The perceived quality of service is a general overall evaluation relating to service excellence that is created based on the relationship between the customer and service provider, where both parties play an active role, while satisfaction refers to a certain implementation and is shaped by a certain experience. It is an emotional reaction to a service or product (Gabbott and Hogg, 1997).

The dimensions that define assessment of satisfaction can be the same as dimensions defining assessment of quality, but this is not necessary. The assessment is based on ideals or the perception of perfection or excellence, while in the assessment of satisfaction expectations needs and personal norms also play an important role. That is why even very high service quality does not guarantee high customer satisfaction, because


*Figure 1: Customer satisfaction model (Source: Anderson, Fornell and Lehmann, 1994)*

satisfaction is also influenced by factors that are not controlled by the service provider (Oliver, 1997; Rust and Oliver, 1994).

Satisfaction as defined by Anderson, Fornell and Lehmann (1994) relies on the theory of expectancy (dis)confirmation. According to this theory, satisfaction is the customer's after-sale valuation of the received quality or value of a certain product or service compared to the expected quality or value. Figure 1 shows a simple model of satisfaction with key factors and their causal relationships.

According to this model, satisfaction is the result of the customer's previous and current experiences, which affect expectations or standards. Expectations are an individual's feelings about the possibility of something happening (Lewis, 1995) or an opinion about service performance, which serve as an assessment standard for the performance (Zeithaml and Bitner, 2003). The customer of the services then knowingly or unknowingly compares to these expectations or standards the user's experience with the quality or performance of a product or service. This means that when expectations are low even relatively low service quality can lead to satisfaction, but of course the opposite holds true as well. When customers have very high expectations, it is difficult to achieve total satisfaction even with service of a relatively high quality. Every time service providers exceed customers' expectations, which is a requirement for true satisfaction, they are raising the bar for expectations and quality standards to be achieved in the future (Zeithaml and Bitner, 2003).

The above discussion suggests that customer satisfaction is inherently a somewhat elusive construct, for several separate but related reasons:

- The construct has both cognitive and emotional components;
- its meaning has a relativistic aspect (i.e. people may have different psychological benchmarks in mind against which they compare their level of satisfaction or judgment of quality);
- and people's responses to satisfaction surveys depend on the time frame to which they, and not the survey, are referring (Ograjenšek and Gal, 2012).

It is important to note that while the research literature tries to distinguish between customer satisfaction and perceived service quality, in practice many service organizations do not: When designing customer satisfaction surveys, they often mix dimensions of these two constructs (Ograjenšek and Gal, 2012).

## 1.2 Measuring perceived service quality and customer satisfaction

Seminal work regarding the conceptualization of these two concepts, and the resulting suggestions for measuring them, was done in the USA by Parasuraman et al. (1985, 1988, 1991, 1994) and in Europe by Grönroos (1990, 2000). The most important results of these studies can be summarized as a recommendation for the use of the so-called gap model and a recommendation regarding the dimension of services that are important for customers and therefore need to be included in the measurement (Ograjenšek and Gal, 2012).

The gap model, in accordance with the definition of both constructs, measures the perceived service quality and customer satisfaction as a "gap", that is the difference between expectations (what I want) and the perception (what I get). If the perceived exceeds the expected, the perceived service quality is higher and satisfaction is achieved. If, on the other hand, expectations exceed the perceived, the gap model anticipates a (too) low perceived service quality or dissatisfaction. A more thorough presentation of the gap model is described by Zeithaml and Bitner (2003).

As far as the service dimensions that are worth including in the measurement of service quality and consumer satisfaction are concerned, a very useful starting point is the SERVQUAL model (Zeithaml et al., 1990). This is a widely used and thoroughly researched model for the measurement of perceived service quality. It includes the following five key dimensions:

- Tangibles: The conditions or appearance of physical facilities, equipment and personnel.
- Reliability: The ability to perform the promised service dependably and accurately.
- Responsiveness: Willingness to help customers and provide prompt service.
- Assurance: Knowledge and courtesy of employees as well as their ability to convey trust and confidence.
- Empathy: Individual care and a sense of attention to personal needs that a company provides its individual customers with

The first two dimensions deal with the appearance and the effectiveness of the organization as a whole, while the last three have a pronounced personal component, because they reflect the behaviour and attitude of individual employees in the organization. Zeithaml et al. (1990) report that while all dimensions are important, the reliability dimension is of special importance for customers.

Based on this, Parasuraman et al. (1985, 1988, 1991 and 1994) devised the SERVQUAL questionnaire. The questionnaire includes two sets of 22 questions about individual service attributes, covering the above-mentioned five dimensions. One series of questions relates to expectations, while the other relates to perceptions of individual service dimensions.

Apart from the SERVQUAL concept, there also exist other means of service quality conceptualization. Widely known is the Grönroos concept (Grönroos, 1984), which distinguishes between three components of service quality - technical, functional and reputational quality. Technical quality represents the outcome of the service encounter (what), while functional quality reflects the process of service delivery (how). Reputational quality is a reflection of the corporate image of the service organization. An example of technical quality in the context of passenger car servicing would be a correctly performed service or repaired malfunction on the vehicle, while an example of functional quality would be the friendliness of service personnel and adherence to agreed deadlines.

Similarly, Lehtinen and Lehtinen (1982) also derive from three components of service quality - interactive, physical and corporate quality, while Hedvall and Paltschik (1989) on the other hand identify two dimensions – willingness and ability to serve, and physical and psychological access.

In assessment of consumer satisfaction, it is important that the assessment is not a single event, but that it is a part of a satisfaction measurement programme. It is unlikely that a company will derive much useful information from a single survey, even if it is very well planned and conceptually sound (Hayes, 2008). Only with regular surveys is it possible to monitor customer satisfaction levels and detect trends. However, this of course necessitates a series of comparable surveys, planned in advance.

An important additional piece of information for companies is also the comparison of satisfaction levels with the competition. To achieve this, companies often also include customers of the competition in their surveys. An additional possibility is the cooperation in annual comparative satisfaction analyses, for example the American Customer Satisfaction Index ACSI (Anderson and Fornell, 2000; Matzler et al., 2004), the Swedish Customer Satisfaction Index SCSI (Anderson et al., 1994) or the Chinese Customer Satisfaction Index CCSI (Dong et al., 2011).

Most of the big and medium-sized companies regularly monitor customer satisfaction (Eklöf et al., 1999). Every year, more and more organizations from Slovenia and the wider region are becoming aware of the importance of customer satisfaction and a regular monitoring thereof, and this topic has also risen to prominence in Slovenian academic research circles (Gaber et al., 2008; Jesenko et al., 2009; Ograjenšek and Žabkar, 2010; Litrop and Piskar, 2011; and Ćoćkalo et al., 2011).

Companies have at their disposal a wide array of methods and tools for measuring customer satisfaction. The choice is of course influenced by the costs of the survey. These costs have to proportional to the value of acquired data for the company.

Customer satisfaction surveys are also performed regularly in the context of passenger car service, however the method of customer satisfaction measuring is usually prescribed by the vehicle manufacturer.

When measuring customer satisfaction it is important to distinguish between simple and complex dimensions of satisfaction (Johnson and Gustafsson, 2000).

Simple dimensions of customer satisfaction represent basic elements that constitute satisfaction. Simple dimensions of satisfaction in the context of passenger car servicing are for example personnel friendliness, workshop tidiness, explanation of the service work performed or the availability of replacement vehicles. It is characteristic of simple dimensions that they can be influenced directly and they are relatively simple to directly measure through questionnaires.

Complex dimensions of customer satisfaction are combined from two or more simple dimensions. For example, the complex dimension of "personalized assistance" consists of the simple dimensions "availability of service over telephone", "inspection of vehicle with a mechanic", "explanation of work done and service bill", "friendliness of service personnel" and "responsiveness of personnel to customer's concerns and wishes".

Complex dimensions cannot be measured and influenced directly, but indirectly through simple dimensions (Johnson and Gustafsson, 2000).

If we wish to influence overall customer satisfaction, we need to ask ourselves which dimensions are the most important to the customers and which of them influence overall satisfaction the most. According to the influence on overall satisfaction, we distinguish two types of simple dimensions - basic factors (dissatisfiers) and excitement factors (satisfiers) (Anderson and Mittal, 2000). It is characteristic of basic factors that they are a sort of minimum standard, something the customer expects and fells should be self-evident. Alone the fact that the minimum standard is achieved does not necessarily mean that the customer will be satisfied with the overall service. That is why further improvements of satisfaction with basic factors do not contribute considerably to overall satisfaction. Basic factors have a much greater influence on overall satisfaction in a negative way, because customers react with dissatisfaction to service that is below minimum standards. Contrary to basic factors, excitement factors denote something above standard, superior and unexpected. The bare absence of excitement factors therefore does not significantly contribute to lower overall satisfaction, but on the other hand, high levels of satisfaction with excitement factors may very significantly improve overall satisfaction.

## 1.3 The influence of customer satisfaction on profitability of companies

In an economic sense, customer satisfaction is important mostly because of its indirect influence on profitability of companies. On a theoretical level, the connection between customer satisfaction and financial results of companies is rationalized by the profit service chain, as shown in Figure 2 (Anderson and Mittal, 2000). The concept of the service profit chain envisages that an increase in the quality of individual service attributes can lead to a greater customer satisfaction, which in turn leads to better financial results through increased customer loyalty.

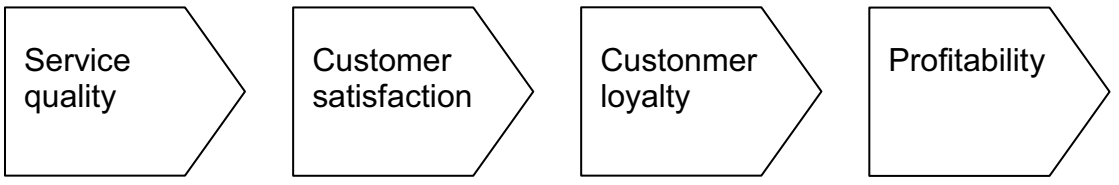


*Figure 2: Service profit chain (Anderson and Mittal, 2000)*

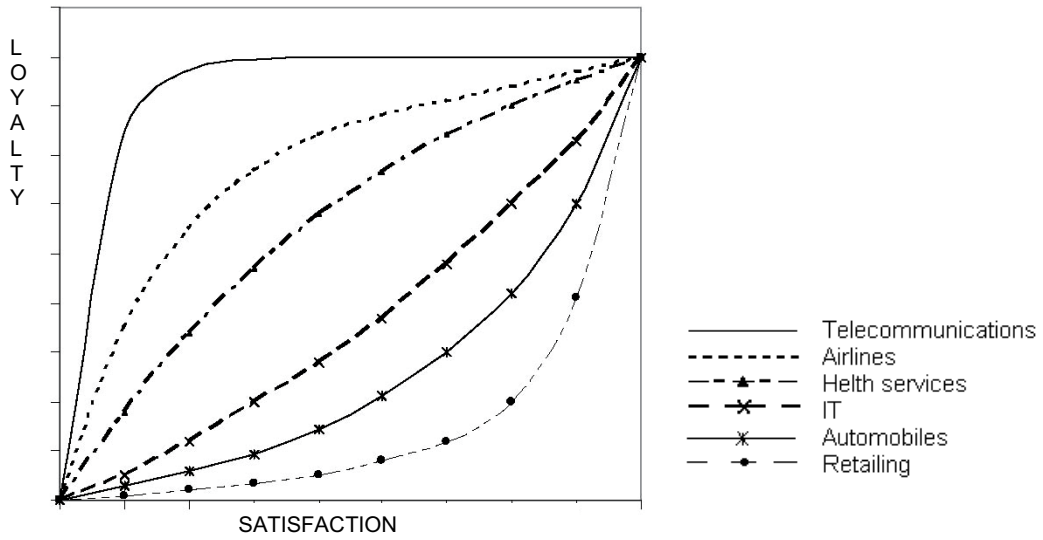


*Figure 3: Relationship between satisfaction and loyalty in various industries (Bateson and Hoffman, 1999)*

Customer loyalty plays a crucial role in the service profit chain. Customer loyalty is inseparably connected with satisfaction, but the connection is not symmetrical. Satisfaction is a necessary requirement for loyalty; however, satisfaction alone is not enough. Without satisfied customers, a company can hardly count on their loyalty, but loyalty is also influenced by other factors, including some that the company has no direct influence on. Customer satisfaction is only one of the factors influencing loyalty, finds Oliver (1996).

The link between satisfaction and customer loyalty is usually a continuous increasing function, but its shape is very much different for different industries, as shown in Figure 4. The connection between satisfaction and loyalty is influenced predominantly by factors that ease or hinder the switching between service providers (Bateson and Hoffman, 1999):

- Level of competition (stronger competition makes service provider switching easier);
- entry and exit barriers (for example knowledge, strong trademarks, high entry investment and similar make it more difficult to switch service providers);
- information, necessary for buyer decision making or use of products and services (this also makes it service provider switching more difficult, because gained experience and specific knowledge are tied to the existing provider).

Customer satisfaction usually has a greater influence on satisfaction in sectors with a higher level of competition and in segments where price is the key factor in buyer decisions; it has a smaller influence on satisfaction in higher-priced segments, where established trademarks play a more important role (Kristensen, Martensen and Gronholdt, 1999).

Customer satisfaction, however, does not influence profitability only through customer loyalty (Anderson and Mittal, 2000). Increased customer satisfaction also lowers costs related to poor quality products or services, for example costs of warranty claims, product replacement, additional repairs and customer complaint processing. References from satisfied and loyal customers also lower the costs of new customer acquisition and improve the overall image of the company.

Anderson and Sullivan (1993) proved that higher customer satisfaction lowers the price elasticity and at the same time lowers the possibility of customer defection even in case of poor quality service.

The link between increased customer satisfaction and improved company profitability has been proven by many studies. In an analysis of scientific literature from this field, Eklöf, Hackl and Westlund (1999) found that all analysed articles defend the positive influence of a higher customer satisfaction on (long-term) commercial success. More recent studies (Mittal et al., 2005; Hart, 2007) have come to similar conclusions.

Because cars are durable goods with a long service life that need regular servicing to insure a faultless operation, the quality of vehicle repair and maintenance services strongly influences overall customer satisfaction with a car. Service quality does not only significantly improve the lifetime of a vehicle but also contributes to safety.

From the standpoint of profitability of car dealerships, the after-sales segment is becoming more and more important. The competition in the field of new car retail is getting stronger, which has also been confirmed by the European Commission in the Motor Vehicle Block Exemption Regulation (http://eur-lex.europa.eu)[1]. The economic crisis has exerted additional pressure upon prices in the past years. The percentage of "hot deals" with minimal profit margins in the sale of new vehicles is growing, while at the same time the promotion of such deals and discounts has increased, which of course raises the expectations of customers regarding sales discounts in the long term. A higher mobility of new car buyers is also evident,

1 Motor Vehicle Block Exemption Regulation European Parliament resolution of 6 May 2010 on the Motor Vehicle Block Exemption Regulation. Retrieved March 4, 2012, from http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:C:2011:081:0089:01:EN:HTML

because they will often buy a car at a dealership that can be 100 or 200 km away from where they live. On the other hand, customers are usually not prepared to drive such distances for vehicle repairs and maintenance, which has a somewhat restrictive effect on the competition intensity. Apart from that, due to price harmonization the hourly rates in the after-sales segment are steadily increasing in all new member states of the European Union. That is why, despite certain pressures upon the prices of spare parts, profits from sales have been shifting to after-sales for more than a decade. This makes after-sales services key for the commercial success of car dealership centres. Most vehicle manufacturers are well aware of this, so they are trying to improve the after-sales services of their sales and service network (Harris, 2002; Kohn, 2002).

# 2 Study methodology

The study is based on the results of a regular survey of customer satisfaction with vehicle maintenance and repair services in the sales and service networks of four European vehicle manufacturers in Slovenia in the years 2005 and 2006. The data for the survey were collected through computer-aided telephone interviews (CATI).

The survey involved 12.941 interviewed persons, customers of 42 service partners from all Slovenian regions.

The customer satisfaction questionnaire on maintenance and repair service consists of 50 questions, including four main questions:

- overall satisfaction with the service,
- willingness to recommend the service to friends,
- intention of visiting the same service provider again (repurchase intention),
- advantage of having decided for this service provider.

Furthermore, there were 46 questions about the individual aspects of the servicing process, including 17 questions about satisfaction with individual attributes of the service, followed by a question about buying a new car of the same brand and a question about buying a new car at the same car dealership.

The questionnaire also included two questions about the vehicle itself (production year and type of ownership) and two questions about the interviewee (sex and age). A 5-point scale was used, with grades from 1 (very satisfied) to 5 (very dissatisfied).

For our study, we used the data related to the main question about overall satisfaction with the service and the 17 questions related to satisfaction with individual attributes of the maintenance and repair service.

The structure of the pattern is shown in Table 1. The predominant amount of interviewees was male (75.2%), reflecting the actual structure of the customers of the service centre. The majority of customers (67.3%) were aged between 30 and 60 years. Most of the serviced vehicles fell between the A0-segment and B-segment, while the number of the smallest vehicles from the A00-segment and bigger and more expensive vehicles from segments C and D was considerably smaller. Slightly over half of the vehicles (52.6%) were owned by individuals, while the remainder were owned by companies.

*Table 1: Pattern structure*

| Pattern structure | | Share in % |
|---|---|---|
| Age | up to 30 | 14.8 |
| | 31 - 40 | 20.9 |
| | 41 - 50 | 24.4 |
| | 51 - 60 | 22.0 |
| | over 60 | 17.9 |
| Sex | male | 75.2 |
| | female | 24.8 |
| Vehicle segment | A00 | 1.0 |
| | A0 | 23.0 |
| | A | 48.0 |
| | B | 18.0 |
| | C | 4.8 |
| | D | 0.1 |
| Type of ownership | individuals | 52.6 |
| | companies | 47.4 |

## 2.2 Hypotheses and statistical methods

Based on these theoretical starting points and considering the goal of the study, we have proposed two hypotheses:

Hypothesis 1:
*The negative and positive evaluation of satisfaction with individual attributes of service influence overall satisfaction asymmetrically.*

Hypothesis 2:
*The relationship between satisfaction with individual attributes of service and overall satisfaction is nonlinear.*

Using the model proposed by Anderson and Sullivan (1993), which was slightly modified by Mittal et al. (1998), we tested the asymmetry and nonlinearity of the link between the satisfaction with individual attributes of the service and overall satisfaction with the following regression model:

$$Overall\ satisfaction = \\ = constant + \beta_1 \times LN\_ELM + \beta_2 \times LP\_ELM$$

Attribute-level performance is represented by the variable ELM, which is divided into the positive P_ELM and the negative N_ELM. The letter L in the name signifies the natural algorithm. LN_ELM therefore represents the natural algorithm of negative values of satisfaction (dissatisfaction) with individual attributes of the service process, while LP_ELM represents the natural algorithm of the positive values of satisfaction. The natural logarithm represents the nonlinearity of the link with overall satisfaction, that is, the diminishing influence of satisfaction with an individual attribute on overall satisfaction.

For each of the attributes of the service process we performed a linear regression analysis with overall satisfaction serving as the dependant variable, and LN_ELM and LP_ELM (for this attribute) serving as an independent variable. In

this way, we have been able to get two regression coefficients ($\beta_1$ and $\beta_2$) for each attribute. Based on these regression coefficients we can ascertain the following facts (Anderson and Sullivan, 1993; Mittal et al., 1998):

- The higher the absolute value of a coefficient, the greater the influence of an individual attribute on overall satisfaction.
- The positive or negative sign before a coefficient shows whether the influence of an individual attribute on overall satisfaction is positive or negative.
- Overall satisfaction is marked by grades from 1 to 5, with 1 signifying the greatest satisfaction. That is why the coefficient for LN_ELM should normally be positive (dissatisfaction with an individual attribute lowers overall satisfaction), and negative for LP_ELM (satisfaction with an individual attribute contributes to overall satisfaction).
- In the case of asymmetric influence on overall satisfaction, coefficients $\beta_1$ and $\beta_2$ will be different.
- Satisfaction values will be subject to transformation with the help of the natural logarithm. Therefore, it is considered that the values of coefficients that are statistically significantly different from zero show a nonlinear connection between the satisfaction with an individual attribute and overall satisfaction.

In order to perform the above-mentioned analysis we needed to transform values from the questionnaire about customer satisfaction with sales and service, which was performed in the following way:

Values from 1 to 5 were divided into positive values (1 and 2), negative values (4 and 5) and a neutral value of 3. We assigned a value of 4 to the most positive and the most negative value, a value of 2 to both less positive and negative values, and a value of 0 to the neutral value. Following that, we calculated the natural logarithm for these values. The transformation process can be seen in Table 2.

*Table 2: Transformation of values from the questionnaire about customer satisfaction*

| ELM | P_ELM | N_ELM | LP_ELM | LN_ELM |
|---|---|---|---|---|
| 1 | 4 | 0 | 1.386294 | 0 |
| 2 | 2 | 0 | 0.693147 | 0 |
| 3 | 0 | 0 | 0 | 0 |
| 4 | 0 | 2 | 0 | 0.693147 |
| 5 | 0 | 4 | 0 | 1.386294 |

Hypothesis 1 (The negative and positive evaluation of satisfaction with individual attributes of service influence overall satisfaction asymmetrically) was tested with the comparison of beta coefficients for positive and negative values. When absolute values of $\beta_1$ and $\beta_2$ are different, the hypothesis is proven.

Hypothesis 2 (The relationship between satisfaction with individual attributes of service and overall satisfaction is nonlinear) was tested with the comparison of the ratio of explained variance between the linear and logarithmic model.

### Limitations of the method used

The biggest limitation of the used method is the use of a 5-point scale. The effect of nonlinearity with logarithmic transformation would be more pronounced with the use of a 10-point scale.

Furthermore, relatively old data were used (for years 2005 and 2006). Because our study explores the nature of the relation between satisfaction with an individual attribute of service and overall satisfaction, which should remain constant through years, this should not influence the usability of the results. We will test the hypothesis that the functional form of the above-mentioned relation is temporally stable with a repeat study using results gathered in Slovenia in 2011.

Another limiting factor is the fact that only repair and maintenance centres of certain brands of passenger cars were included in the survey. Despite that, it should be noted that the combined number of registered vehicles of these brands in Slovenia represents more than 20% of the market share (Source: Ministry of the Interior, 2011)[2]. The survey also covered a wide array of car types from all price ranges. In the next phase an expansion of the study into other European countries is planned, which would enable a comparison between different countries and possibly also lead to a generalization of the results regarding the servicing of motor vehicles in Europe.

## 3 Results

Table 3 shows the results of the calculations for each of the attributes of the repair and maintenance service. The first paired row shows the values of coefficients $\beta_1$ (influence of dissatisfaction on overall satisfaction) in $\beta_2$ (influence of satisfaction on overall satisfaction). The next paired row shows $R^2$ for the logarithmically transformed model and then $R^2$ for the linear model. The last row presents the comparison of both models. Shown is the model that performs better as per the explained variance criterion. For this study we proposed that the model with $R^2$ greater for at least 0.015 is better.

For example, in the case of "explanation of necessary service work" $R^2$ of the logarithmic model was 0.351 and $R^2$ of the linear model was 0.279. The linear model in this case is linear regression, which includes satisfaction and dissatisfaction with the explanation of necessary service work as independent variables, and overall satisfaction as an independent variable.

The logarithmically transformed model is also a linear regression of overall satisfaction with service as an independent variable, but here logarithmically transformed values are

2 Ministry of the Interior. 2011. Registered vehicles status on 31 December 2011, Retrieved January 26, 2012, from http://www.mnz.gov.si/si/mnz_za_vas/evidence_vozil/

*Table 3: Results of linear regression in the context of the linear and the logarithmically transformed model*

| | Negative β1 | Positive β2 | Logarithm. model $R^2$ | Linear model $R^2$ | Comparison |
|---|---|---|---|---|---|
| reachability of dealership by phone | 0,118 | -0,382 | 0,176 | 0,176 | equal |
| flexibility of time of service | 0,187 | -0,387 | 0,204 | 0,188 | log |
| explanation of work to be done | 0,361 | -0,411 | 0,351 | 0,279 | log |
| correctness of repair work | 0,276 | -0,440 | 0,315 | 0,378 | lin |
| minor repairs without appointment | 0,274 | -0,413 | 0,300 | 0,299 | equal |
| quality-price-ratio of service | 0,164 | -0,386 | 0,188 | 0,250 | lin |
| possibility of a replacement car | 0,299 | -0,356 | 0,246 | 0,165 | log |
| duration of repairs | 0,200 | -0,414 | 0,235 | 0,249 | equal |
| flexibility of time for picking up a car after service | 0,173 | -0,427 | 0,239 | 0,240 | equal |
| waiting time after service | 0,153 | -0,427 | 0,220 | 0,223 | equal |
| cleanliness of vehicle after service | 0,168 | -0,399 | 0,200 | 0,176 | log |
| explanation of invoice and work done | 0,172 | -0,425 | 0,221 | 0,213 | equal |
| friendliness of service personnel | 0,292 | -0,423 | 0,313 | 0,262 | log |
| technical ability of service personnel | 0,268 | -0,449 | 0,318 | 0,317 | equal |
| service personnel listened to customer's wishes | 0,121 | -0,480 | 0,255 | 0,300 | lin |
| visual impression of a dealership | 0,100 | -0,405 | 0,181 | 0,180 | equal |
| opening hours | 0,103 | -0,384 | 0,162 | 0,152 | log |

used with independent variables (satisfaction and dissatisfaction with the explanation of necessary service work).

Since $R^2$ of the logarithmically transformed model is greater by more than 0.015 from $R^2$ of the linear model, we assume for the purpose of this study that the logarithmically transformed model is more adequate for the illustration of the influence of satisfaction with the explanation of necessary service work on overall satisfaction.

The logarithmically transformed model proved more suitable in five more attributes of service ("consideration of customer's wishes about the time of service", "possibility of a replacement car", "cleanliness of vehicle after service", "friendliness of service personnel", "opening hours"). For three attributes of service ("fair service", "quality-price-ratio of service work", "service personnel listened to customer's wishes") the linear model proved more suitable, while in the remaining 8 attributes of service there were no significant differences between both models.

Absolute values of the coefficients $\beta_1$ and $\beta_2$ differ in all attributes of the maintenance and repair service. Hypothesis 1 (The negative and positive evaluation of satisfaction with individual attributes of service influence overall satisfaction asymmetrically) is therefore confirmed for all attributes of the maintenance and repair service.

In the end, we also compared the results on the level of the whole model (Table 4). We compared the logarithmically transformed and the linear models including all independent variables at the same time. The comparison does not show any significant differences between the models, because $R^2$ of the logarithmically transformed model is less than 0.015 higher than $R^2$ of the linear model.

# 4 Discussion

The results of the study confirm the hypothesis that both negative and positive evaluation of satisfaction with an individual attribute of the service influence overall satisfaction asymmetrically, however the shape of the asymmetry is surprising. Previous (Mittal et al., 1998; Chueng and Lee, 2009) showed a bigger influence of dissatisfaction with individual attributes of service on overall satisfaction, while our study in the context of vehicle servicing of passenger cars and light commercial vehicles shows just the opposite: In all attributes of maintenance and repair services satisfaction has a greater influence on overall satisfaction than dissatisfaction.

One of the possible explanations for such results is that the service quality in the studied service and sales network is still relatively high. That is why the values of satisfaction are relative and the values of "dissatisfied" and "less satisfied" in reality reflect less satisfaction rather than true dissatisfaction. This is also hinted at indirectly by the distribution of answers: More than half of interviewees (56.4%) were satisfied or very satisfied, while the combined percentage of less satisfied and

*Table 4: Comparison of $R^2$ between the logarithmically transformed and linear models for the whole model*

| **Comparison of models** | Logarithmically transformed model ($R^{2)}$ | Linear model ($R^{2)}$ |
|---|---|---|
| Whole model | 0,485 | 0,474 |

dissatisfied interviewees amounted to only 6.4%. We assume that seriously substandard service work or appalling customer service would have a much more pronounced effect on overall satisfaction than satisfaction in this context. It is however also possible that the different shape of asymmetry is due to the differences in industries, so we suggest additional studies in this field.

The results of the testing of Hypothesis 2 are somewhat less convincing and uniform. The results show that there are considerable differences between the individual attributes of service. The comparison of the ratio of explained variance between the logarithmically transformed and linear model shows that the logarithmically transformed model is more adequate for six attributes of the service. The linear model performs better for three attributes, which means that Hypothesis 2 is not confirmed for these attributes. For eight attributes, there are no significant differences between both models. For a majority of the attributes of maintenance and repair services the logarithmically transformed model is at least as adequate as the linear model (for some it is even better), but on the level of the whole model there are no differences between them.

Mittal et al. (1998) reached the same conclusions when they used data on the satisfaction with physical characteristics of vehicles, while a study on the satisfaction with a web portal from Hong Kong (Chueng and Lee, 2009) showed somewhat better results using the logarithmically transformed model.

It is possible that general types of satisfaction determinants exist, for which a linear link is true, and also types of satisfaction determinants that exhibit a nonlinear link with overall satisfaction. We suggest that further research in this field try to establish a new typology of satisfaction determinants (attributes), taking into account the different influence of determinants on overall satisfaction and increasing efficiency of measures for improving service quality and customer satisfaction.

Service centres need to offer such service quality that will entice customers to return. This is the only way to guarantee long-term loyalty. The link between satisfaction with a maintenance and repair service and loyalty can be seen nicely also from the analysis of answers to the questionnaire that were used in the study. We have performed a correlation analysis between the satisfaction with the service, intended loyalty to the service centre for vehicle servicing, intended recommendation of the service centre to friends and acquaintances, intended loyalty to the brand when buying a new car and intended buying of a new car at the service centre. The results are displayed in Table 5. All correlations are statistically significant at the level 0.01.

The results show a moderate correlation between the satisfaction with maintenance and repair services and intended loyalty to service centre for further vehicle servicing (0.528), and an even higher correlation between satisfaction with maintenance and repair services and intended recommendation to friends and acquaintances (0.616). Apart from satisfaction, the decision to continue servicing one's vehicle at a particular service centre (repurchase intention) is influenced by many other factors, such as lack of alternative, while we only usually recommend a provider we are really satisfied with. The results are consistent with the findings of studies on influence of switching barriers on the ratio between customer satisfaction and intended repurchase and willingness to recommend a provider (Vázquez-Casielles et al., 2009) and hint at the presence of negative switching barriers.

Satisfaction with service is also connected to brand satisfaction and loyalty when buying a new car, as confirmed by some prior studies (Bonicalzi, 2004, and Lanza, 2008).

The calculated correlation coefficient between satisfaction with maintenance and repair services and intended purchase of new vehicle of the same brand is 0.205. The correlation coefficient between satisfaction with maintenance and

*Table 5: Correlation between satisfaction with service and loyalty in the context of vehicle servicing and new vehicle sales (Pearson coefficients)*

| | satisfaction with the service | intended loyalty to the service centre | intended recommen- dation | intended brand loyalty | intended buying of a new car at the service centre |
|---|---|---|---|---|---|
| satisfaction with the service | 1.000 | 0.528 | 0.616 | 0.205 | 0.406 |
| intended loyalty to the service centre | 0.528 | 1.000 | 0.699 | 0.208 | 0.499 |
| intended recommendation | 0.616 | 0.699 | 1.000 | 0.226 | 0.496 |
| intended brand loyalty | 0.205 | 0.208 | 0.226 | 1.000 | 0.312 |
| intended buying of a new car at the service centre | 0.406 | 0.499 | 0.496 | 0.312 | 1.000 |

repair services and intended purchase of new vehicle at the same service centre is 0.406.

The results of the study show that it would be - contrary to general recommendations in the industry of passenger car servicing - wiser to care about improving satisfaction rather than preventing dissatisfaction. The results also show that investments in customer satisfaction should be done selectively and after careful consideration. The diminishing returns of increasing satisfaction with individual attributes of maintenance and repair services on overall satisfaction means that higher and higher investment into further improvement of customer satisfaction is less and less effective. There is probably an upper limit as to where investment into customer satisfaction is still viable, as thoughtless investment into satisfaction improvement does not automatically produce desired financial results.

Results also show that care must be taken in business process remodelling based on linear understanding of the importance of individual attributes of service on overall satisfaction. If we only focus on attributes of satisfaction that currently have the greatest influence, it could happen that a change in the processes would lower the satisfaction with a "less important" attribute, which would in turn suddenly make it important. That is why it seems wise to be careful in the remodelling of processes, so that other, currently less important attributes are not neglected. When it is possible to increase satisfaction with "important" attributes purely by sacrificing satisfaction with "less important" attributes, it is advisable to re-examine the importance of individual attributes after the process remodelling is completed.

Based on our results that diverge in certain segments from the results of prior studies from abroad and other industries, we propose further research in this field in order to gain more insight into differences between different industries.

# 5 Conclusion

In this paper, we have researched the relation between customer satisfaction and individual attributes of the repair and maintenance services of passenger cars in Slovenia. The analysis was performed on data from almost 13,000 questionnaires from a survey on customer satisfaction in the sales-service network of four European car manufacturers. The questionnaires used, apart from the question about overall satisfaction with service, also include questions about satisfaction with individual attributes of the repair and maintenance services, which allow us to react to this data and think about necessary changes and improvements. In order to effectively increase overall satisfaction by changing individual attributes of the service, it is imperative to understand how changes in satisfaction with individual attributes influence overall satisfaction.

Increased customer satisfaction also guarantees long-term commercial success of a business through customer loyalty. And that is why we measure customer satisfaction - to gain insight into the satisfaction of our customers, their needs, wishes, etc.

Because the link between satisfaction with individual attributes and overall satisfaction is not necessarily linear and symmetrical, we have tried to determine the nature of this link based on the survey from the years 2005 and 2006.

The results have shown that the link between satisfaction with individual attributes of the service and overall satisfaction with the service is nonlinear and asymmetric.

The results thus show that the impact of satisfaction with individual attributes of service on overall satisfaction is asymmetric and that overall satisfaction is more strongly influenced by positive than negative values of satisfaction in the context of passenger car servicing in Slovenia. Linear regression of individual attributes of satisfaction with overall satisfaction as the independent variable has for all attributes shown higher values of the beta coefficient for positive values than for negative values. The difference between beta coefficients ranged from 0.05 to 0.36, with an average of 0.21.

As far as the nonlinearity of the link between satisfaction with individual attributes of service and overall satisfaction is concerned, the results are less uniform. The results show that the logarithmically transformed model (representing the nonlinearity of the link) describes the influence of individual attributes on overall satisfaction as well if not better than the linear model in most cases. However, on the level of the whole model there are no significant differences between the models in the ratio of explained variance, since $R^2$ for the linear model has a value of 0.747, while $R^2$ for the logarithmically transformed model has a value of 0.485.

# 6 Literature


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**Slavko Ažman** is employed in the company Porsche Slovenija d.o.o. in Ljubljana. As head of Business Management department, he is mostly engaged in the development of the dealership network, controlling, investment planning and business coaching.

**Boštjan Gomišček** is associate professor at the Faculty of Organizational Sciences, University of Maribor. As head of the Laboratory for Quality Management, he is engaged in the following research and teaching fields: quality management, environmental protection and maintenance management.

**Asimetrični in nelinearni vpliv determinant zadovoljstva na skupno zadovoljstvo strank na primeru dejavnosti servisiranja vozil štirih evropskih znamk avtomobilov v Sloveniji**

V raziskavi je bila na podlagi rezultatov rednega merjenja zadovoljstva strank s servisnimi storitvami v trgovski in servisni mreži štirih evropskih avtomobilskih znamk v Sloveniji v letih 2005 in 2006 s pomočjo 12.941 računalniško podprtih telefonskih intervjujev izvedena analiza nelinearnosti in asimetričnosti med zadovoljstvom s posameznim elementom storitve in zadovoljstvom s storitvijo v celoti.

Uporabljena je bila metoda, ki vključuje ločitev vrednosti zadovoljstva na zadovoljstvo in nezadovoljstvo, logaritmično transformacijo posameznih vrednosti, izračun linearnih regresij ter primerjavo linearnega in logaritmično transformiranega modela. Rezultati kažejo, da nezadovoljstvo vpliva drugače kot zadovoljstvo, ter da je vpliv zadovoljstva na zadovoljstvo s celokupno storitvijo večji od vpliva nezadovoljstva. Izkazalo se je tudi, da je za določene elemente servisne storitve predpostavka nelinearnosti povezave velja, vendar pa ne za vse.

Povzamemo lahko, da je pomembno natančno poznavanje povezave med zadovoljstvom strank s posameznimi elementi servisne storitve in zadovoljstvom s storitvijo v celoti. Rezultati kažejo, da je potrebna previdnost pri vrednotenju pomena posameznih dejavnikov za skupno zadovoljstvo, saj se pomen lahko z ravnjo zadovoljstva spreminja. Zdi se, da je bolj smiselno osredotočeno usmerjanje ukrepov na povečanje zadovoljstva kot v zmanjševanje nezadovoljstva. Rezultati prav tako kažejo, da je zaradi pojemajočega vpliva povečevanja zadovoljstva s posameznimi elementi storitve ob hkratnem naraščanju stroškov smiselna selektivnost pri investicijah v dejavnosti za dvig zadovoljstva strank, če je to zadovoljstvo že na relativno visokem nivoju.

**Ključne besede:** kakovost storitev, zadovoljstvo strank, avtomobilska panoga, asimetričnost, nelinearnost