

Structural Equation Modeling with IBM SPSS Amos



*A methodology for predicting behavioral intentions
in the services sector*

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Executive summary

To remain competitive in the services sector, companies must better understand what drives key customer behaviors such as purchase intent and repeat purchase frequency. The use of Structural Equation Modeling (SEM) and IBM SPSS Amos* is quickly emerging as a powerful approach to understanding this relationship, not only in academia but also in the corporate and public sectors. By understanding how service quality impacts customer satisfaction and behavioral intentions, firms can develop operational and marketing strategies that enhance customer satisfaction and, in turn, foster positive behavioral intentions such as purchase intent or customer loyalty. The benefits of these strategies are clear and far-reaching.

This paper provides an overview of Dr. Maxwell K. Hsu's research on the role service quality plays in predicting customer satisfaction and customer behavioral intentions in two types of service industries: lodging and retail banking. The author explains how SEM was applied, starting with IBM® SPSS® Statistics Base* and then using IBM SPSS Amos, to investigate the underlying relationships between service quality, satisfaction and behavioral intentions, with satisfaction being a mediating factor (i.e., the variable that explains the actual relationship between service quality and behavioral intentions).

The results of Hsu's study quantify the relationship between service quality, satisfaction, and behavioral intentions. They also illustrate that the degree to which service quality relates to either satisfaction or behavioral intentions is likely to vary according to the type of service business.

* IBM® SPSS® Amos and IBM SPSS Statistics Base were formerly called Amos™ and PASW® Statistics Base.



Highlights:

This paper presents research to support the contention that a service typology for measuring service quality can be developed by those in service industries. The implication is that, by verifying models empirically using IBM SPSS Statistics and then IBM SPSS Amos, service firms will be able to identify the relationships between service quality and other important constructs such as behavior intentions or perceived value.

Introduction

Competition in the services sector today is intense and, as a result, service firms need a better understanding of what drives customer behavior. If businesses are to remain competitive and achieve their growth targets, they must be able to encourage positive behaviors such as customer loyalty. However, to accomplish this, they must first understand how service quality impacts customer satisfaction and behavioral intentions. Service quality, satisfaction and behavioral intentions are also known as latent variables, hidden variables or constructs that cannot be observed or measured directly but whose existence could be inferred by the properties of observed variables. The objective of my co-authored research was to measure the impact of service quality on satisfaction and behavior intentions – a crucial issue that all service providers must understand in order to market their services successfully.

Previous research approaches

A preponderance of research exists to support the service quality to satisfaction model (see Cronin, Brady and Hult, 2000 for a comprehensive discussion). Yet while many researchers conclude that both service quality and satisfaction have direct links to behavioral intentions (i.e., service quality to behavioral intentions and satisfaction to behavioral intentions) (Cronin and Taylor, 1992; Cronin, Brady and Hult, 2000; Dabholkar, Shepherd and Thorpe, 2000), they disagree on whether service quality has a direct relationship to behavioral intentions in all service contexts.

Using a sample from six industries (spectator sports, participative sports, entertainment, healthcare, long-distance ground carrier and fast food), Cronin, Brady and Hult (2000) concluded that there is a significant direct link between service quality and behavioral intentions. Interestingly, when the same authors tested the industry data separately, they found that “service quality had a direct effect on consumer behavioral intentions in every industry with exceptions being the healthcare and long-distance ground carrier industries.” This finding challenges traditional thinking about the service sector—that is, that service quality has a direct effect on behavioral intentions.

Schmenner (1986, 2004) proposed a two-dimensional service process matrix to help differentiate between various types of service businesses. This classification scheme groups industries with similar operational processes into four categories: service factory, service shop, mass service and professional services. According to Schmenner (2004), the x-axis of the matrix (Figure 1) represents the degree of variation in customer interaction and customization of services, while the y-axis represents the relative throughput time (a measure of labor intensity).

		Degree of interaction and customization	
		Low	High
Degree of labor intensity	Low	SERVICE FACTORY: Airlines Trucking Hotels Resorts & recreation	SERVICE SHOP: Hospitals Restaurants Auto repair Other repair services
	High	MASS SERVICE: Retailing Wholesaling Schools Retail banking	PROFESSIONAL: Doctors Lawyers Accountants Architects

Figure 1: Service process matrix (Schmenner, 1986 and 2004)

Approach for this paper

To investigate whether service quality has a direct relationship to behavioral intentions in various service contexts, we used Schmenner’s classification framework.

In collaboration with Festus Olorunniwo, PhD, professor of operations management at Tennessee State University, and Godwin Udo, PhD, professor of information and decision sciences at the University of Texas-El Paso, I developed a methodology for identifying and confirming the dimensions of service quality and measuring their relationship to customer satisfaction and behavioral intentions based on a service firm’s classification. We looked specifically at the lodging (service factory) and retail banking (mass service) industries.

Methodology

For our research, we utilized a three-part methodology to understand behavioral intentions in the lodging and retail banking industries. This methodology consisted of:

- Survey instrument development
- Exploratory factor analysis on dataset 1 with IBM SPSS Statistics Base (generally, the recommended sample size for an EFA is 200+)
- Confirmatory factor analysis (CFA) and structural equation modeling (SEM) on dataset 2 (i.e., confirming correlations and inferred causal relationships among factors)

We developed our surveys using focus groups and walk-through assessments of lodging and retail banking establishments in which we took the customer’s perspective. Once the survey instruments were created, we asked industry experts (e.g., hotel managers and bank managers) to review the questionnaires before we collected survey data in person.

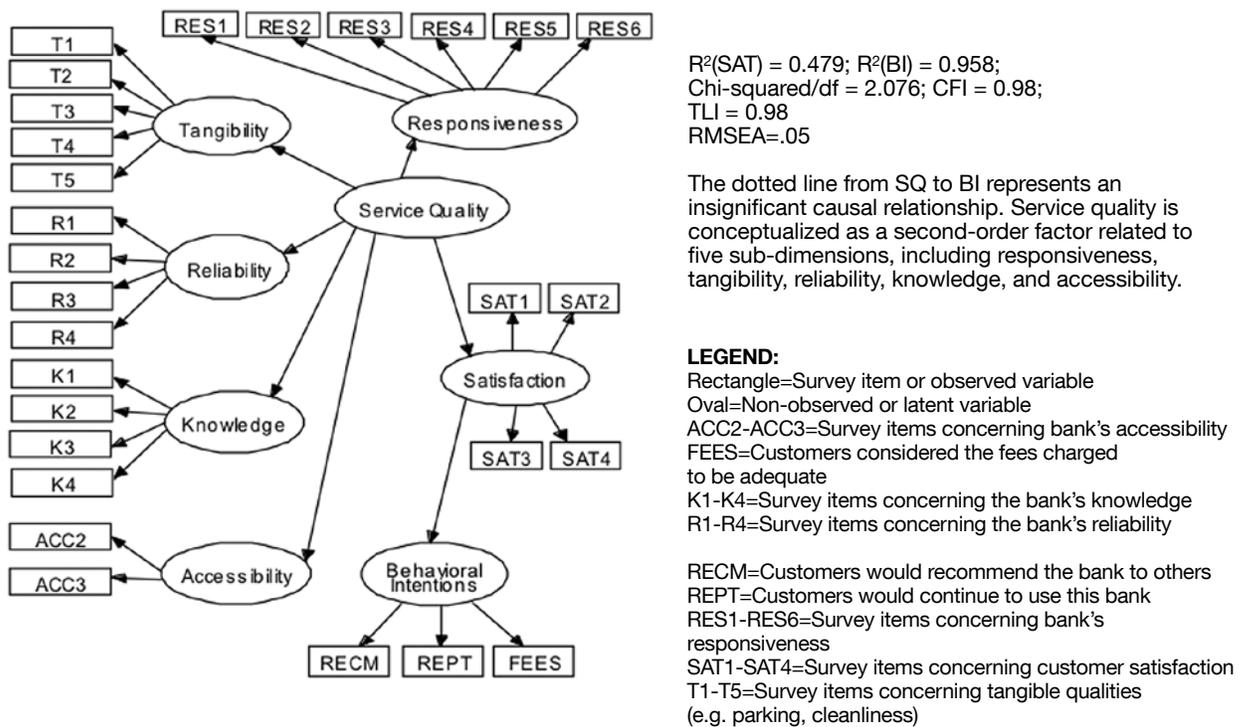


Figure 2: Retail banking industry findings as illustrated in Amos

Next, using IBM SPSS Statistics Base, we:

- Entered the results from the paper surveys
- Used descriptive statistics to identify outliers that may result from possible data entry errors
- Split the survey data into two parts and ran an exploratory factor analysis on one dataset to determine the underlying factor structures (in other words, we explored which observed variables were associated with each latent variable or construct, such as tangibility)

Finally, using the results of our exploratory factor analysis, we leveraged IBM SPSS Amos' user-friendly interface to run a confirmatory factor analysis, using the second dataset to examine the reliability and validity of the measurement model without identifying the directional relationship among the factors (i.e., where all factors are related, graphically depicted with double-headed arrows). We then drew on our hypothesized models and examined the underlying directional relationships among service quality, satisfaction, and behavioral intentions. In Figure 2, these relationships are connected with single-headed arrows.

Since the fit indices we obtained were acceptable, we knew we had identified a model that fit our empirical data (i.e., both the comparative

fit index (CFI) and the Tucker-Lewis index (TLI) were greater than .95, and the root mean square error of approximation (RMSEA) was smaller than .08). This model allowed us to graphically view the inferred causal relationships between service quality, satisfaction, and behavioral intentions.

Research results

Our retail banking research (Olorunniwo and Hsu, 2006) revealed that the underlying dimensions of service quality were responsiveness, tangibility, reliability, knowledge and accessibility. The outcome of the confirmatory factor analysis suggests that all five dimensions contribute significantly to customer perceptions of service quality, and that the level of satisfaction resulting from service quality impacts behavioral intentions.

In our study of the lodging industry (Olorunniwo, Hsu, and Udo, 2006), we empirically identified four underlying dimensions of service quality: tangibility, recovery, responsiveness and knowledge.

We also found that satisfaction fully mediates the influence of service quality on behavioral intentions in retail banking but only partially mediates it in the lodging industry. A mediating relationship is one in which the path relating one variable to another is impacted by a third variable (e.g., service quality leads to satisfaction which drives behavioral intentions).

The graph in Figure 2 was generated using IBM SPSS Amos and illustrates the findings of the retail banking study. The squares represent the questions, or items, asked during the survey phase (e.g., item T1 asked “Is the parking adequate?”) and are also known as observed variables. The ovals represent the latent (non-observed) variables, also described as constructs or dimensions. It is important to note that the ovals are not actual variables. Rather, they are factors defined by the observed variables (rectangles). It is worth noting that, for the purpose of simplicity, error measurement terms are not shown in Figure 2.

Based on these results, it appears that this model could be generalized to other mass services businesses including retailing, wholesaling, schools, and long-distance trucking (although the definition of service quality will most likely differ for each of these businesses).

Some researchers have suggested that the universal conceptualization of the service quality construct may be futile (Levitt 1981, Lovelock 1984), while others argue that service quality is either industry- or context-specific (Babakus and Boiler 1992, Cronbach 1986). However, we contend that a service typology for measuring service quality can be developed by those in service industries. By verifying models empirically using IBM SPSS Statistics and then IBM SPSS Amos, service firms will be able to identify the relationships between service quality and other important constructs such as behavior intentions or perceived value.

Benefits to service firms

Adoption of SEM using IBM SPSS Amos could provide significant benefits for service firms. In the United States, where the service sector accounts for over 80 percent of the gross domestic product, managers may be able to recognize similarities in the relationship between service quality, satisfaction, and behavioral intentions (and other relevant variables such as customer's perceived value) in their own service category.

Service managers in the mass service category in particular are advised to develop operational and marketing strategies that focus on the service quality dimensions that can enhance customer satisfaction and, in turn, foster positive behavioral intentions.

In general, building more precise models allows marketers to make better decisions, saving money in the long term. Building SEM models in IBM SPSS Amos allows marketers to identify previously unknown relationships between latent variables and uncover more meaningful insights.

Benefits of CFA and SEM over EFA and regression

There is a fundamental difference between EFA and CFA. "EFA is an exploratory analysis because no a priori restrictions are placed on the pattern of relationships between the observed measures and the latent variables" while "in CFA, the researcher must specify in advance several key aspects of the factor model such as the number of factors and patterns of indicator-factor loadings" (Brown, 2006; p. 20). Because results obtained from EFA alone are exploratory in nature and can be unreliable, using CFA can help avoid costly mistakes.

Unlike IBM SPSS Amos and SEM, which allow researchers to examine more than one regression equation/relationship at one time, regression analysis allows researchers to look at only one equation at a time. Since no factor exists alone, using SEM is more realistic. This approach also takes potential measurement errors into account, something that regression is incapable of doing. SEM is, therefore, an extension of, and not necessarily a replacement for, EFA and regression analysis.

About the author

Maxwell K. Hsu (DBA, Louisiana Tech University, 1999) is Associate Professor of Marketing at the University of Wisconsin-Whitewater. His work has appeared in more than a dozen scholarly journals such as the *Applied Economics Letters*, *Information & Management*, *International Journal of Advertising*, *Journal of International Marketing*, *Journal of Nonprofit and Public Sector Marketing*, *Journal of Services Marketing*, *Managing Service Quality Marketing*, and other publications. One of Hsu's recent papers, "A Typology Analysis of Service Quality, Customer Satisfaction and Behavioral Intentions in Mass Services," co-authored with Festus Olorunniwo, PhD, and published in *MSQ*, Vol. 16, No. 2, was nominated as a finalist for *MSQ's* 2006 Highly Commended Paper Award. Hsu's research interests include diffusion of innovations, international marketing, services marketing, and information technology. Hsu is the corresponding author and can be contacted at hsum@uww.edu.

Acknowledgements

Special acknowledgements go to Sean Dwyer, PhD, for his constructive comments, and to the SPSS Inc. staff involved in the review, editing, and design of this paper.

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May 2010
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