



Predicting and explaining patronage behavior toward web and traditional stores using neural networks: a comparative analysis with logistic regression

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Abstract

Web stores, where buyers place orders over the Internet, have emerged to become a prevalent sales channel. In this research, we developed neural network models, which are known for their capability of modeling noncompensatory decision processes, to predict and explain consumer choice between web and traditional stores. We conducted an empirical survey for the study. Specifically, in the survey, the purchases of six distinct products from web stores were contrasted with the corresponding purchases from traditional stores. The respondents' perceived attribute performance was then used to predict the customers' channel choice between web and traditional stores. We have provided statistical evidence that neural networks significantly outperform logistic regression models for most of the surveyed products in terms of the predicting power. To gain more insights from the models, we have identified the factors that have significant impact on customers' channel attitude through sensitivity analyses on the neural networks. The results indicate that the influential factors are different across product categories. The findings of the study offer a number of implications for channel management.

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1. Introduction

The Internet is changing the way firms market and distribute their products to customers. Despite the fact that Internet bubble in 2002 was accompanied by the

shutdown of many Internet companies, sales over the Internet have continued to increase. According to Forrester Research [5], online sales in the United States grew 51% to approximately US\$26 billion just in the third quarter of 2003. Seemingly, web stores, where buyers place orders over the Internet, have emerged to become a prevalent sales channel. While more and more companies are engaging in online sales, there are speculations of an uncertain future of e-commerce due to the fact that the total amount of

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online sales is still a small portion of total retail sales. According to the U.S. Census Bureau [32], online sales accounted for only 1.6% of all retail sales in 2003. Will web stores prevail in future?

Apparently, the success of a web store as a viable sales channel is dependent upon whether it helps to attain a significant amount of potential customers who are willing to make purchases online. Therefore, understanding consumers' attitude toward web stores appears crucial in the business-to-consumer (B2C) e-business context. The questions are: What are the predictors of consumers' online buying behavior? Are we able to accurately predict and explain consumers' channel choice between web and traditional stores? As indicated by Chiang et al. [6], the answers to the questions provide significant implications for firms who want to expand their market potential by tapping into customer segments that otherwise would not buy, or for suppliers who are strategically contemplating multi-channel distributions.

Although there are some recent papers (e.g., Refs. [2,14]) that provide insights into customers' channel choice through analytical models and game theories, most studies seeking to address the above questions are based on empirical surveys and statistical analyses. For example, Liang and Huang [23] tried to explain the acceptance of online buying using consumer perceptions of transaction-costs associated with shopping, uncertainty and asset. The authors provided evidence that, in general, customers prefer traditional markets to the web stores and different products have different customer acceptance levels on the electronic market. Szymanski and Hise [30] measured "satisfaction" with the Internet-shopping experience in a study of antecedents of e-satisfaction. They found that greater satisfaction with online shopping is positively correlated with consumer perceptions of the convenience, product offerings, product information, site design and financial security of web stores relative to traditional stores. Degeratu et al. [7] studied the decisions of individuals to use Peapod online grocery shopping. They gathered a sample of Peapod online buyers and a matching sample of individuals who did their grocery shopping in traditional supermarkets. As part of their broader study of brand preferences, their random utility model specified an indirect utility

function for online versus offline shopping that depended only on the income of individuals. Bellman et al. [4] analyzed the responses of over 8000 participants in the Wharton Virtual Test Market who completed an initial survey about online buying and attitudes. Their logistic regression model indicated that online experience (i.e., web browsing) was the dominant predictor of whether or not a respondent had ever bought anything online. Kwak et al. [22] surveyed chatroom participants via email to discover whether these consumers had bought any of nine products online. They showed that four broad independent constructs (attitudes toward the Internet, experience with the Internet, demographics, and personality type) could explain Internet purchases of those products with logistic regressions.

All of the above empirical studies are forms of what Urban and Hauser [33] called "preference regressions" and they all share the same a priori assumption that the process of consumers' channel evaluation is linear compensatory. Specifically, those models assume that any shortfall in one channel attribute (e.g., immediate possession of a product) can be compensated by enhancements of other channel attributes (e.g., price). Although linear compensatory models, which can be easily estimated by statistical methods (such as analysis of variance procedures, logistic regression, and discriminant analysis), are widely used to predict consumer behavior for their ability to imitate consumer choice processes, challenges regarding their reliability have been levied by many research studies. It has been demonstrated that consumers might judge alternatives based on only one or a few attributes, and therefore the process of evaluation might not always be compensatory [18,24]. For instance, in the case of channel choice, the consumers' concern may just be immediate possession of a product. This concern may not be compensated by the enhancement of other channel attributes, such as price (consumers do not mind paying more to possess a product immediately from another channel). Johnson et al. [18] suggested that compensatory statistical models may not be able to capture noncompensatory decision rules and, consequently, may be unreliable.

To the best of our knowledge, there are no research studies that have used noncompensatory

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