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The possibility of using search traffic information to explore consumer product attitudes and forecast consumer preference

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ABSTRACT

In recent years, many researchers have devoted their attention to using search traffic information gathered from Google Insights to carry out consumer attitude research. The purpose of this study is to assess the effectiveness of using search traffic information to analyze actual consumer attitudes regarding a product. By comparing the results of conventional survey-based attitude research with the results of search traffic information, this study reveals that search traffic information indicates consumers' level of interest regarding a product, the product attributes that they are considering, and the importance of each attribute to them. Also, it demonstrates the potential benefits of search traffic analysis, which can be useful for forecasting consumer preferences regarding products. Focusing on the Prius, a hybrid car, this study shows that search traffic information serves as an accurate indicator of consumer attitudes, and even succeeds in identifying consumers' hidden attitudes toward the Prius, which can be explained by cognitive dissonance theory. Finally, this study utilizes search traffic information to forecast changes in consumer attitudes and to develop an econometric model of consumer demand for the Prius by incorporating environmental variables such as the WTI (West Texas Intermediate) price. This study concludes that search traffic information offers new potential advantages, in that it not only overcomes the limitations imposed by the high cost of conducting surveys, in terms of money and time, but also helps to reduce the distortions caused by conscious or unconscious errors committed by survey respondents.

1. Introduction

In recent years, intense market competition has accelerated the launching of new products that are based on new technologies. Competitive technological developments have shortened product lifecycles, and consequently, have reduced the probability of commercial success enjoyed by particular technologies. It is necessary for companies to develop new products and to offer new features and functions that fulfill consumers' needs. For this reason, companies have been conducting consumer research, as they cannot afford to remain complacent about the technological achievements to be gained from their research and development (R&D) activities. The primary purpose of consumer research is to understand consumer attitudes toward a new product or technology and identify which product attributes are important in determining the consumer's attitude [1,2]. This type of research is predicated on the use of the survey method, which not only involves high costs in terms of money and time, but also fails to overcome the inherent limitations of sample-based research and psychological problems such as cognitive dissonance [3].

In this study, by using search traffic information, we identify consumers' attitudes toward a product and the key product attributes that they consider important. Search traffic

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information can be a direct indicator of consumer behavior, providing macroscopic information proximate to the total population. Search traffic information obtained from Google Insights is particularly economically advantageous, in terms of the expense and time involved, and enables us to analyze hidden consumer intentions.

With the advent of the era of big data, many attempts have been made to analyze the abundant information generated by the actual behaviors of consumers. This study suggests useful methods for discovering consumer attitudes and key product attributes by using search traffic information. More specifically, by focusing on a new technological product, we demonstrate the credibility of search traffic information in studying consumer attitudes toward a product and its key product attributes. We do so by comparing results based on search traffic information with the results from conventional survey-based attitude research. Furthermore, we forecast future changes in consumers' attitudes and key product attributes based on search traffic information.

2. Theoretical background and hypotheses

2.1. Consumer research using search traffic

People have individual attitudes toward nearly everything, including religion, politics, clothing, music, and food [4]. Consumer attitudes can be defined as the sustained evaluations, feelings, and tendencies that consumers exhibit regarding objects or ideas. Consumer attitudes, consisting of the sum of weighted values of each respective attribute of a product, play an important role in the actual behavior of consumers, and therefore, determine whether they will adopt a product. Consumer attitudes are difficult to change once they have become established, and therefore, companies generally opt to customize their products to suit existing consumer attitudes, rather than attempting to change these attitudes [4].

Consumers perceive products as bundles of product attributes with different respective capabilities, and pay attention to the attributes that deliver the advantages they desire. Sometimes the market for a product becomes subdivided according to special attributes that are regarded as important by particular groups of consumers [5]. With this in mind, companies conduct consumer research, based on which they design product attributes to correspond to the respective weighted values involved in consumer attitudes. Representative works of research on consumer attitudes and preferences include studies based on the Delphi method, WTP (willingness-to-pay), and consumer surveys [6,7]. However, consumer survey research is hampered by sampling issues, as well as by psychological issues such as cognitive dissonance. Tancer [3] has questioned why there is a discrepancy between results obtained from conventional consumer survey research and the results based on online search data. He has revealed the presence of cognitive dissonance among survey participants who wish to present themselves in a more positive light, which leads to differences between survey results and online search results.

With the advent of the era of big data, many researchers have begun actively engaging in studies that address the enormous masses of online information that are currently available, such as search traffic information and social network service information. Ginsberg et al. [8] have presented a model for estimating the current level of influenza based on the analysis of data acquired from past queries made through Google's search engine. Their paper describes a computer model that was able to convert unprocessed search data into accurate forecasts of the activity of the influenza virus between one and two weeks in advance of conventional reports published by the Centers for Disease Control and Prevention (CDC). This work precipitated an awareness of the diverse potential of forecasting using search traffic. In addition, Bollen et al. [9] have investigated whether measurements of collective mood states derived from large-scale data from Twitter feeds correlate to the values of the Dow Jones Industrial Average (DJIA) over time. Using mood tracking tools, they find that public mood states can be predictive of changes in DJIA closing values. Their results indicate that the accuracy of DJIA predictions can be significantly improved by the inclusion of specific public mood dimensions.

Choi and Varian [10] provide a strong illustration of the possibilities of demand forecasting enabled by search traffic data, which our present study also seeks to demonstrate. They find that Google Trends is able to enhance forecasting of current economic activity over time. Their explanation of economic activities covers categories such as car sales, house sales, retail, and travel. Choi and Varian claim that there are cases in which it is useful to forecast conditions in the present rather than in the future, since this assists in identifying "turning points" in economic time. For example, if there has been an increase in searches for "real estate agencies" in a particular location, this can point to a rise in housing sales in the location in the near future. Since their paper focuses on corporate brands in its analysis, however, its objective differs from that of our present study, which seeks to observe consumer behavior regarding new technologies. Goel et al. [11] show that what consumers are searching for online can also predict their collective future behavior with regard to feature films, first-month sales of video games, and the ranks of songs on the Billboard Hot 100 chart. They find that search counts are highly predictive of future outcomes in all of these cases. Moreover, search counts generally boost the performance of baseline models and their fit with other publicly available data.

As demonstrated in the study by Choi and Varian [10], search traffic can be employed to forecast demand, but can also be utilized in entirely different fields, such as in forecasting election results in politics or stock prices in finance. A study by Lui et al. [12] offers an example of such potential uses of search traffic. Their study examined the possibility of forecasting the success of candidates in the U.S. congressional elections in 2008 and 2010 by using an analysis of search traffic of Google Trends. However, the study concludes that this is not yet a significant method for forecasting election outcomes. Da and Engelberg [13] propose a new and direct measure of investor attention, using search frequency in Google's Search Volume Index (SVI). By studying a sample of Russell 3000 stocks from 2004 to 2008, they find that SVI is correlated with (but different from) existing proxies of investor attention, captures investor attention in a more timely fashion, and likely measures the attention of retail investors. An increase in SVI predicts higher stock prices in the following two weeks, and an eventual price reversal within the year. Jun [14] has conducted comparative

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