Implementing second-order CFA model for the factorial validity of brand equity

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Abstract: The purpose of this study was to test the implementation of a second-order CFA model for the factorial validity of Aaker’s consumer-based brand equity framework. To test the proposed theoretical model 186 data sets generated through a standardized online survey were evaluated. The data was analyzed using structural equation modeling with AMOS 21.0 software. The results demonstrated that the higher order CFA model for consumer-based brand equity did not have an acceptable goodness-of-fit. This study also offers suggestions for further research in the field of brand equity management.

1. Introduction

Brand managers are continually under pressure to demonstrate the impact of marketing activities, and this has renewed interest in measures of marketing and brand performance (Simon and Sullivan, 1993). The volume of sales and profit provide partial indicators of marketing performance. That is mainly due to their historical orientation and typically, a short-term horizon (Lane and Jacobson, 1995). However, intangible, market-based assets provide a better indication of marketing performance, reconciling short- and long-term performance (Styles and Ambler, 1995). Market-based assets also act as a bridge between marketing and shareholder value (Srivastava and Shocker, 1991). Moreover, competitors don’t have full access to financial and physical assets, making intangible assets a more sustainable competitive advantage (Morgan and Hunt, 1994).

This study provides a better understanding of the statistical measurement of brand equity. It tested the factorial validity of consumer-based brand equity scale using a second-order CFA model. This research objective is relevant for companies in general and for brand management in particular. The study established whether:

1. It is possible to validate a brand equity measurement model by using a high-order factorial validity;

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2. a second-order CFA model for factorial validity of brand equity has a better goodness-of-fit than a lower-order model.

This paper is organized as follows. The first section presents a literature review and findings from previous brand equity research. The second section provides a description of the structural equation modeling used in this article, and the hypothesized model. The third section presents the methodology, the data sources, as well as the model estimations. The last section provides a summary and a discussion of the results.

2. Brand equity

Brand equity has been the subject of interest and academic investigation for over a decade. According to Srivastava and Shocker, brand equity can be defined as “a set of associations and behaviors on the part of a brand’s consumers, channel members and parent corporation that enables a brand to earn greater volume or greater margins than it could without the brand name and, in addition, provides a strong, sustainable and differential advantage” (Srivastava and Shocker, 1991).

In existing literature, brand equity has been discussed from two main perspectives. Some authors focus on the financial perspective of brand equity, while others on the customer-based perspective. The first perspective considers the financial value brand equity creates for companies and is often referred to as firm-based brand equity (FBBE). The second perspective considers brand equity to be the driving force of increased market share and profitability of brands, and it is based on the market’s perceptions (consumer-based brand equity - CBBE)(Christodoulides and de Chernatony, 2010).

Consumer-based brand equity can be defined as "the consumer’s different response between a focal brand and an unbranded product when both have the same level of marketing stimuli and product attributes" (Yoo and Donthu, 2001). In other words, CBBE is a concept that predicts that individuals will react more favourably toward a branded product than they would react toward a generic product in the same category (Keller, 1993).

Researchers have been measuring consumer-based brand equity using such dimensions as brand awareness, perceived quality, brand loyalty, and brand association. Aaker defines brand awareness as the "strength of a brand’s presence in the consumers’ mind" (Aaker, 1991). In other words, brand awareness refers to an individual’s ability to recognize or recall a brand in its product category (Pappu et al., 2005). Brand association can be defined as "whatever that consumer relates to brand. It can include consumer image-making, profile of the product, consumer’s conditions, corporate awareness, brand characteristics, signs and symbols" (Aaker and Joachimsthaler, 2000). However, empirical evidence indicates that brand awareness and brand association can be combined into a single dimension named brand awareness/association Yoo and Donthu (2001). Perceived quality can be understood as "the overall preference or superiority, quite the same as approach assessment" (Netemeyer et al., 2004). Brand loyalty is defined as "a deeply held commitment to rebuy or repatronise a preferred product or service consistently in the future, despite situational influences and marketing efforts having the potential to cause switching behavior" (Oliver, 1997).
There are three competing frameworks for empirical measurement of consumer-based brand equity. They include Aaker’s framework, which is a managerial view of brand equity; Keller’s psychological, memory-based interpretation of brand equity; and Erdem and Swait’s framework based on information economics and signalling theory (Menictas et al., 2012). This study used the framework introduced by Aaker, using brand awareness, brand associations, perceived quality, and brand loyalty as CBBE dimensions.

2.1. Structural equation modeling

First and second-order factorial validity

Structural equation modeling (SEM) is a statistical technique that applies a confirmatory approach to the structural analysis of a theory. The theory represents causal processes which generate observations on multiple variables (Bentler, 2006). The hypothesized model is tested statistically in a simultaneous analysis of the whole system of variables to determine the extent to which it fits with the collected data. The model supports the plausibility of postulated relations among variables if goodness-of-fit is adequate. In case of poor fit, the tenability of such relations is rejected (Byrne, 2010).

The best-known statistical procedure for exploring relations between sets of observed and latent variables is factor analysis. Covariation among a set of observed variables is used to identify underlying latent constructs. There are two basic types of factor analysis: exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) (Byrne, 2010). For the purposes of this study only CFA was considered.

Confirmatory factor analysis is used when the researcher has theoretical or empirical knowledge of the underlying latent variable structure. The researcher postulates relations between the observed measures and the underlying factors a priori and then tests the hypothesized structure statistically. A priori specification of the CFA model allows the specific items measures to load on their own postulated factors, but restricts their loadings on the remaining constructs to zero. The model is evaluated by statistical means to determine the its goodness-of-fit to the sample data.

Following the consumer-based brand equity framework introduced by Aaker (Fig. 1), this study used four factors (brand awareness, brand associations, perceived quality, and brand loyalty) which operated as independent variables; each could be considered to be one level, or one unidirectional arrow, away from the observed variables. Such factors are termed first-order factors.

In some cases the theory argues for a higher level factor that is considered accountable for the lower order factors. Although the model schematically portrayed in Fig. 2 has essentially the same first-order factor structure as the one shown in Fig. 1, it differs in that a higher order consumer-based brand equity (CBBE) factor is hypothesized as accounting for, or explaining, all variance and covariance related to the first-order factors. As such, CBBE is termed the second-order factor.

To determine whether a second-order factor represents the most appropriate factorial structure of consumer-based brand equity it was necessary to specify the model and empirically confirm its goodness-of-fit.
3. The hypothesized model

The CFA model to be tested in this study hypothesized a priori that (a) responses to the consumer-based brand equity scale can be explained by four first-order factors (brand awareness, brand associations, perceived quality, and brand loyalty) and one second-order factor (CBBE); (b) each indicator has a non-zero loading on the first-order factor it was designed to measure, while having zero loadings on the other three first-order factors; (c) error terms associated with each item are uncorrelated; and (d) covariation among the four first-order factors is explained fully by their regression on the second-order factor. A diagrammatic representation of this second-order model is presented in Fig. 3.

As suggested in literature, in an initial check of the hypothesized model, it is recommended to determine a priori the number of degrees of freedom associated with the model under test to ascertain its model identification status. In relation to the model shown in Fig. 3, there are 136 pieces of information contained in the covariance matrix, and 36 parameters to be estimated, thereby leaving 100 degrees of freedom. These include the following:

Variables (16): 16 observed and 25 unobserved

1. Observed variables (16): 16 CBBE items

Fig. 1. Conceptual framework of CBBE – first-order factors

Fig. 2. Conceptual framework of CBBE – second-order factor
2. Unobserved variables (25): 16 error terms, 4 first-order factors, 1 second-order factor, and 4 residual terms

3. Exogenous variables (21): 16 error terms, 1 second-order factor, and 4 residual terms

4. Endogenous variables (20): 16 observed variables and 4 first-order factors

Fixed parameters:

1. Weights (24): 16 error term regression paths (fixed to 1.0), 4 factor loadings (fixed to 1.0), and 4 residual regression paths (fixed to 1.0)

2. Variances: Second-order factor

Unlabeled parameters:

1. Weights (16): 16 factor loadings


4. Methodology

Sample and procedure  To examine whether the implementation of a second-order CFA model for the factorial validity of CBBE is feasible, data was collected using a standardized online survey. A link to the questionnaire was available online for two weeks, from 01 April 2013 to 15 April 2013. In total, 205 questionnaires were completed. As recommended in literature, data screening and detecting univariate outliers were performed (Carter et al., 2009), and non-valid questionnaires were excluded from the analysis, resulting in a total of 186 valid questionnaires. The survey was administered in Polish. To ensure that the original items were translated correctly, a back-translation process was employed (Craig and Douglas, 2000).

All questions in the survey were identical to those in the original version, except for the brand names. The items in this study were adapted from Yoo and Donthu’s

![Diagram](image)

Fig. 3. Hypothesized second-order model of factorial structure for the CBBE framework
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research (2001) and measured using a seven-point Likert scale, ranging from "strongly disagree" (1) to "strongly agree" (7). Brand awareness was measured using four items; brand associations was measured by four items; brand loyalty was measured using four items; finally, perceived quality was measured using four items.

Six different brands were used in this study, namely, Coca-Cola, Pepsi, H&M, Reserved, Nike, and Adidas. The selection was based on considerations regarding relevance and variance criteria.

Measurement procedures and results Reflective measurements were used to evaluate the conceptual model. Cronbach’s α coefficients were calculated and confirmatory factor analysis was performed to ensure the reliability and validity of the scales. Cronbach’s alpha coefficients ranged from 0.851 to 0.931 for the constructs used in the analysis. All of the items in each scale loaded on single factor, suggesting that CBBE constructs are unidimensional. All factor loadings exceed the 0.70 level, as suggested in literature (Byrne, 2010).

All independent and dependent latent variables were included in one single multifactorial CFA model in AMOS 21.0 software. The model demonstrated a poor goodness-of-fit. The Chi-square/df (cmin/df) value was 410.534, the comparative fit index (CFI) value was 0.864, the adjusted goodness-of-fit index (AGFI) value was 0.687, the Tucker-Lewis coefficient (TLI) was 0.837, and the root mean square error of approximation (RMSEA) value was 0.13. None of the given values reach the permitted threshold accepted in literature.

5. Summary

The consumer-based brand equity framework, introduced by Aaker and examined in this study, used four dimensions and was tested using a single second-order factor CFA model. The four scales used to measure the constructs achieved high levels of Cronbach’s α, proving to be valid and reliable. However, when a high order CFA was performed on the four constructs, the goodness-of-fit of the model was significantly poor. This suggests that measurements of consumer-based brand equity need improvement. Further research should focus on the core of the CBBE measurement. A new list of items should be elaborated and tested to eliminate cross-loadings and high covariances among the indicators. For a further confirmation of the scale and the multidimensionality of the consumer-based brand equity constructs, other brands and industries should be considered for the analyses.

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