
Original Article

Measuring CBBE across brand portfolios: Generalizability theory perspective

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Luming Wang

completed her PhD at the University of Alberta (Canada) in 2010. Her research interests include branding, brand equity and brand management, research methodology, Bayesian modeling, consumer choice modeling and international marketing.

Adam Finn

completed his PhD at the University of Illinois (Urbana, USA) in 1983. His research interests include marketing measurement, retailing and service assessment, new product management, retailing and service management, application of choice modeling to policy issues in marketing and the cultural industries.

ABSTRACT Existing consumer-based brand equity (CBBE) scales were developed to differentiate consumers. They cannot be reliably used to examine other objects such as brands and sub-brands within and across brand portfolios in a product category, due to much similarity among them. The multidimensional nature of CBBE (covering brand awareness, brand associations, brand loyalty, perceived quality and uniqueness) makes the brand portfolio CBBE measurement even more difficult. In order to fill this gap, we develop a new scale to better differentiate brands and sub-brands within and across brand portfolios and examine its psychometric performance at both the dimension and the item levels by using Multivariate Generalizability Theory. We collected CBBE data for soft drinks crossed with respondents for an empirical demonstration.

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INTRODUCTION

Brand equity has drawn widespread attention from both practitioners and academics since US advertising practitioners coined the term in the early 1980s.¹ Brand equity is viewed as the added value that a brand name endows upon a product as a result of the firm's marketing efforts and it comprises a large percentage of the total value of many firms. For example, it accounted for 61 per cent, 46 per cent and 37 per cent of the

total firm value in apparel, tobacco and food companies, respectively.² It has also been found to positively affect companies' future profits and long-term cash flow and is considered to be a sustainable competitive advantage.³

Researchers have defined brand equity from three major approaches and measured it accordingly: finance approach (for example, Simon and Sullivan⁴ and Mahajan *et al*⁵), economics approach (for example, Kamakura and Russell⁶ and Park and Srinivasan⁷), and psychology approach (for example, Aaker⁸ and Keller⁹). This study takes the psychology approach and examines consumer-based brand equity (hereafter, called CBBE), taking the

Correspondence: Luming Wang
University of Manitoba, 676 Drake Center, Winnipeg R3T 5V4, Canada
E-mail: wang4@cc.umanitoba.ca

perspective of consumers who are the most widely considered stakeholder group in the existing brand equity literature.

Numerous measures of CBBE (for example, Yoo and Donthu¹⁰ and Netemeyer *et al*¹¹) have been used since it was first conceptualized by Aaker⁸ and Keller.⁹ Aaker⁸ identified five components of brand equity as awareness, associations, perceived quality, loyalty and other proprietary assets such as patents and trademarks. Keller⁹ focused on brand knowledge, including awareness and unique favorable beliefs (or brand associations). More CBBE components such as willing to pay a price premium and uniqueness were later identified by CBBE researchers (for example, Netemeyer *et al*¹¹).

CBBE researchers have focused on the psychometric performance of their proposed scales and measured dimensions across consumers (for example, Yoo and Donthu¹⁰ and Netemeyer *et al*¹¹). But a reliable scale across consumers cannot guarantee the same level of reliability across other objects of measurement^{12–15} such as brands, products and firms. No scales have been developed to differentiate brands from each other, let alone a scale for a complex brand nesting structure such as brand portfolio.

Brand portfolio structures with both ‘superbrands’ (‘megabrands’/master brands) and a variety of sub-brands are commonly observed in food, drinks, paper, confectionery, media, retail, transport and so on. In soft drink product category, the Coca-Cola brand family has many sub-brands including Classic Coke, Diet Coke, Coke Zero, whereas the Pepsi brand family includes Original Pepsi, Diet Pepsi, Diet Pepsi Max along with other sub-brands. Moreover, in confectionery gum category, Wrigley’s has a large number of different sub-brands, with multiple and often competing sub-brands in each of the taste (Juicy Fruit, Wrigley’s Spearmint, Doublemint, Extra), breath-freshening (Winterfresh, Big Red, Eclipse), oral care (Orbit, Freedent), and wellness (Alpine, Airwaves) segments.¹⁶

Sub-brands do benefit from the halo effect of their master brands, and sub-brands within a portfolio have closer relationships with each other.¹⁷ These relationships have not been

accounted for in CBBE measurement literature, which still assumes brands are independent from each other. Given that brand portfolios are a commonly observed phenomenon and that sub-brands have been identified as a good strategy to leverage master brands’ equity, the lack of research in brand portfolio CBBE measurement may limit efforts to effectively and efficiently manage brand portfolios. Simultaneous measuring CBBE of both master brands and sub-brands will benefit brand portfolio management. Aaker¹⁸ argued that ‘Many organizations offer a number of brands across a variety of markets. If these brands are managed separately and independently or on an *ad hoc* basis, overall resource allocation among the brands may be less than optimal ... the strategic decisions made for the benefit of individual brands might in the end hurt the company’s overall performance’ (p. 102).

Developing reliable measures to examine the brand equity of a master brand and its sub-brands is an initial and essential step for brand portfolio management. The current research contributes to the CBBE measurement literature by proposing the first CBBE scale particularly developed for brand portfolios. Instead of assuming that all brands are independent from each other and ignoring the existence of brand portfolios (for example, Coke Zero and Diet Coke share the same master brand, Coca-Cola), we explicitly add another facet (that is, master brand) into the analysis and simultaneously examine both master brands and their sub-brands.

Brand portfolio in the current work is defined as a branded house rather than a house of brands.¹⁹ A branded house consists of a single master brand and its sub-brands. For example, Disney is the master brand and Disney World, Disney Land, Disney Picture and Disney DVD can be seen as sub-brands. In contrast, a house of brands contains independent, unconnected brands. Consumers may not realize that the independent and unconnected house of brands belong to the same company’s portfolio. For example, when consumers buy Folgers Coffee, most are probably unaware that Folgers is a division of Procter & Gamble.²⁰ The common ownership of the brands is generally not relevant to the purchase decision. Any image

activated by the name of brand portfolio is going to have little influence on consumers' attitude about the brands in a house of brands. In the current research, a master brand is conceptualized as a category or schema and sub-brands share the same or part of the master brand name.

METHODOLOGY

Generalizability Theory (hereafter, called GT), which is a statistical theory about the dependability of behavioral measurements,²¹ was originally developed by Cronbach *et al*²² and was recently updated by Brennan.²³ It liberalizes Classical Test Theory (CTT), in part through the application of analysis of variance procedures that focus on variance components. GT is arguably the most broadly defined measurement model currently in existence. It includes CTT as a special case.

In CTT, the observed score on any marketing scale X can be partitioned into two components by a single index r :

$$X_r = v_r + error \quad (1)$$

where v_r is the latent true score of respondent r and $error$ is a random error.

In GT, systematic errors are differentiated from the random error. For example, if X_{bri} is a score for respondent r about brand b on item i , the specification is

$$X_{bri} = v_r + (v_b + v_i + v_{br} + v_{ri} + v_{ib} + v_{bir,e}) \quad (2)$$

The sum of the terms in the parentheses is equal to $error$ in the CTT specification. Owing to the separation of different sources of variations, we can examine the reliability of the same scale when measuring different objects. For example, the reliabilities for scaling consumers versus brands can be calculated, respectively, as:

$$\text{Reliability (consumers)} = \frac{\sigma_r^2}{\sigma_{total}^2} \quad (3)$$

$$\text{Reliability (brands)} = \frac{\sigma_b^2}{\sigma_{total}^2} \quad (4)$$

σ_r^2 is the variance component for consumers; σ_b^2 is the variance component for brands; and σ_{total}^2 is the total variance.

Chapters 9 and 10 in Cronbach *et al*²² provided an extensive treatment of Multivariate Generalizability Theory (MGT), which is a multivariate application of GT. Other scholars such as Brennan²³ further explained MGT in their work. In MGT, each object of measurement (such as brands) has multiple universe scores and is associated with a condition of one or more fixed facets (such as dimensions).

The following model is developed for any two dimensions γ and z (such as brand awareness and brand associations). There is a different set of items nested within each dimension. It is not required that the number of items be the same for γ and z . The potential sources of variation for each dimension are brands (b), consumers (r), items (i), their interactions and error (e).

$$X_{bri,brand\ awareness} = \mu_{brand\ awareness} + v_b + v_r + v_i + v_{br} + v_{ri} + v_{ib} + v_{bir,e} \quad (5)$$

and

$$X_{bri,brand\ associations} = \mu_{brand\ associations} + \xi_b + \xi_r + \xi_i + \xi_{br} + \xi_{ri} + \xi_{ib} + \xi_{bir,e} \quad (6)$$

where $X_{bri,brand\ awareness}$ and $X_{bri,brand\ associations}$ are the responses for brand b from respondent r , $\mu_{brand\ awareness}$ and $\mu_{brand\ associations}$ are the universe mean scores (or grand means) for brand awareness and brand associations, and $v_b, v_r, v_i, v_{br}, v_{ri}, v_{ib}, v_{bir,e}, \xi_b, \xi_r, \xi_i, \xi_{br}, \xi_{ri}, \xi_{ib}$ and $\xi_{bir,e}$ are the random effects associated with brands, respondents, items and their interactions, respectively. The three-way interactions are confounded with any other sources of error.

EMPIRICAL STUDIES

We preliminarily selected 34 items from existing CBBE scales on five dimensions (brand awareness, brand associations, brand loyalty, perceived quality and uniqueness) based on Aaker⁸ and Keller,⁹ as most of the specific dimensions found in the literature can fit into five of their dimensions. All items were positively worded and used a seven-point Likert scale from 'strongly disagree' (one) to 'strongly agree' (seven).

Table 1: Brand equity measures – means

	<i>Classic Coke</i>	<i>Coke Zero</i>	<i>Diet Coke</i>	<i>Pepsi</i>	<i>Diet Pepsi</i>	<i>Diet Pepsi Max</i>
Brand awareness	6.02	5.34	5.26	5.50	5.00	3.64
Brand associations	5.51	4.82	4.71	5.15	4.52	4.06
Brand loyalty	4.98	4.25	4.00	4.60	3.94	3.84
Perceived quality	5.57	4.80	4.50	5.03	4.35	4.11
Uniqueness	4.58	4.33	3.79	4.15	3.65	3.79

Pretest

In February 2008, 44 undergraduate students at a North American university, who participated in exchange for course credit, responded to five randomly chosen brands (Pepsi, Sprite, Mountain Dew, Dr Pepper and Diet Pepsi). Brands, dimensions and items were fully randomized to avoid common order effects.

We used GENOVA²³ to estimate the variance components for each dimension, focusing on their implications for the scaling of brands. The results indicated that fewer items could provide sufficiently high reliability (that is, above 0.95 for G-coefficient when scaling brands). Therefore, we deleted items where brands accounted for too small a proportion of total variance.¹⁵ We ended up with 25 items that differentiated well between brands (Appendix).

Primary study

Fully crossed brands-by-respondents data were collected in 2008 from 254 North American undergraduate students, who received course credit for their participation. The students evaluated six soft drink brands (that is, Classic Coke, Diet Coke, Coke Zero, Pepsi, Diet Pepsi and Diet Pepsi Max). The first three are with master brand Coca-Cola and the last three are with master brand Pepsi. The brand evaluation instrument consisted of 25 items capturing the five dimensions (that is, brand awareness, brand associations, brand loyalty, perceived quality and uniqueness). These items were drawn from existing scales as identified in the Appendix. All items were positively worded and used a seven-point Likert scale from ‘strongly disagree’ (one) to ‘strongly agree’ (seven).

Brand results

Table 1 reports the observed brand means for each CBBE dimension. As expected, Classic Coke has the highest means on all dimensions. Pepsi is the next except for uniqueness. Coke Zero has a larger value for uniqueness than Pepsi. Diet Pepsi and Diet Pepsi Max have the lowest means across dimensions.

Variance components analysis

We use mGENOVA to do an MGT analysis to estimate the variance components for each of the five dimensions. Sub-brands are nested within their master brands and estimates of the variance components are for 11 sources of variability. In the following notation, ‘:’ represents ‘nested within’. The 11 sources of variation are master brand (M), sub-brand nested within the master brand (B:M), person (P), item (I), master brand by person (MP), master brand by item (MI), sub-brand by person nested within master brand (BP: M), sub-brand by item nested within master brand (BI:M), person by item (PI), master brand by person by item (MPI) and sub-brand by person by item nested within master brand (BPI: M). Estimates are reported in Table 2. Table 3 reports the total variances and the percentages of variance due to the 11 sources to facilitate comparisons across dimensions.

There is considerable variation in the total variances observed for different dimensions. The lowest level of the total variance is for brand loyalty (2.219). The highest level occurs with brand awareness (4.471). To make the comparison easier, we will discuss the proportions instead of the absolute values of the variance components in more detail.

There are substantial differences in the proportions of variance due to the 11 sources of

Table 2: Brand portfolio brand equity – variance components

	Variance components										
	<i>M</i>	<i>B:M</i>	<i>P</i>	<i>I</i>	<i>MP</i>	<i>MI</i>	<i>BP:M</i>	<i>BI:M</i>	<i>PI</i>	<i>MPI</i>	<i>BPI:M</i>
Brand awareness	0.000	1.643	0.228	0.391	0.000	0.024	0.757	0.195	0.209	0.017	1.007
Brand associations	0.000	0.516	0.213	0.106	0.074	0.000	0.422	0.167	0.373	0.000	0.871
Brand loyalty	0.000	0.317	0.423	0.057	0.164	0.000	0.678	0.010	0.072	0.000	0.478
Perceived quality	0.000	0.444	0.425	0.012	0.165	0.006	0.595	0.006	0.088	0.002	0.476
Uniqueness	0.043	0.101	0.528	0.001	0.138	0.000	0.821	0.021	0.041	0.000	0.584

Table 3: Brand portfolio brand equity – variance components (total variance and percentage)

	Variance components											
	<i>M</i>	<i>B:M</i>	<i>P</i>	<i>I</i>	<i>MP</i>	<i>MI</i>	<i>BP:M</i>	<i>BI:M</i>	<i>PI</i>	<i>MPI</i>	<i>BPI:M</i>	<i>Total</i>
Brand awareness	0.0	36.7	5.1	8.7	0.0	0.5	16.9	4.4	4.7	0.4	22.5	4.471
Brand associations	0.0	18.8	7.8	3.9	2.7	0.0	15.4	6.1	13.6	0.0	31.8	2.742
Brand loyalty	0.0	14.4	19.2	2.6	7.5	0.0	30.8	0.5	3.3	0.0	21.7	2.199
Perceived quality	0.0	20.0	19.2	0.5	7.4	0.3	26.8	0.3	4.0	0.1	21.5	2.219
Uniqueness	1.9	4.4	23.2	0.0	6.1	0.0	36.0	0.9	1.8	0.0	25.6	2.278

variability for different dimensions. Some interesting results are: (i) the proportions of variance owing to master brands (*M*) for all dimensions are about zero except for uniqueness; (ii) the proportions of variance owing to sub-brands nested within master brands (*B:M*) are relatively large; (iii) the proportions of variance owing to the interaction between sub-brands and persons nested within master brands (*BP:M*) are quite big; (iv) the proportions of variance owing to the interaction between master brands and persons (*MP*) are relative small; (v) the proportions of variance owing to persons (*P*) are generally substantial; and (vi) the proportions of variance owing to items (*I*) and the interactions of item and other sources of variability are less substantial.

Several observations can be made from the MGT study. First, uniqueness plays a bigger role in differentiating master brands from each other than other dimensions, which is consistent with the marketing strategy research suggesting that creating uniqueness or difference from competitors is the only robust strategy (for example, Kotler²⁴). Second, the scale works pretty well in terms of differentiating sub-brands from each other within brand portfolios. Therefore, it can be used to evaluate and monitor sub-brands' CBBE performance across time.

Third, within brand portfolios, consumers can be grouped by their evaluations of sub-brands. Consumers apparently have their own favorites. This may suggest that soft drink market is segmentable more at the sub-brand level (big *BP:M* variance components) than at the master brand level (small *MP* variance components). It also shows some evidence that the positioning of different sub-brands within both Coca-Cola and Pepsi families is pretty successful. At last, there are big individual differences and items are in general exchangeable within dimensions.

DISCUSSION AND CONTRIBUTION

The brand portfolios of consumer packaged-goods companies (such as Heinz, Sara Lee and Kraft) have become supersizes and maintaining the economic health of portfolio has become a hot topic in brand portfolio management. Brand equity of brand portfolios as a sustainable competitive advantage has drawn much attention from both academics and practitioners. Both the finance and the economics approaches to brand equity are satisfactory in terms of objectivity and managerial relevance. However, an indispensable link and the real source of brand equity, consumers, have been left out.

As an important tool to track the value of brands, CBBE has been widely used by managers

and researchers. Multiple scales have been developed (for example, Yoo and Donthu¹⁰ and Netemeyer *et al*¹¹) to scale consumers. However, no scale has ever been developed to measure brands and brand portfolios, partly owing to the complex nesting relationship between master brands and their sub-brands. Thus, the lack of a CBBE scale for measuring brand portfolios may limit efforts to effectively and efficiently manage brand portfolios.

The current research is trying to fill the gap. An advanced testing theory, the Generalizability Theory, has been introduced to examine the CBBE of brand portfolios and their brands. We choose to use a multidimensional scale including brand awareness, brand associations, brand loyalty, perceived quality and uniqueness to measure two soft drink brand portfolios (that is, Coca-cola and Pepsi). We find that the performance of the scale does vary by dimension and the level of brand portfolio (that is, master brand and sub-brand). Specifically, from a scale development perspective, uniqueness can be a far more useful tool to differentiate master brands from each other than other dimensions. Moreover, a soft drink market is more segmentable at the sub-brand level within brand portfolios rather than at the brand portfolio level. Consumers do not perceive too much difference between Coca-Cola family and Pepsi family in terms of CBBE, but within each brand portfolio, big differences among sub-brands are identified. At last, the dimensions of the scale behave well in terms of psychometric performance.

With the insight provided by the current research, managers and researchers can have a better idea of which dimensions can better scale brands at which level, the segmentability of soft drink market and the psychometric performance of each dimension. Examining the brand equity of a master brand and its sub-brands is an initial and essential step to efficient and effective brand portfolio management. Our research contributes to the literature by examining a never-touched area and measuring brands within and across brand portfolios simultaneously and jointly. It has potential to be used to avoid the pitfalls such as less optimal overall resource allocation among

brands, which may benefit individual brands but in the end hurt the company's overall performance. The information provided by the current research may also serve managerial goals such as (i) to benchmark their brands against the competition across brand portfolios, (ii) to identify aspects that are in need of improvement²⁵ within brand portfolios, and (iii) to help managers interpret their past marketing performance and to design their future marketing programs²⁶ for both master brands and sub-brands. The scale can be, as well, used to monitor CBBE of the brand portfolios and results can be compared with those from other brand equity measurement approaches (that is, finance and economics approaches) to identify the existence of inconsistency and investigate the reason. It helps managers precisely monitor the response from the consumer side on their brand marketing moves, the crucial step leading to the success of any marketing program, and facilitates timely adjustments.

This research has some limitations that we plan to address in future research. The first limitation is that the small sample of brands in the current study may result in unstable estimates of brand equity. Studies including more brands would be warranted before drawing any definitive conclusions. It will likely be necessary to switch to fractional factorial designs instead of the fully crossed designs employed here when collecting data for substantially larger numbers of brands. Second, the student sample will be replaced by a more representative national sample in the future research. As we examine the methodological instead of substantive issue in the current research, we believe the student sample serves its purpose.

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APPENDIX

Table A1: Dimensions and items used

	<i>Items</i>	<i>Source</i>
Brand awareness	Have you heard of this brand?	Aaker ¹⁸
	I have an opinion about this brand.	
	I am aware of X.	Yoo and Donthu ¹⁰
	When I think of (product category), (brand name) is the brand that first comes to mind. (Brand name) is a brand of (product category) I am very familiar with.	Netemeyer <i>et al</i> ¹¹
Brand associations	I have a clear image of the type of person who would use the brand.	Aaker ¹⁸
	I can quickly recall the symbol or logo of X.	Yoo and Donthu ¹⁰
	X is a very good brand.	Villarejo-Ramos and Sanchez-Franco ²⁸
	X is a very nice brand.	
Brand loyalty	X is an extremely likeable brand.	
	I would buy the brand on the next opportunity.	Aaker ¹⁸
	I would recommend the product or service to others.	
	X would be my first choice.	Yoo and Donthu ¹⁰
Perceived quality	I will not buy other brands if X is available at the store.	
	The next time, I buy (product category), I intend to buy a (brand name) brand.	Netemeyer <i>et al</i> ¹¹
	The quality of this brand is very high (9-point agree/disagree scale).	Erdem and Swait ²⁷
	In terms of overall quality, I'd rate this brand as (measured on a 9-point scale with 1=low quality and 9=high quality).	
Uniqueness	I can always count on (brand name) brand of (product) for consistent high quality.	Netemeyer <i>et al</i> ¹¹
	The likelihood that X is reliable is very high. X is a quality leader within its category.	Villarejo-Ramos and Sanchez-Franco ²⁸
	This brand is different from competing brands.	Aaker ¹⁸
	(Brand name) is 'distinct' from other brands of (product).	Netemeyer <i>et al</i> ¹¹
	(Brand name) really stands out from other brands of (product).	
	(Brand name) is very different from other brands of (product).	
	(Brand name) is 'unique' from other brands of (product).	