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GDAŃSK UNIVERSITY OF TECHNOLOGY  
FACULTY OF MANAGEMENT AND ECONOMICS

# THE CONSUMER-BASED BRAND EQUITY INVENTORY: SCALE CONSTRUCT AND VALIDATION

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**GUT Faculty of Management and Economics**

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# The consumer-based brand equity inventory: scale construct and validation

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## ABSTRACT

The present study aims to meet the need for a refinement of the consumer-based brand equity scale and to address the limitations of the previous research on the subject. Based on previous measurements of brand equity, CBBE is conceptualized in this study as a four-dimensional model consisting of brand awareness, brand association, perceived quality, and brand loyalty. A sample of 1874 Polish consumers was used to test the proposed dimensions. To measure the construct, we used a combination of exploratory and confirmatory factor analyses employing structural equation modeling in 12 product categories and across 24 brands. Additionally, for the purpose of cross-validation, we tested the framework for the factorial invariance of instrument scores.

The results of our research support the hypothesized four-factor CBBE model. Moreover, the subscales designed to measure the construct operate equivalently across different product categories, which allows the meaningful comparison of scores and a wider empirical application.

**Keywords:** consumer-based brand equity; brand awareness; brand associations; perceived quality; brand loyalty

**JEL:** M30; M31; Y1

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## 1. Introduction

The concept of brand equity is a core marketing asset (Styles & Ambler, 1995) that induces a relationship that forms distinctive ties between companies and their audiences and that nurtures long-term buying behavior (Keller, 2013). The comprehension of the concept of brand equity and its growth increases competitive barriers and drives brand wealth (Yoo, Donthu, & Lee, 2000).

In spite of its academic prestige, the literature on brand equity is largely fragmented and inconclusive (Christodoulides & de Chernatony, 2010). A lack of agreement on which definition best describes this phenomenon has resulted in a proliferation of methodologies for measuring the concept (Christodoulides & de Chernatony, 2010). However, the authors in the literature agree on one common point: brand equity denotes the added value a brand brings to a product (Farquhar, 1990).

The measurement of brand equity has been tackled from two major perspectives. Some scholars have focused on the firm-based perspective of the construct (Simon & Sullivan, 1993), while others have emphasized consumer-based perceptions (Aaker, 1991; Keller, 1993; Yoo & Donthu, 2001). However, the dominant stream of the research has been based on the consumer-based approach, focusing on cognitive psychology and memory structures (Christodoulides & de Chernatony, 2010).

The operationalization of the consumer-based approach to measuring brand equity can be classified as direct or indirect (Christodoulides & de Chernatony, 2010). The direct approach attempts to capture the phenomenon directly by focusing on individuals' preferences or utilities. In contrast, the indirect approach captures brand equity through its demonstrable manifestations. In this article, we will focus on the latter approach.

Several different dimensions (e.g., brand awareness, brand associations, perceived quality, brand loyalty, perceived value, products' symbolic and functional utilities, trust, etc.) were used to indirectly capture brand equity by authors such as Lassar et al. (1995), Yoo and Donthu (2001), Vazquez et al. (2002), Washburn and Plank (2002), de Chernatony et al. (2004), Netemeyer et al. (2004), Pappu et al. (2005), Christodoulides et al. (2006), Koçak et al. (2007), Buil et al. (2008), and Ahmad and Butt (2012). However, among all the suggested frameworks, Aaker's (1991) construct of brand equity is still among the most frequently applied in marketing research.

Scholars have developed indicators to implement Aaker's brand equity framework in empirical studies (Yoo et al., 2000; Yoo & Donthu, 2001). Although some researchers have attempted to improve the measurement of brand equity, limitations remain. These limitations are relevant when using confirmatory statistics in the lack of consistency in the scale; the employment of a single construct to measure two distinctive dimensions, brand awareness and brand associations (Washburn & Plank, 2002); and the use of a single item to measure brand awareness (Pappu et al., 2005). To address these limitations, Buil et al. (2008) suggested a hybrid scale with the use of sub-dimensions to capture brand associations; However, such an approach necessitates the use of additional statistics (e.g., the imputation of composites or

establishment of a second-order factor); requires the implementation of additional factors in the model; and makes the survey task harder for the respondents (especially when testing several different constructs in one structural model). Therefore, this study aims to fulfill the need for the refinement of the scale and to address the limitations of previous research.

This article is organized as follows. The first section presents a literature review of the conceptual domain and previous measurements of consumer-based brand equity. In the second section, we provide a description of our research methodology. The third section presents the results of the study. Finally, the last section provides a summary and a discussion of our results. Research limitations and suggestions for further research are also included in this study.

## **2. Conceptual domain of consumer-based brand equity**

According to Aaker (1991, 15), the consumer's perspective on brand equity can be defined as "a set of brand assets and liabilities linked to a brand, its name and symbol that add to or subtract from the value provided by a product or service to a firm and/or to that firm's customers". An alternative notion of consumer-based brand equity (CBBE) was introduced by Keller (1993, 02), who defined "the differential effect of brand knowledge on consumer response to the marketing of the brand". Keller emphasized that brand equity should be captured in terms of brand awareness and in the strength, favorability and uniqueness of the brand associations that individuals hold in their memories.

To capture the concept of consumer-based brand equity, we draw on four of Aaker's five core brand equity dimensions: brand awareness, brand associations, perceived quality, and brand loyalty. The fifth dimension, other proprietary brand assets, is not included in the CBBE framework because it is not directly related to consumers, only to firms.

Brand awareness is defined as "the ability of a potential buyer to recognize or recall that a brand is a member of a certain product category" (Aaker, 1991, p. 61), reflecting the strength of the brand in the customer's mind (Aaker, 1996; Keller, 1993). Keller conceptualized this construct as consisting of brand recognition and brand recall. Brand recognition requires that consumers recognize a brand as one they have seen or heard of previously (Keller, 1993). Brand recall is related to consumers' ability to retrieve a brand from memory: for example, when the product's category or the needs fulfilled by that category are mentioned (Keller, 1993). Hence, in the present study, brand awareness is articulated as consisting of both brand recognition and brand recall.

The second dimension, brand associations, is defined by Aaker (1991, p. 109) as "anything linked to the memory of a brand". According to Keller (1993), brand associations are thought to contain "the meaning of the brand for consumers" and can derive from an extensive range of sources, varying according to their favorability, strength, and uniqueness. Moreover, those associations have difference levels of strength, and a bond to a brand tends to be stronger when it is based on frequent repetitions of stimulus or exposure than when it is

based on infrequent exposure (Aaker, 1991). In the current study, when developing the construct of brand associations, we focused on Aaker's (1991) recommendation that brand associations provide value to the consumer by providing individuals with reasons to purchase a brand and creating positive attitudes/feelings toward the brand among customers.

The third dimension, perceived quality, is defined as "the consumer's judgment about a product's overall excellence or superiority" (Zeithaml, 1988). According to Zeithaml (1988), the consumer's perception of quality has four main characteristics: (a) it is different from the objective or actual quality of the product; (b) it is an abstract conception, rather than a specific attribute of the product; (c) it is a global assessment that resembles attitude; and (d) it is a judgment made within a consumer's evoked set. As in the second dimension, perceived quality also delivers value by differentiating a brand from its competitors and providing the consumer with reasons to purchase it (Pappu et al., 2005).

Finally, Aaker (1991, p. 39) defines the fourth dimension, brand loyalty, as "the attachment that a customer has to a brand". In the literature, this construct has been conceptualized based on the consumer's behavioral perspective, focusing on product purchasing repetition (Ehrenberg, Goodhardt, & Barwise, 1990; Oliver, 1997) or on an attitudinal perspective, which emphasizes a personal commitment to a set of unique values related to the brand (Chaudhuri & Holbrook, 2001) and the tendency to be loyal to a brand, prioritizing the brand as a first choice for purchase (Yoo & Donthu, 2001).

### **3. Scale development**

#### *3.1. Best-Worst scale and expert item judging*

Prior to conducting our primary studies, we employed the Best-Worst scaling (BWS) method and expert item judging in the selection of the construct items.

To develop the list of items we used to capture the CBBE dimensions, we used the definitions of the constructs presented in the literature. An original pool of 43 items was generated and presented to two groups of 15 respondents. Each individual was presented with four sets of BWS tasks for each of the CBBE constructs (Lee, Soutar, & Louviere, 2008). Before each task, the respondents learned about what each dimension should capture. In each assignment, the respondents were asked to indicate which items were the best and worst representatives of each construct. The items with the lowest scores were not considered in further studies.

Three marketing professors with backgrounds in measurement and brand management then judged the remaining items for representativeness. This process resulted in 23 retained items with a minimum of 4 and a maximum of 7 indicators per latent variable.

#### *3.2. Study 1*

The purpose of this initial quantitative study was to refine the CBBE items derived from BWS and expert item judging and obtain initial estimates of their psychometric properties.

The data were collected online using the CAWI technique, which was first presented by a Polish market research institution. Only one subject was allowed to participate in the survey per computer.

Three product categories were chosen, and two brands were evaluated within each category. Product categories and brands with which Polish consumers were already familiar were chosen, as follows: (1) athletic shoes: Adidas and Nike; (2) clothing: H&M and Reserved; and (3) colas: Coca-Cola and Pepsi. The study used the same questionnaire items for all the brands. The only differences between the questionnaires were the brand names. The questionnaire was administered in Polish. A sample of 225 consumers participated in the study. Invalid and incomplete questionnaires were rejected, resulting in 206 valid questionnaires. The average age of respondents was 33 years, 24% had at least some college education, 50.5% were female, and the median monthly household income was in the 2500zł to 4500zł (~760 USD to ~1360 USD) range.

The items used during this stage of the research were measured using a seven-point Likert scale ranging from 1 for "strongly disagree" to 7 for "strongly agree" (Aaker, Kumar, & Day, 2007). Brand awareness was measured using seven items. Brand association was measured using six items. Perceived quality was measured using four items. Finally, brand loyalty was measured using six items.

To test for the reliability, dimensionality and validity of the new measures, multi-item scales were evaluated using exploratory and confirmatory techniques. To measure the initial reliability of the indicators, we employed Cronbach's alpha and exploratory factor analysis (EFA). The Cronbach's alpha values for all the constructs were above the 0.70 threshold (Hair Jr., Black, Babin, & Anderson, 2010). The alpha coefficients ranged from 0.87 to 0.91. To explore the dimensionality of each construct, an EFA was performed with Promax rotation and the maximum likelihood extraction method. The Kaiser-Meyer-Olkin measure of sampling adequacy test was 0.92. A total of four factors were extracted, and 69.21 per cent of the total variance was explained. The items did not load on single factors, suggesting a lack of unidimensionality and cross-loadings.

Proceeding with the analyses, all four latent variables were included in a single multifactorial confirmatory factor analysis (CFA) model in AMOS 21.0. The CFA was executed using the maximum likelihood estimation. During the CFA, the model demonstrated a poor fit. The chi-square/df (cmin/df) value was 5.49, the comparative fit index (CFI) value was 0.75, the standardized root mean square residual (SRMR) value was 0.14, and the Tucker-Lewis coefficient (TLI) was 0.72. The root mean square error of approximation (RMSEA) value was 0.14; 90% C.I. 0.14, 0.15. All the values were outside the range of the acceptable thresholds (Hair Jr. et al., 2010), demonstrating the bad fit of the model.

We applied a combination of statistical heuristics and content validity judgments to exclude or retain items in a manner that is consistent with the psychometric literature (Haynes, Nelson, & Blaine, 1999). The indicators that presented low (< 0.50) or very high factor loadings (> 0.95) were considered for deletion (Bagozzi & Yi, 1988). Additionally,

items that had very low or very high item-to-total correlations and a high correlation with another item within its category ( $> 0.80$ ) were considered for deletion (Byrne, 2010). The items that survived those procedures were used in the subsequent study.

### 3.3. Study 2

The purpose of this second stage of the study was to refine the CBBE items used during the initial stage while rewording the problematic ones. As in the first wave of research, the data were collected online using CAWI technique and the sample had similar metrics. To ensure the answers' reliability, individuals that took part at the first study did not participate in this stage.

Three product categories were chosen, and two brands were evaluated within each category. The product categories and brands were as follows: (1) chocolate bars: Mars and Snickers; (2) colas: Coca-Cola and Pepsi; and (3) toothpaste: Blend-a-med and Colgate. As in the previous study, the only differences between the questionnaires were the brand names. A sample of 167 consumers participated in the study. The procedures used for data screening were the same as in the previous study and resulted in 152 valid questionnaires.

The items used during the second stage of the research were also measured using a seven-point Likert scale. Brand awareness was measured using five items. Brand association was measured using six items. Perceived quality was measured using four items. Finally, brand loyalty was measured using seven items.

The alpha coefficients ranged from 0.79 to 0.93. Similarly to the first study, EFA was performed with Promax rotation and ML extraction method. The KMO value was 0.92. A total of four factors were extracted, and 67.10 per cent of the total variance was explained. Brand awareness and brand associations loaded on two distinctive factors; however, perceived quality and brand loyalty loaded on a single factor. The fourth factor emerged from cross-loadings from perceived quality and brand loyalty. These findings suggested a lack of unidimensionality on two CBBE subscales.

The next step was to include all the four dimensions in a CFA model. The CFA was executed using the ML estimation. During CFA, the model demonstrated a reasonable fit. The chi-square/df value was 2.22, the CFI value was 0.90, the SRMR value was 0.08, and the TLI value was 0.89. The model rendered a RMSEA value of 0.09; 90% C.I. 0.07, 0.1. These findings demonstrated that the fixed scales achieved a better statistical performance; however, they still needed refinement to produce better GOF values. Statistical heuristics and content validity judgment procedures were applied to the items, following the procedures used during the first study.

### 3.4. Study 3

The purpose of the third stage of the study was to reword the CBBE items used during the second part of the study to achieve acceptable GOF values. As in the first two waves of the



research, CAWI was used, and the sample had similar metrics. The individuals who took part in the first two waves of the research did not participate in the third study.

Four product categories were chosen, and similarly to the first two waves of the study, two brands were evaluated in each category. The product categories and brands were as follows: (1) athletic shoes: Adidas and Nike; (2) chocolate bars: Mars and Snickers; (3) colas: Coca-Cola and Pepsi; and (4) toothpaste: Blend-a-med and Colgate. As in the previous studies, the only differences between the questionnaires were the brand names. A sample of 179 consumers participated in the study. After data screening, a total of 152 valid questionnaires were analyzed.

Each dimension was measured using a set of five items. A total of twenty indicators were tested using a seven-point Likert scale during this wave of the study.

The alpha coefficients ranged from 0.87 to 0.93. Subsequently, an EFA was performed with Promax rotation and the ML extraction method. The KMO value was 0.89. A total of four factors were extracted, and 66.52 per cent of the total variance was explained. All of the items loaded on a single factor, suggesting that the CBBE facets were unidimensional. All factor loadings exceeded the 0.70 threshold, and there was no evidence of cross-loadings (Hair Jr. et al., 2010).

Proceeding with the confirmatory analyses, all four latent variables were included in a single CFA model executed using the maximum likelihood estimation. During CFA, the model demonstrated a good fit. The chi-square/df value was 1.87, the CFI value was 0.93, the SRMR value was 0.06, the TLI value was 0.92, the RMSEA value was 0.07; 90% C.I. 0.06, 0.08. All values were in the ranges of the acceptable thresholds and indicated a good fit of the model to the data (Hair Jr. et al., 2010). The complete list of items used during the three studies can be found in Table 01 of Appendix A.

### 3.5. *Study 4*

The purpose of this study was to validate the CBBE items and obtain the estimates of their psychometric properties in a large sample of brands and product categories. As in the first three stages of the research, the data were collected online using the CAWI technique by a Polish market research institution. Only one subject was allowed to participate in the survey per computer, and individuals that took part in the first stages of the study were not invited to the validation study. Each subject evaluated only one brand.

A total of ten product categories were chosen, and two brands were evaluated within each category. All the product categories and brands are familiar and easily available to the average Polish consumer. They were as follows: (1) athletic shoes: Adidas and Nike; (2) beer: Tyskie and Żywiec; (3) coffeehouses: Coffee Heaven and Starbucks; (4) colas: Coca-Cola and Pepsi; (5) deodorants: Axe and Old Spice; (6) energy drinks: Burn and Red Bull; (7) juices: Frugo and Tymbark; (8) laundry detergents: Persil and Vizir; (9) shampoos: Garnier and Head &

Shoulders; and (10) smartphones: Apple and Samsung. A summary of the frequencies of the brands is displayed in Table 02.

Table 02. Brand frequencies

Brands	Frequency	Percent	Cumulative Percent
Tyskie	54	4,0	4,0
Tymbark	89	6,5	10,5
Apple	78	5,7	16,2
Żywiec	65	4,8	21,0
Samsung	60	4,4	25,4
Persil	83	6,1	31,5
Red Bull	64	4,7	36,1
Old Spice	45	3,3	39,4
Vizir	68	5,0	44,4
Burn	45	3,3	47,7
Axe	57	4,2	51,9
Head & Shoulders	86	6,3	58,2
Adidas	66	4,8	63,0
Starbucks	82	6,0	69,1
Garnier	54	4,0	73,0
Nike	81	5,9	79,0
Coffee Heaven	95	7,0	85,9
Pepsi	56	4,1	90,0
Coca-Cola	83	6,1	96,1
Frugo	53	3,9	100,0
Total	1364	100,0	

The final set of CBBE items was measured using a seven-point Likert scale. Brand awareness, associations, and loyalty were measured by five items each. Perceived quality was measured by four items, resulting in a scale of nineteen indicators. The final list of CBBE items can be found in Table 03 of Appendix B.

During the validation study, the same questionnaire was used for all the brands, with only the brand names differing. As in the first three waves, the questionnaire was administered in Polish. An omnibus of 1650 Polish consumers participated in the study. Participants were invited to join the study from across Poland. Invalid, unusual, and incomplete questionnaires were rejected. As the testing for the factorial equivalence of scores from the measuring instrument is based on the analysis of covariance structures (COVS), we set a  $< 0.45$  cut off for the standard deviation among a single respondent's answers to determine whether he or she was engaged during the task. Individuals who demonstrated low engagement were also rejected, resulting in 1364 valid questionnaires. The age of respondents ranged from 18 to 68 years with an average age of 34 (std. deviation 6.19), 29.3% had at least some college education, 54.6% were female, and the median monthly household income was in the 2500zł to 4500zł (~760 USD to ~1360 USD) range. The profile of the sample closely matches the demographic structure of the Polish population (Dmochowska, 2012).

#### 4. Results

As in the first steps of the study, the reliability, dimensionality and validity of the measures were assessed using exploratory and confirmatory techniques.

##### 4.1. Exploratory factor analysis

The EFA was performed with Promax rotation and the maximum likelihood extraction method. The KMO test yielded 0.94, which is greater than the minimum recommended value of 0.6. (Kaiser, 1974). The outcome of the EFA suggested a four-factor solution, accounting for 75.69 per cent of the total variance. All of the items loaded on a single factor, demonstrating that the four dimensions were unidimensional, and no evidence of substantial cross-loadings were observed. The EFA pattern matrix can be found in Table 04.

Table 04. Four-factor solution for the CBBE subscales

		FACTOR			
n = 1364	Brand loyalty	Brand awareness	Brand associations	Perceived quality	
BL1	.935	.025	-.027	.010	
BL2	.904	-.006	-.005	.006	

BL4	.868	-.010	.071	-.023
BL3	.830	.003	.122	-.094
BL5	.817	.029	-.075	.142
BAW5	-.047	.907	-.037	.003
BAW2	-.018	.898	.033	-.011
BAW3	.034	.896	-.003	.018
BAW1	.015	.894	.009	.007
BAW4	.052	.884	.005	-.034
BAS2	.012	-.018	.943	-.078
BAS5	.093	-.025	.858	-.044
BAS4	.102	-.018	.854	-.035
BAS1	.040	-.013	.757	.150
BAS3	-.134	.127	.602	.221
PQ1	.056	.018	-.075	.802
PQ4	.052	-.043	.106	.715
PQ3	-.135	.020	.247	.709
PQ2	.288	-.043	.002	.645

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Notes: Extraction method = ML; Rotation method = Promax with Kaiser normalization; Rotation converged in 5 iterations; BL = brand loyalty; BAW = brand awareness; BAS = brand associations; PQ = perceived quality

To establish reliability, we used Cronbach's alpha and composite reliability (CR). The alpha coefficients ranged from 0.87 to 0.95, higher than the recommended threshold value of 0.7 (Hair Jr. et al., 2010). Moreover, there was no evidence of redundant items within the scales. The item-total statistics are presented in Table 05 in Appendix C. The CR values ranged from 0.88 to 0.95, meeting the standard minimum threshold of 0.7 (Chin, Marcolin, & Newsted, 2003). For convergent validity, three criteria must be achieved: first, the model fit must be adequate; second, the lambda values must be significant and greater than 0.30 (see Table 06 in Appendix D); and third, the average variance extracted (AVE) must exceed 0.50 (Hair Jr. et al., 2010). All three criteria were met during the study. To achieve discriminant validity, we relied on the Fornell-Larcker test, which requires that the square root AVE for each construct is greater than any inter-construct correlations (Fornell & Larcker, 1981). All

the constructs from the CBBE scale met this criterion. The reliability, convergent and discriminant validity scores are summarized in Table 07.

Table 07. Reliability, convergent and discriminant validity table chart

n = 1364	ALPHA	CR	AVE	BAS	BAW	PQ	BL
BAS	0.927	0.929	0.726	<i>0.852</i>			
BAW	0.952	0.953	0.802	0.281	<i>0.896</i>		
PQ	0.876	0.880	0.647	0.790	0.253	<i>0.804</i>	
BL	0.948	0.949	0.787	0.660	0.077	0.702	<i>0.887</i>

Note: The square roots of the average variance extracted (AVE) are marked in italics

#### 4.2. *Confirmatory factor analysis*

To establish the unidimensionality of the CBBE factors, we followed Gerbing and Anderson's (1988) recommendation and examined the 19 items through CFA. The CFA model hypothesized a priori that (a) consumers' responses to the CBBE framework can be explained by the four factors of brand awareness, brand associations, perceived quality, and brand loyalty; (b) each indicator will have a non-zero factor loading on the CBBE dimension it was designed to measure and zero factor loadings on all other dimensions; (c) the four factors would be correlated; and (d) the measurement error terms would be uncorrelated. Following Byrne (2010), we based our analyses on covariance.

The maximum likelihood estimation in the Amos 21 software package was used for the CFA procedures. All the factor loadings exceeded the 0.70 threshold (Kline, 2011), and as demonstrated during the EFA analysis, there was no indication of cross-loadings. The model's chi-square/df value was 7.09 with a  $\chi^2_{(146)}$  value<sup>1</sup> of 1036.17, the CFI value was 0.96, the SRMR value was 0.04, the TLI was 0.96, and the RMSEA value was 0.06; 90% C.I. 0.06, 0.07. All these values demonstrate a good fit for the model (Hair Jr. et al., 2010).

#### 4.3. *Tests for the factorial equivalence of the instrument scores*

For the purpose of cross-validation, the data were divided into two groups (Cudeck & Browne, 1983). Each group consisted of five product categories and ten brands (see Table 08 in Appendix E).

The cross-validation of the conceptual framework was achieved by testing for invariance across the two samples. For this purpose, we followed the partial invariance test procedures

<sup>1</sup> The  $\chi^2$  value is inflated as a consequence of the high sample size (n = 1364).

suggested by Byrne and colleagues (Byrne, Baron, & Balev, 1998). The first step of the test involved the specification of a full-constrained model set to be equal across the samples of the two groups. This model was then compared to less restrictive models in which the parameters were unconstrained. Two increasingly restrictive hypotheses were tested that related to the invariance of (a) measurement weights and (b) factor covariances.

A classical approach for determining evidence of difference across models is based on the  $\chi^2$  difference. In addition, the  $\chi^2$  difference test functions as a stringent test of invariance, assuming that SEM models are, at best, only estimates of reality (Cudeck & Browne, 1983; MacCallum, Roznowski, & Necowitz, 1992); therefore, we argued that it would be reasonable to include the CFI difference test on the analysis. To base invariance decisions on a difference in CFI values, those values must exhibit a probability of  $< 0.01$  (Cheung & Rensvold, 2002). Furthermore, there is still no agreement in the literature on which tests of invariance are the best (Byrne, 2010). Therefore, both the  $\Delta\chi^2$  and  $\Delta\text{CFI}$  values are reported in this article.

To test for the factorial equivalence of the CBBE instrument scores, we used the ML estimation on Amos 21 with the Emulislrel6 option. The results of the configural model yielded a  $\chi^2_{(292)}$  value of 1238.47 with a CFI value of 0.96 and an RMSEA value of 0.04; 90% C.I. 0.04, 0.05; and a PCLOSE value of 0.75. These results show that the hypothesized multigroup measurement model fits well across the samples.

Following the classical approach of the invariance test, the next step was to run a model in which only the factor loadings are constrained equal (Bentler, 2006). To simplify the comparison of models, we called this model Model 2A. As expected, a review of the results of this model reveals the fit to be consistent with that of the configural model (CFI 0.96; RMSEA 0.04; 90% C.I. 0.04, 0.05; PCLOSE 0.92). The differences of the  $\chi^2$  and CFI values reported from the configural model and Model 2A yield the following results:  $\Delta\chi^2_{(15)}$  14.10 (p-value 0.51) and  $\Delta\text{CFI} < 0.000$ . Given its statistical stringency, both tests argue for evidence of invariance. These findings indicate that all the items designed to measure consumer-based brand equity operate equivalently across the different product categories.

Proceeding with the analysis, the next step specifies a model with all factor loadings, in addition to the six factor covariances that were constrained equal across the groups (Model 3A). A review of the results of this model reveals its fit to be consistent with that of the configural model (CFI 0.96; RMSEA 0.04; 90% C.I. 0.04, 0.05; PCLOSE 0.95). The  $\Delta\chi^2$  and  $\Delta\text{CFI}$  values reported for the configural model and Model 3A yield the following results:  $\Delta\chi^2_{(21)}$  26.24 (p-value 0.19) and  $\Delta\text{CFI} < 0.000$ . As in the previous step of our analyses, both the  $\chi^2$  and CFI difference tests argue for invariance. These findings suggest that the covariances among the CBBE dimensions are invariant across the groups. The summary of findings is presented in Table 09.

Table 09. Summary of goodness-of-fit statistics of tests for the invariance of causal structure

Model description	Comparative model	$\chi^2$	df	$\Delta\chi^2$	$\Delta df$	<i>p</i> -value	CFI	$\Delta CFI$
1. <i>Configural model</i> No equality constraints imposed	□	1238.478	292	□	□	□	0.962	□
2. <i>Measurement model</i> (Model 2A) All factor loadings invariant	2A versus 1	1252.582	307	14.104	15	0.518	0.962	0.000
3. <i>Structural model</i> (Model 3A) Model 2A with all covariances invariant	3A versus 1	1264.722	313	26.244	21	0.197	0.962	0.000

Notes:  $\Delta\chi^2$  = difference in  $\chi^2$  values between models;  $\Delta df$  = difference in number of degrees of freedom between models;  $\Delta CFI$  = difference in CFI values between models.

## 5. Discussion, limitations and further research

The primary objective of this study was to meet the need for a refinement of the four-factor CBBE scale. To delineate the CBBE items, we used the four dimensions proposed by Aaker (1991): brand awareness, brand associations, perceived quality, and brand loyalty.

To achieve our objectives, we used a combination of qualitative and quantitative research methods. These procedures included the Best-Worst scaling method to help filter the measurements, item judging by marketing professors with expertise in measurement and branding management, exploratory and confirmatory factor analyses, dimensionality and the assessment of internal reliability, and tests for the factorial equivalence of the instrument scores.

Consistent evidence for the internal consistency and validity of the instruments was observed across four studies that surveyed 1874 respondents across Poland and examined 24 different brands over 12 product categories. Moreover, the results showed that the four-factor CBBE scale was invariant across different product categories, indicating that consumers interpret and respond to the indicators in an equivalent manner.

These results have important implications for academic researchers and brand managers. Because the scale measures the four dimensions of CBBE, researchers and managers can use this instrument to measure brand equity across different product categories and brands, improving the reliability, validity and comparability of their research findings. Furthermore, this instrument is suitable for testing theoretical and conceptual relationships, allowing Aaker's framework to be implemented in the examination of antecedents and consequences within the brand equity context. Additionally, the use of this measurement should contribute at a managerial level, supporting the decision-making process and the management of consumer-based brand equity.

Although this study makes a significant contribution to the measurement of consumer-based brand equity, it is not without limitations. However, the restrictions of our study can provide guidelines for future research. First, brand associations and perceived quality presented relatively high inter-construct correlations. This issue did not affect the convergent validity scores in the context of our study; however, under other circumstances, if this inter-construct correlation becomes higher than the square root of the AVE value, it may be a sign of problematic indicators.

A wider range of product categories should be examined in future studies. This practice will indicate how the scale behaves under different product and brand choices. Finally, because a central European sample was used in this study, it may be difficult to generalize our results to other cultures. We recommend that similar research be conducted in different countries to produce a stronger validation and generalization of the findings.

The future extensions of this project will involve testing the measurement instrument for consumer-based brand equity in a cross-national validation. Data from countries with different social-economical bases should be collected to test for measurement invariance across the samples.

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## APPENDIX A

Table 01. List of items discarded during the three studies

Dimension	Items
<i>Brand awareness</i>	I easily recognize brand X among other brands
	I have a good opinion about company X
	I know brand X
	I know the products of company X
	I know there is a brand X
	I recognize brand X
	I recognize the logo of brand X
	If someone asks me about PC, company X easily comes to mind
	When I need PC, brand X comes to mind
	I am able to name a few characteristics of brand X
<i>Brand associations</i>	I associate good feelings with brand X
	I feel sympathy for brand X
	I have good associations with brand X
	I have good memories linked to brand X
	I have good memories of brand X
	I like brand X
	I think that brand X has a strong image
	I think that brand X has character
	Somehow I feel personal affection for brand X
	The memories I have of brand X influence purchasing decisions
<i>Perceived quality</i>	Although other brands' products are good, I still think that brand X has better products

Brand X has better products than its competitors  
Brand X offers products of very good quality  
Brand X offers reliable products  
Brand X products are of better quality than the generic alternatives  
Brand X products are worth the money  
I think that brand X has good-quality products  
I think that brand X products are of good quality  
In general, I believe that brand X products are superior in quality compared to the alternatives  
The products offered by brand X are worth the price

As a personal choice, I will continue to consume brand X

I am attached to brand X

I am committed to brand X

I am faithful to brand X

I am loyal to brand X

I consider myself a fan of brand X

I think I am loyal to brand X

I will continue to buy products from brand X

If I need to buy PC, I usually buy brand X

If similar products cost the same, I choose brand X

If someone offers me a competitive brand, I still buy products from brand X

If someone offers me a competitor's brand, I still buy brand X

In the future, I will definitely buy products from brand X

*Brand loyalty*

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Note: PC = product category

## APPENDIX B

Table 03. Consumer-based brand equity inventory

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<i>Brand awareness</i>	[BAW1] I know brand X
	[BAW2] I know at least one brand X product
	[BAW3] I easily recognize brand X among other brands
	[BAW4] I recognize the logo of brand X
	[BAW5] I know that there is a brand X
<i>Brand associations</i>	[BAS1] I like brand X
	[BAS2] I have good memories of brand X
	[BAS3] Brand X has a good image
	[BAS4] I feel sympathy for brand X
	[BAS5] My memories associated with brand X positively influence my purchasing decisions
<i>Perceived quality</i>	[PQ1] Brand X products are of better quality than the generic alternative
	[PQ2] Although other brands' products are good, I still think that brand X is better
	[PQ3] Brand X products are of good quality
	[PQ4] Brand X offers reliable products
<i>Brand loyalty</i>	[BL1] I am faithful to brand X
	[BL2] I think I am loyal to brand X
	[BL3] I consider myself a fan of brand X
	[BL4] I am attached to brand X
	[BL5] If someone offers me a competitive brand, I still buy brand X products

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## APPENDIX C

Table 05. Item-total statistics

n = 1364	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
BAW1	26.08	18.53	0.871	0.941
BAW2	26.03	18.12	0.876	0.940
BAW3	26.12	18.12	0.878	0.939
BAW4	26.11	18.09	0.855	0.944
BAW5	25.89	19.23	0.865	0.942
BAS1	20.67	26.52	0.852	0.903
BAS2	20.91	25.53	0.848	0.903
BAS3	20.37	30.90	0.681	0.935
BAS4	21.03	25.32	0.852	0.902
BAS5	21.17	25.00	0.835	0.906
PQ1	14.68	14.14	0.727	0.845
PQ2	15.27	13.30	0.754	0.836
PQ3	14.13	16.27	0.728	0.849
PQ4	14.85	14.78	0.752	0.834
BL1	13.55	37.89	0.892	0.930
BL2	13.53	38.36	0.873	0.934
BL3	13.71	38.77	0.822	0.942
BL4	13.44	37.77	0.872	0.934
BL5	13.43	39.11	0.831	0.941

APPENDIX D

Table 06. Measurement analysis results: unstandardized values

Dimensions and Items	Factor loadings	Factor loadings	<i>t</i> -value	<i>t</i> -value	Factor loadings	<i>t</i> -value
	Group 1	Group 2	Group 1	Group 2	Common	
	n = 682	n = 682			n = 1364	
<i>Brand awareness</i>						
BAW1	1.000	1.000	□	□	1.000	□
BAW2	1.063	1.035	24.047	37.161	1.047	36.023
BAW3	1.020	1.067	17.300	33.358	1.045	28.622
BAW4	1.059	1.027	27.968	31.280	1.041	38.805
BAW5	0.900	0.966	20.927	30.412	0.921	31.813
<i>Brand associations</i>						
BAS1	1.000	1.000	□	□	1.000	□
BAS2	1.062	1.045	30.888	34.952	1.056	42.752
BAS3	0.638	0.674	18.039	20.178	0.647	25.569
BAS4	1.080	1.084	30.848	37.736	1.085	44.819
BAS5	1.125	1.088	32.179	31.561	1.107	40.661
<i>Perceived quality</i>						
PQ1	1.000	1.000	□	□	1.000	□
PQ2	1.113	1.182	24.894	23.541	1.160	31.283
PQ3	0.789	0.850	21.635	20.570	0.821	25.640
PQ4	0.934	1.001	23.210	21.439	0.984	28.249
<i>Brand loyalty</i>						
BL1	1.000	1.000	□	□	1.000	□
BL2	0.963	0.986	50.441	45.826	0.972	66.123

BL3	0.943	0.920	39.118	37.996	0.932	50.237
BL4	0.987	1.004	47.866	44.759	0.995	61.394
BL5	0.903	0.929	37.077	38.958	0.922	51.740

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## APPENDIX E

Table 08. Division of brands for the invariance tests

GROUP 01	GROUP 02
Apple	Adidas
Burn	Axe
Coca-Cola	Frugo
Coffee Heaven	Garnier
Pepsi	Head & Shoulders
Red Bull	Nike
Samsung	Old Spice
Starbucks	Persil
Tyskie	Tymbark
Żywiec	Vizir

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