Original Article

Marketing research using single-item indicators in structural equation models

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Maria Petrescu
is an assistant professor of marketing at Nova Southeastern University. She participated and published in prestigious conferences and publications, such as the AMA Summer Educators' Conference, the AMS World Marketing Congress, the Academy of Marketing Science Conference, the *Journal of Product & Brand Management* and the *Journal of Internet Commerce*.

Correspondence: Maria Petrescu, H. Wayne Huizenga School of Business and Entrepreneurship, Nova Southeastern University, 3301 College Avenue, Ft. Lauderdale, Florida, FL 33314, USA.
E-mail: mpetresc@nova.edu

ABSTRACT This article analyzes the use of single-item indicators in marketing research and their utilization in structural equation modeling (SEM). The study provides a literature review regarding the debate of the use of single-item measures in social sciences research and methodologically in SEM. The analysis of recent studies that use single-item indicators from top marketing journals provides information regarding the types of constructs fit for single-item measurement and their use in SEM. The article presents clarifications to the debate regarding the use of single-item indicators in marketing research, gives examples of types of constructs measurable through single-item indicators and provides recommendations that add knowledge to the empirical analysis and methodology domains of marketing research.
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INTRODUCTION

In a 1999 study regarding the state of marketing research, Malhotra, Peterson and Kleiser noted the need for a focus on the quality of the measures used in marketing and recommended more detailed conceptualizations and more specific measures. They also underlined the importance of multi-item scales and multiple methods of measurement, including the use of structural equation modeling (SEM). Especially in the case of SEM, research can benefit from the possibility of using multiple-item measures and accounting for both random and systematic error.

At the same time, other researchers note the option of using single-item measures and their benefits for research under specific circumstances, especially in the case of long and complicated surveys (Wanous and Reichers, 1996; Drolet and Morrison, 2001a, b; Bergkvist and Rossiter, 2007).

In this context, most researchers write about the fact that journal editors and reviewers tend to reject studies using single items, especially due to the generally well-known issues with measurement reliability (Wanous and Hudy, 2001; Fuchs and Diamatopoulos, 2009).

Given the debate related to single-item versus multiple-item measures, the call for improved measures in marketing and for an increased use of SEM, this study focuses on the use of single-item indicators in marketing research and their employment in SEM.

We first provide a short overview of the benefits of SEM and a summary of the debate related to the use of single-item or multiple-item indicators. We then analyze studies that use single-item indicators from top marketing journals and the way these indicators were introduced in SEM. The study provides recommendations on circumstances when single-item indicators can be used and their modeling in SEM in order to prevent reliability and validity issues.

Overall, this article brings clarifications to the debate on whether single-item indicators can or should be used in marketing research, especially for circumstances when the use of multiple-item measures is not possible. Besides a snapshot on the current state of single-item measures use in marketing research, this study contributes to the marketing methodological literature, by providing a review and recommendations on how single items can be introduced in structural equation models. The article provides marketing researchers with a practical review on possible uses of single-item indicators in marketing studies and how they can be modeled in SEM empirical testing.

SEM

An econometric model is represented by a set of independent variables and one or more dependent variables, usually with causal relationships specified by an equation for each dependent variable. When the model specifies causal links between variables, the econometric model is a 'structural equation model', where each variable represents a theoretical construct (Aaker and Bagozzi, 1979). Structural equation models are statistical procedures used to test measurement, functional, predictive and causal hypotheses (Bagozzi and Yi, 2012). SEM is used in marketing research in both business-to-business and business-to-consumer studies (Iacobucci, 2009).

One of the benefits of SEM is the possibility to take into account random or measurement error in indicators of latent variables, as well as systematic or method error. Other advantages include the possibility to take into account the reliability of measures, the use of multiple-item constructs, easier mediation testing and even methods to assess construct validity (Kline, 2005; Iacobucci, 2009; Bagozzi and Yi, 2012). Thanks to the use of confirmatory factor analysis (CFA), researchers no longer need to average the multiple-item measures and can test whether a set of indicators shares enough common variance to be considered measures of a single factor.

SEM is also important for validity testing and construct validation, because it focuses on the distinction between the measurement model and the structural model, but also allows more rigorous tests of construct reliability, convergent validity and discriminant validity (Anderson and Gerbing, 1984; Malhotra *et al*, 1999; Jarvis *et al*, 2003; MacKenzie *et al*, 2005).

Given the possibility to use multiple-items in SEM, the debate on whether researchers should employ single-item indicators, and how, is even more interesting. In the following, we provide an overview of pros and cons for single-item measures, as well as a snapshot of how they are actually used in practice in marketing studies.

SINGLE-ITEM MEASURES

While in practice there are studies using a single-item indicator to represent a construct, many researchers have noted that this mostly happens with demographic variables and items that typically do not represent constructs (Hair *et al*, 2009). This is due especially to some of the main worries regarding the use of single items, such as measurement error and reliability, and the continuous debate on the topic, as shown in the following and in summary form in Table 1.

Arguments pro single-item measures

At the same time, researchers note that measurement error might be justified

Table 1: Arguments for and against single items

Arguments for single items	*Arguments against single items*
Useful for concrete, singular and one-dimensional constructs	Do not allow for calculation of Cronbach's α
Common method bias avoided	Decreased reliability
Do not tap into other predictive constructs or dimensions	Not recommended for abstract constructs
Shorter questionnaires, increased response rates	Low correlation with the attribute measured
Necessary for demographics and other concepts	Categorize individuals into a small number of groups
More substance from the right conceptual domain	Difficulty in calculating reliability and measurement error
	Validity issues
	Identification and convergence issues in SEM

(or necessary) in some circumstances, such as when only one indicator is available, when the indicator has a high degree of validity and reliability, and when researchers have problems with construct and relationship specification dominate (Aaker and Bagozzi, 1979; Anderson and Gerbing, 1988; Hayduk, 1996; Iacobucci, 2010). For example, Raykov and Marcoulides (2006) note that the total score on the Stanford-Binet Intelligence Test as single-item indicator can be a good measure of the construct of intelligence.

Focusing on predictive validity, Bergkvist and Rossiter (2007) show that single-item measures are equally as valid as multiple-item measures and theoretical tests and empirical findings would be the same if single-item measures are used instead of multiple-item measures. The authors note that two of the most widely employed constructs in advertising and consumer research, attitude toward the ad and brand attitude are doubly concrete constructs, which should be validly measurable by a single item. Bergkvist and Rossiter (2007) demonstrate that for both constructs the single-item measure demonstrated equally high predictive validity as the multiple-item measure, not supporting the classic psychometric argument that multiple-item measures are more valid than single-item measures for all types of constructs. In this specific case, when multiple-item measures are used to measure doubly concrete constructs, they do not appear to have better discriminant validity.

As researchers underline, the issue of single-item measures is also related to the editors and reviewers of scholarly journals, who tend to be very concerned with measurement reliability, which is an issue in the case of single-item measures (Wanous and Hudy, 2001; Fuchs and Diamantopoulos, 2009). That is due to beliefs that the reliability of a single-item measure cannot be estimated, and, even if possible, it would be unacceptably low. However, Wanous and Reichers' (1996) study on single-item measures of overall job satisfaction has challenged both of these assumptions about single-item reliability. They show how the minimum level of reliability for a single-item measure could be estimated by using the well-known correction for attenuation formula. Also, Wanous and Hudy (2001) replicate the results by using the measure of overall teaching effectiveness of college faculty as rated by their students.

Other authors note the difficulty that multifaceted definitions and measurement place on respondents and researchers due to survey length. Drolet and Morrison (2001a, b) write that, for example, multi-item measures of service quality and customer satisfaction used in marketing reduce the number of different constructs that can be investigated in the same survey, leading to a trade-off between information and reliability. In this context, using multiple-item measures in in order to improve reliability measured by coefficient α may create difficulties for the researcher and, as the number of items needed to produce a 'reliable' scale increases, it may be much more difficult to identify items whose true scores are equivalent or very similar. Multiple items and long measurement scales can also present other issues, such as related to multi-dimensionality, as in the case of complex measures such as electronic service quality (Blasco *et al,* 2011).

Regarding test–retest reliability, some studies note that it can be good even for single-item measures, and the same for internal consistency reliability (Wanous and Hudy, 2001; Fuchs and Diamantopoulos, 2009). Drolet and Morrison (2001a, b) note that multiple-item scales that produce high reliabilities may also reduce the quality of respondent responses, while not adding a significant amount of information over a single-item construct. Multiple-item measures require lengthy surveys, which can decrease response rates and include more missing values, and can also lead to sampling bias because of the potential to lose respondents not interested in the topic (Wanous and Hudy, 2001; Fuchs and Diamantopoulos, 2009). At the same time, single-item measures are less time-consuming, short, flexible and reduce response bias (Drolet and Morrison, 2001a, b; Fuchs and Diamantopoulos, 2009).

Concerning validity, as multiple items might pick up substance from more than one conceptual domain, one item that taps the right domain might yield better information and might avoid presenting survey questions that seem repetitions (Wanous and Hudy, 2001; Drolet and Morrison, 2001a, b; Fuchs and Diamantopoulos, 2009).

Arguments against single-item measures

Researchers have noted that, while econometric models assume that theoretical constructs are measured without error by a single indicator, in most circumstances any single indicator is usually biased and requires the use of multiple indicators (Campbell and Fisk, 1959; Nunnally, 1978; Aaker and Bagozzi, 1979; Churchill, 1979; Anderson and Gerbing, 1988; Kline, 2005; Bergkvist and Rossiter, 2007). Aaker and Bagozzi (1979) also note that research has shown that even if an indicator is an unbiased representation of a theoretical construct, measurement error can still lead to biased conclusions, due to the fact that economic data tend to be aggregated and collected by others, and defining theoretical constructs is not an error-proof activity. Random error can be statistically controlled by using multiple measures of constructs (Mackenzie, 2001).

Churchill (1979) states that individual items usually have considerable uniqueness, so each item tends to have only a low correlation with the attribute being measured and tends to relate to other attributes as well. He also notes another negative characteristic of single items, their tendency to categorize individuals into a relatively small number of groups, as a function of the measurement scale. Churchill (1979) also warns that individual items typically have considerable measurement error and unreliable responses, while the reliability tends to increase and measurement error decreases as the number of items in a combination increases. One major source of measurement error happens when the sampling of the domain items is inadequate and single-item measures are more prone to this problem than are multiple-item measures (Grapentine, 2001; Hair *et al,* 2009). Even though single-item indicators can be used in certain circumstances, single indicators with more than 40–50 per cent error variance can lead to estimation problems for the structural model (Hayduk, 1987).

Although the use of single-item indicators was common in marketing research during the 1960s and 1970s, their utility in a measurement model is limited and makes the statistical assessment of measurement error problematic (Diamantopoulos and Winklhofer, 2001). Moreover, not all of the systematic part of an indicator's variance may reflect the construct that the researcher is trying to measure (Kline, 2005). In addition, even though some single items can correctly represent some phenomena, they are difficult to validate (Hair *et al,* 2009).

Single-indicator constructs are not recommended because they ignore the unreliability of measurement, exactly one of the problems SEM was designed to avoid; note Baumgartner and Homburg (1996). Even two measures per factor might present problems, as bias issues could arise and SEM needs three indicators per construct for a model to be identified (Anderson and Gerbin, 1984; Baumgartner and Homburg, 1996; Iacobucci, 2009). Even if identification is not an issue, there can appear problems related to interpretational confounding, as their dimensionality can only be established in relation to other constructs, bias problems and convergence issues in SEM (Anderson and Gerbin, 1984; Hair *et al,* 2009). Moreover, the use of models with single indicators of latent variables can present indeterminacies and ambiguities, especially when clear concepts of latent variables have not been formulated, although these models rely on the extension of causes to determine that the causes are what they are supposed to be (Mulaik, 2009). In this case, it is difficult to demonstrate that the indicator used to test causal effects has the right intentional meaning.

In technical terms, the use of single-item indicators does not allow the calculation or specific error and measurement error (Bollen and Curran, 2006). By using multiple measures, researchers can estimate the influence of method variance and random error components by using the multitrait-multimethod matrix in CFA (Cote and Buckley, 1987).

SINGLE ITEMS IN SEM

Latent variables

Authors have noted situations when in practice only a single indicator of some construct is available for an SEM analysis. In this case, researchers should assume that this indicator seems unlikely to perfectly estimate the construct, therefore the modeling issue in this situation is what values should the θ–δ and λ parameters be set (Anderson and Gerbing, 1988). Ideally, in these situation, a researcher would have an independent estimate for the error variance of the single indicator, usually from prior research, however, this is not always available. In this context, conservative values for the θ–δ and λ parameters are recommended, such as $0.1s^2$ and 0.95s, or setting θ–λ at the lowest value of the other estimated error variances (Anderson and Gerbing, 1988; Sorbom and Joreskog, 1982).

In an analysis of marketing studies, Baumgartner and Homburg (1996) note that sometimes SEM is also applied to examinations of the structural relations among constructs that are all measured by single indicators. In this case, the specification is done by ignoring the unreliability of measurement and setting λ equal to identity matrices, or by assuming reliability to be known and fixing the factor loadings or error variances.

Regarding the use of single-item indicators in Lisrel, Joreskog and Sorbom (1982) give the example of the verbal intelligence test and, assuming the measure is fallible, recommend a reliability value of 0.85 as a better assumption than an equally arbitrary value of 1.00. The assumed value of the reliability will affect parameter estimates as well as standard errors (Joreskog and Sorbom, 1982). In this case, the specification of the reliability 0.85 in Lisrel is done by assigning the fixed value 0.15 times the variance to the error term.

Mackenzie (2001) also recommends, if multiple measures cannot be obtained, to partially control for random error by fixing the measurement error term at some reasonable value based on prior research or theory. For example, researchers can use a reliability estimate from another study if the measure is a scale score (Mackenzie, 2001).

Kline (2005) notes that for unstandardized factors, the initial estimates of factor variances should not exceed 90 per cent of that of the observed variance for the corresponding reference variable. He recommends that start values for factor covariances follow the initial estimates of their variances, and if the indicators of a construct have similar variances to that of the reference variable, the initial estimates of their factor loadings can be 1.0. Regarding measurement error, conservative starting values of measurement error variances are around 90 per cent of the observed variance of the associated indicator, implying that only 10 per cent of the variance will be explained (Kline, 2005). When modeling the single-item indicator in SEM, Kline (2005) discusses about estimating the proportion of observed variance due to random error by computing 1 – a reliability coefficient and notes that this probably underestimates the proportion of variance in a single indicator due to measurement error. The error variance of a single variable can be calculated by computing (1-reliability) * variance (Schumacker and Lomax, 2004). Another recommendation is to analyze the model with a range of estimates, in order to evaluate the impact of different assumptions about measurement error on the solution, especially when not certain about the estimate of the measurement error variance for a single-item indicator (Kline, 2005). Anderson and Gerbing (1988) write that researchers should ideally have an independent estimate for the error variance of the single indicator, like from prior research, or, in its absence, use a conservative value 0.1 * variance, and its associated λ set at 0.95 * variance.

Hayduk (1996) recommends the use of single-item indicators by selecting a single indicator of a latent variable, fixing its structural coefficient on the latent to 1, and the error variance of the variable to that value to show what proportion of the total variance of the indicator is not due to the hypothesized latent.

Regarding validity, as it presents issues in the use of single-item indicators, establishing the reliability of scores of the observed variable helps in estimating the validity coefficients (factor loadings) in the measurement model, as validity is limited by the reliability of the observed variable scores (Schumacker and Lomax, 2004).

Multiple group analysis

When discussing about categorical data and SEM, there are always different issues that arise in the formulation of the model. For example, binary variables truncate the magnitudes of correlations (or covariances), which are the input for SEM (Iacobucci, 2010). Researchers mention different alternatives of using categorical data, such as using a log linear model if all the variables in the model are discrete, or if some variables are discrete and the sample size is large, using polychoric correlations (Iacobucci, 2010).

As Raykov and Marcoulides (2006) note, many studies in the behavioral and social sciences examine differences or similarities between two or more groups regarding the phenomenon under investigation, especially related to demographic variables such as age, educational level and nationality. In this context, SEM offers a method for conducting these types of comparisons using a modification of its general model-fitting approach, allowing for the simultaneous estimation of models in all samples involved, by using the covariance matrix of a set of observed variables or the covariance/mean matrix. An advantage of multiple-groups CFA is that all potential aspects of invariance across groups can be examined (Brown, 2006). Bollen and Curran (2006) mention the situations when, in multiple-group analysis, a separate model and data set are established for each group. These models allow the analysis of minor or major differences in the latent curve model for each group. Unlike using only dummy variables for a categorical variable, in this approach it is that the multiple-group method enables us easily to test the implicit restrictions in the dummy variable approach. As Kline (2005) writes, SEM is a very flexible analytical approach that can incorporate ANOVA-type analyses, including between-group and within-group mean comparisons, but can also test for group mean differences on latent variables. In this case, researchers can compare, for example, if a model is different for two groups, such as male versus female, of other types of categorical variables.

Composite measures

Another example of using single-indicator constructs refers to situations when authors perform a factor analysis on the items available and then combine the variables into composites, analyzed as single-indicator constructs (Baumgartner and Homburg, 1996).

In this case, Baumgartner and Homburg (1996) mention different types of models, including the total aggregation model and the total disaggregation model. In the total aggregation model, a single composite is formed by combining all the measures of a given construct, in a model that is formally identical to one in which only a single indicator is available. However, unlike in this case of actual single-item indicators, researchers note that in general a composite single indicator should be more reliable. Moreover, in this case, a measure of reliability can be calculated when a composite of items is available, and the error variance of the indicator can be fixed to (1 – reliability) times the variance of the indicator (Baumgartner and Homburg, 1996). In the total disaggregation model, single-item measures are used as multiple measures of an underlying latent variable.

A composite score is usually calculated as an unweighted sum in order to provide an estimate of the corresponding construct. However, researchers warn that the computation of this composite score is meaningful only if each of the measures is acceptably one-dimensional, meaning a single trait or construct underlying a set of measures (Gerbing and Anderson, 1988).

SINGLE ITEMS IN MARKETING

Researchers underline that while the use of unobservable variables in SEM might have potential to help marketing researchers, for marketing problems single indicators tend often to be biased and unreliable (Aaker and Bagozzi, 1979). Marketing literature recommends the use of multiple indicators and modeling the errors in variables (Churchill, 1979; Bergkvist and Rossiter, 2007). However, there are still circumstances when single-item indicators are or must be used for diverse reasons, such as when the construct is simple and single-faceted, making it difficult to create many different items that measure the same construct (Poon *et al*, 2002). For example, Baumgartner and Homburg (1996), in a study on the applications of SEM in marketing, note that in 15 per cent of the cases analyzed SEM is used for examining the relationships among variables, which are all measured by single indicators. Malhotra *et al* (1999) note that the quality of measures that are used in marketing research needs to be improved, by using more detailed conceptualizations and a greater number of more specific measures. They specifically recommend the use of multi-item scales and multiple methods to measure key variables. Researchers should also focus on assessing the psychometric properties and the structure of multidimensional constructs, with the help of SEM (Malhotra *et al*, 1999).

In order to analyze the use of single-item indicators in marketing research, we analyzed studies using SEM in the period 1997–2012 in top marketing journals: *Journal of Marketing*, *Journal of Marketing Research*, *Journal of the*

Academy of Marketing Science, *Marketing Science*, *Journal of Retailing*, *Journal of Consumer Research*, *Journal of Advertising Research* and *Journal of Advertising*. Using ABI/Inform Complete database, we searched for articles including the terms 'structural equation model' or 'SEM'. The studies we found through this method are presented in Table 2, together with a few older but highly cited articles in the marketing literature for how they modeled the use of single-item indicators, such as the MacKenzie *et al* (1986) article. Overall, we found and analyzed in detail 69 articles that used SEM in their empirical analysis.

Regarding the domain of the articles using single-item indicators, the articles present studies related both to business-to-business and consumer behavior studies, with varied topics such as online brand communities (Adjei *et al*, 2010), store manager behavior (Arnold *et al,* 2009a), satisfaction in a marketing channel (Ping, 2003) and regret in consumer decision making (Tsiros and Mittal, 2000).

Regarding the type of variables that were represented through single items, the most common are the demographic variables such as age, gender, income and education, which appear in 25 per cent of the studies analyzed. Overall, 15 per cent of the articles did not use a pure single-item indicator, but used path analysis and included in their analysis summated or composites scores of the items forming the measurement scale. The scores were preferred for a more facile analysis, especially in the case of scales with a significant number of items that could have made the SEM analysis difficult (Babin and Boles, 1998; Maignan *et al*, 1999; Bettencourt, 2004; Cadogan *et al,* 2005; Luega et al, 2006; Auh *et al,* 2007; Hunter and Perreault, 2007).

A few of the studies that used single-item indicators were meta-analyses, focusing, for example, on the effectiveness of publicity versus advertising (Eisend and Küster, 2011) and salesperson adaptive selling behavior and customer orientation (Franke and Park, 2006).

Regarding some of the concepts that were measured through single-item scales, most of them are concrete constructs that assume a lower error risk, such as share of customer, frequency of sales calls and length of relationship (Ahearne *et al*, 2007); product sales, service sales, annual advertising expenditures and store size (Arnold *et al,* 2009a); interaction frequency, failure severity and presence of perceived alternatives (Grégoire *et al*, 2010); number of employees and number of customers (Grewal *et al,* 2003); firm size and firm export experience (Katsikea *et al*, 2007); and employees, years in business, competitors, revenue and years with wholesaler (Ping, 2003). Other single-item variables represented those manipulated in the case of an experiment or dichotomous variables, such as manufacturer's pledge of exclusivity (Gilliland and Bello, 2002).

Very few of the constructs measured through single-items represent true behavioral variables; however, there are cases when attitudes and behavioral intentions were measured this way, especially as recommended by Bergkvist and Rossiter (2007), for doubly concrete constructs, which should be validly measurable by a single item. The examples found include repeat purchase intention (Arnold and Reynolds, 2009), supervisor-rated performance (Arnold *et al,* 2009b), perception of the overall value of the conference (Gruen *et al*, 2007), customer value (Lam *et al,* 2004) and behavioral intentions – repurchase and complaint (Tsiros and Mittal, 2000).

Regarding the modalities of modeling the single-item indicators, half of the analyzed studies do not mention how they set up the structural and measurement model. Four of the articles use the single items in a group analysis, separating the data into groups based on the single-item variable (Roberts *et al*, 2003; Nysveen *et al*, 2005; Davis and Mentzer, 2008; Arnold and Reynolds, 2012).

Table 2: Marketing studies using single-item indicators

Study	*Journal*	*Topic*	*Single-item variables*	*Purpose*	*Modeling method*	*Software*
Adjei *et al* (2010)	*Journal of the Academy of Marketing Science*	Online brand communities and C2C communication	Depth of purchase and breadth of purchase	Hypothesis testing	Not mentioned	Amos
Ahearne *et al* (2007)	*Journal of the Academy of Marketing Science*	Salesperson service behavior	Share of customer, frequency of sales calls and length of relationship (CV)	Hypothesis testing	Not mentioned	Lisrel
Arnold and Reynolds (2012)	*Journal of Retailing*	Approach and avoidance motivations in a hedonic consumption context	Gender	Hypothesis testing	Multi-group SEM procedures were also employed to assess the effects of gender on the path relationships	Lisrel
Arnold and Reynolds (2009)	*Journal of Retailing*	Affect and retail shopping behavior	Repeat purchase intention	Hypothesis testing	Not mentioned	Not mentioned
Arnold *et al* (2009a)	*Journal of Retailing*	Store manager behavior	Product sales, service sales, annual advertising expenditures (CV), store size (CV)	Hypothesis testing	Not mentioned	Amos
Arnold *et al* (2009b)	*Journal of Retailing*	Role ambiguity, competitive climate	Supervisor-rated performance	Hypothesis testing	Not mentioned	Not mentioned
Auh *et al* (2007)	*Journal of Retailing*	Customer loyalty	Study 1: age, gender, relationship length; Study 2: entire model (path analysis)	Hypothesis testing	Path analysis: combined the items of each construct into a single indicator and set the measurement path estimates to 1 (Bollen, 1989) and the error variance to the scale variance × (1 − reliability) to account for measurement error (Hayduk, 1987)	Lisrel
Babakus *et al* (2003)	*Journal of the Academy of Marketing Science*	Service quality and employee performance	Age, education, tenure (CV) and composite scores for the other variables in the model	Hypothesis testing	Path analysis: modeling not mentioned	Lisrel
Babin and Boles (1998)	*Journal of Marketing*	Employee behavior	Path analysis: entire model includes summated indicators	Hypothesis testing	Constrained measurement coefficients to the square root of a scale's reliability and the corresponding error coefficients to 1-reliability	Not mentioned
Baker and Sinkula (2005)	*Journal of the Academy of Marketing Science*	Environmental marketing strategy and firm performance	Industry covariates	Hypothesis testing	Not mentioned	Not mentioned
Baldauf *et al* (2009)	*Journal of Retailing*	Country of origin and brand equity	CV: brand category turnover, business size	Hypothesis testing	Not mentioned	Amos

Table 2: (Continued)

Study	*Journal*	*Topic*	*Single-item variables*	*Purpose*	*Modeling method*	*Software*
Batra and Sinha (2000)	*Journal of Retailing*	Purchasing preferences for private label brands	PLB purchase	Hypothesis testing	Modeled with a measurement error or 1-α and a reliability of 0.85	Lisrel
Bettencourt (2004)	*Journal of Retailing*	Organizational citizenship behavior	Entire model (mean centered sum scales)	Hypothesis testing	Fixed the error term of each construct to the variance of the scale * 1-α; the reliability of each interaction variable was set to 0.90	Not mentioned
Bettencourt *et al* (2005)	*Journal of Retailing*	Boundary-spanning behaviors	Job satisfaction and organizational commitment (single scale scores)	Hypothesis testing	Fixed the measurement error terms at 1-α * variance of their individual scale scores; the scale of measurement for the latent constructs was set by constraining the variance for each exogenous construct and the variance for each structural error term for endogenous constructs to be 1	
Blocker *et al* (2011)	*Journal of the Academy of Marketing Science*	Customer orientation	Control variables (firm size, relationship age, relationship spending)	Hypothesis testing	Not mentioned	Not mentioned
Brockman and Morgan (2006)	*Journal of the Academy of Marketing Science*	Organizational cohesiveness and new product development	Product radicalness	Hypothesis testing	Not mentioned	Lisrel
Brumbaugh and Rosa (2009)	*Journal of Retailing*	Coupon use	Coupon redemption	Hypothesis testing	Not mentioned	Not mentioned
Burnkrant and Page (1982)	*Journal of Marketing Research*	Fishbein behavioral intention model	Behavioral intention	Hypothesis testing	λ fixed to 1, error fixed to 0	Lisrel
Cadogan *et al* (2005)	*Journal of the Academy of Marketing Science*	Export performance	Mean-centered single-scale indicators for the entire model	Hypothesis testing	Error set at (1-α) * variance, assuming a reliability of 0.7	Lisrel
Cotte and Wood (2004)	*Journal of Consumer Research*	Families and consumer behavior	Birth order (CV)	Hypothesis testing	Not mentioned	Not mentioned
Davis and Mentzer (2008)	*Journal of Retailing*	Trade and brand equity, relational resources	Relationship age	Hypothesis testing	Group testing	Not mentioned
Clercq *et al* (2009)	*Journal of the Academy of Marketing Science*	Innovation, collaboration	Covariates: firm size, firm age	Supplementary analysis	Not mentioned	Not mentioned
Eisend and Küster (2011)	*Journal of the Academy of Marketing Science*	The effectiveness of publicity versus advertising	Source credibility, attitude toward message, attitude toward brand, purchase intention, cognitive responses	Meta-analysis	Measurement errors corrected by reliability coefficients; a 0.8 reliability estimate applied to single-item measures; error variances are set to 0, as measurement errors are considered when integrating the effect sizes	Not mentioned

Fornell and Bookstein (1982)	*Journal of Marketing Research*	Lisrel and PLS applied to consumer exit-voice theory	Consumer exit	Compare PLS and Lisrel	λ fixed to 1, error fixed to 0	PLS and Lisrel
Franke and Park (2006)	*Journal of Marketing Research*	Meta-analysis on salesperson adaptive selling behavior and customer orientation	Entire model	Meta-analysis	Error set at 0 for age and sales experience and set at 1-mean reliabilities for the other variables	Lisrel
Garretson *et al* (2002)	*Journal of Retailing*	Private label attitude and national brand-promotion attitude	Percentage of private label purchases and percentage of promoted product purchases	Hypothesis testing	Not mentioned	Not mentioned
Gelbrich (2010)	*Journal of the Academy of Marketing Science*	Service failure	Age, gender, experience	CFA and PLS to SEM for hypothesis testing	Not mentioned	Amos
Gilliland and Bello (2002)	*Journal of the Academy of Marketing Science*	Attitudinal commitment	Manufacturer's pledge of exclusivity (dichotomous)	Hypothesis testing	Polyserial correlation matrix, estimated by maximum-likelihood estimation (MLE)	Lisrel
Grégoire *et al* (2010)	*Journal of the Academy of Marketing Science*	Customer direct and indirect revenge	Interaction frequency, failure severity, presence of perceived alternatives, age and gender	Hypothesis testing	Not mentioned	PLS and Lisrel SEM
Grewal *et al* (2003)	*Journal of Retailing*	Effects of wait expectations and store atmosphere evaluations on patronage intentions	Number of employees, number of customers, gender	Hypothesis testing	Not mentioned	Lisrel
Gruen *et al* (2007)	*Journal of the Academy of Marketing Science*	Value creation through customer-to-customer exchange	Perception of the overall value of the conference	Hypothesis testing	Not mentioned	Amos
Hoffmann and Broekhuizen (2009)	*Journal of the Academy of Marketing Science*	The relevance of consumers' susceptibility to interpersonal influence in an investment context	Number of transactions	Hypothesis testing	Not mentioned	Amos
Hui *et al* (1998)	*Journal of Consumer Research*	Consumers' reaction to waiting	Affective response to the wait, service evaluation	Hypothesis testing	λ fixed to 1	Lisrel
Hunter and Perreault Jr. (2007)	*Journal of Marketing*	Sales technology effectiveness	Test the fit of the overall structural model and the hypothesized effects by using scale scores (based on the average of the individual items) for the latent constructs	Hypothesis testing	The standardized effect of measurement error for a scale is equal to the square root of the reliability estimate. The error variances are equal to the product of the scale variance and 1 minus the scale reliability	Not mentioned
Im *et al* (2003)	*Journal of the Academy of Marketing Science*	Innate consumer innovativeness, personal characteristics and new product-adoption behavior	Income, length of residence, education and age (CV)	Hypothesis testing	Not mentioned	Not mentioned
Jiang and Punj (2010)	*Journal of the Academy of Marketing Science*	Effects of attribute concreteness and prominence on selective processing, choice and search experience	Attribute importance, subjective knowledge, online shopping experience, gender	Mediation effect testing	Not mentioned	Not mentioned

Table 2: (Continued)

Study	*Journal*	*Topic*	*Single-item variables*	*Purpose*	*Modeling method*	*Software*
Johnson (1999)	*Journal of the Academy of Marketing Science*	The strategic role of interfirm relationships	Age (CV)	Hypothesis testing	λ fixed to 1	Lisrel
Jones *et al* (2008)	*Journal of the Academy of Marketing Science*	Commitment in service provider–consumer relationships	Duration of the personal relationship	Hypothesis testing	Not mentioned	Not mentioned
Katsikea *et al* (2007)	*Journal of the Academy of Marketing Science*	Drivers of sales effectiveness in export market ventures	Firm size and firm export experience (CV)	Hypothesis testing	Not mentioned	EQS
Klein *et al* (1998)	*Journal of Marketing*	Foreign product purchase	Animosity (second-order) and product ownership	Hypothesis testing	Not mentioned	Lisrel
Ko *et al* (2005)	*Journal of Advertising*	Advertising interactivity	Duration of time on a Website	Hypothesis testing	Not mentioned	Lisrel
Kukar-Kinney and Close (2010)	*Journal of the Academy of Marketing Science*	Determinants of consumers' online shopping cart abandonment	Buying from land store	Hypothesis testing	Not mentioned	AMOS
Kukar-Kinney and Walters (2006)	*Journal of Retailing*	Price-matching guarantees	Competitive scope, depth of refund	Hypothesis testing	Latent variable SEM	MLE
Kwak *et al* (2006)	*Journal of the Academy of Marketing Science*	Consumer ethnocentrism	E-mail communications	Hypothesis testing	Not mentioned	Lisrel
Lam *et al* (2004)	*Journal of the Academy of Marketing Science*	Customer value, Satisfaction, loyalty and switching costs	Customer value	Hypothesis testing	Indicator loading fixed to 1, error variance to 0	Lisrel
Larson *et al* (2008)	*Journal of the Academy of Marketing Science*	Cause-related marketing efforts' influence on sales representatives	Tenure	Hypothesis testing	Not mentioned	Lisrel
Laverie *et al* (2002)	*Journal of Consumer Research*	Social identity model of mundane consumption	Possessions, social and media commitment	Hypothesis testing	Reliability of each single indicator construct was fixed at 0.95	Lisrel
Lueg *et al* (2006)	*Journal of Retailing*	Consumer socialization	Single-indicator composites created by averaging the individual scale items	Hypothesis testing	Error set at (variance of the scale) * (1-reliability) for each indicator	Lisrel
MacKenzie *et al* (1986)	*Journal of Marketing Research*	Attitude toward the ad	ad, brand cognitions	Hypothesis testing	Factor loadings fixed at 1, measurement error at 0	Lisrel
MacKenzie *et al* (1999)	*Journal of the Academy of Marketing Science*	Citizenship behaviors	Objective performance	Hypothesis testing	Reliability of 1 assumed for single-item indicators	Lisrel
Magi and Julander (2005)	*Journal of Retailing*	Store-level price knowledge	Income, education, number of stores shopped, length of residence	Hypothesis testing	The error variances of the single indicators set at 0.1 * variance	Lisrel

Maignan *et al* (1999)	*Journal of the Academy of Marketing Science*	Corporate citizenship	Summated scales for all indicators except performance	Hypothesis testing	Factor loadings set at the square root of the reliabilities for each scale, error terms to 1-reliability	Lisrel
Mangleburg *et al* (2004)	*Journal of Retailing*	Teens' susceptibility to peer influence	Age, money spent	Hypothesis testing	Factor loadings fixed at 1	Lisrel
Marshall *et al* (2008)	*Journal of Advertising Research*	Image congruity	Image congruity	Hypothesis testing	Not mentioned	Amos
Martin and Bush (2006)	*Journal of the Academy of Marketing Science*	Antecedents and performance-related consequences of customer-oriented selling	Objective salesperson performance; represented each latent construct with a single average index	Hypothesis testing	Indicator loading fixed to square root of its construct reliability, error terms to 1-reliability	Lisrel
Nijssen *et al* (2003)	*Journal of the Academy of Marketing Science*	The influence of industry context on consumer satisfaction, trust, value and loyalty	Gender, education, industry	Hypothesis testing	Not mentioned	EQS
Noble *et al* (2006)	*Journal of Retailing*	Local merchant loyalty	Age, gender	Hypothesis testing	Not mentioned	Amos
Nysveen *et al* (2005)	*Journal of the Academy of Marketing Science*	Consumers' intention to use mobile services	Age, gender	Hypothesis testing	Group analysis	Amos
Patterson *et al* (1997)	*Journal of the Academy of Marketing Science*	Determinants of customer satisfaction or dissatisfaction	Complexity, fairness	Hypothesis testing	Not mentioned	Lisrel
Ping Jr. (2003)	*Journal of Retailing*	Satisfaction in a marketing channel	Employees, years in business, competitors, revenue, years with wholesaler	Hypothesis testing	Not mentioned	Lisrel
Reynolds and Harris (2009)	*Journal of Retailing*	Dysfunctional customer behavior severity	Sex, age, income, level of intoxication	Hypothesis testing	Not mentioned	Not mentioned
Roberts *et al* (2003)	*Journal of the Academy of Marketing Science*	Impact of family structure on materialism and compulsive buying	Family structure, socioeconomic status	Hypothesis testing	Group analysis for family structure	Not mentioned
Scheer *et al* (2010)	*Journal of the Academy of Marketing Science*	Supplier capabilities and industrial customers' loyalty	Supplier's price competitiveness, ability to reduce customer inventory costs, ability to reduce customer ordering costs, customer–supplier relationship duration and the time pressure	Hypothesis testing	Path analysis	EQS
Schim *et al* (2001)	*Journal of Retailing*	Online prepurchase intentions	Subjective norm	Hypothesis testing	A conservative error variance was established for the single-item scale	Lisrel
Shim and Eastlick (1998)	*Journal of Retailing*	The role personal values	Ethnicity, ethnic identification and mall shopping behavior	Hypothesis testing	Level of reliability at 0.85 and adjustment formula suggested by Joreskog and Sorbom for error	Lisrel

Table 2: (Continued)

Study	*Journal*	*Topic*	*Single-item variables*	*Purpose*	*Modeling method*	*Software*
Singhapakdi *et al* (1999)	*Journal of the Academy of Marketing Science*	Perceived moral intensity and personal moral philosophies	(Un)ethical intentions, gender, education, income	Hypothesis testing	Except for gender, treated as a perfectly reliable measure, the error terms for the other single-item indicators were set at 0.20	Lisrel
Tsiros and Mittal (2000)	*Journal of Consumer Research*	Regret in consumer decision making	Behavioral intentions (repurchase and complaint)	Hypothesis testing	Not mentioned	Not mentioned
Wilson and Till (2007)	*Journal of Advertising Research*	Direct-to-consumer advertising effectiveness	Age and education	Hypothesis testing	λ fixed to 1 and assigned an error variance of 0.0	Lisrel
Yilmaz and Hunt (2001)	*Journal of the Academy of Marketing Science*	Salesperson cooperation	Financial rewards and nonfinancial rewards	Hypothesis testing	Measurement error set at set at 0.1 * variance of each measure	Lisrel

In addition, as it can be seen in Table 2, 9 articles used a relatively easy method to model a single-item indicator in SEM, by fixing the error term to 0 and the path loading λ to 1 (MacKenzie *et al*, 1986). Eight studies employed a modeling method recommended by numerous researchers cited in our previous analysis: modeling the error at (1-α) $\star$ variance, while using reliability values ranging from 0.7 to 0.95, most commonly at 0.85 (Sorbom and Joreskog, 1982; Anderson and Gerbing, 1988; Baumgartner and Homburg, 1996; Schumacker and Lomax, 2004).

Regarding the software used for SEM analysis, whereas some studies do not mention the program employed, the majority of the articles use either Lisrel or Amos, with some mentions of EQS.

Overall, the synthesis provided in Table 2 shows an image on the use of single-item indicators in marketing research, from the types of constructs and domains more prone to employing this type of measurement, to how single-item indicators are modeled in SEM and software such as Lisrel and Amos. However, research would benefit even more from methodological point of view if more articles could mention the method of modeling and setting up in the software syntax of single items, especially for constructs that cannot be measured through multiple items, such as demographics, sales, expenditures, years of experience and number of customers.

In the following section, we summarize the discussion regarding the use of single-item indicators and their presence in marketing, and provide recommendations that can help improve the frequency and quality of their use in marketing research.

RECOMMENDATIONS

One of the outcomes and conclusions of the single-item debate in the marketing and, in general, social sciences literature is that, indeed, their use is not always recommended and might have, in many circumstances, negative consequences. Some of the potential risks to be kept in mind are especially represented by reliability and error measurement issues, as shown in the overview we provided (Campbell and Fisk, 1959; Nunnally, 1978; Aaker and Bagozzi, 1979; Churchill, 1979; Anderson and Gerbing, 1988; Kline, 2005; Bergkvist and Rossiter, 2007). Nevertheless, from practical point of view, marketing researchers need to remember reviewers' and editors' reluctance in accepting (certain) studies that employ single-item measures. However, as we saw in our theoretical and practical overview, there are circumstances when measures using a single item can be successful and can be employed in statistical procedures such as SEM.

When to use single-item measures

As stated in previous studies, single-item constructs can easily be used for more concrete constructs, as they might require a more abstract thinking than multiple-item scales, and when the survey will be administered to a wide range of different populations (Fuchs and Diamantopoulos, 2009). Single-item measures can be used to assess concepts that are simple and lack the complexity of the majority of psychological constructs, meaning easy to understand meanings of terms (Hair *et al,* 2009).

In marketing, Hair *et al* (2009) give the example of some behavioral outcomes, such as sales and other directly observable variables, including purchase versus non-purchase. Moreover, they also note the fact that the concept of liking a product, a brand or a store is a simple and easily understood and might not require multiple items. For example, the purchase intention scale used by MacKenzie *et al* (1986) asks about the 'probability that you will try Shield toothpaste when it becomes available in your area' and was measured by three scales, likely/unlikely, probable/improbable and possible/impossible, with excellent α coefficients over 0.8. The three items are extremely beneficial for use in SEM, especially when discussing about model identification, degrees of freedom and measurement error. However, some respondents might react in a negative way when seeing the three scales and might even have difficulties in discriminating between them. In this case, intention to buy might represent a simple and easy-to-understand term (Hair *et al,* 2009) that does not exclude the use of a single item, especially if the researcher is pressed by a lengthy questionnaire.

Therefore, besides the demographic variables where researchers have no choice, there are other concrete and easy–to-understand variables in marketing that can be measured through single items. In our analysis of single-items use in marketing research, we saw successful uses of such measures for concrete concepts, such as sales, expenditures or interaction frequency, but also for behavioral constructs, such as repeat purchase intention, supervisor-rated performance and affecting response to waiting.

How to use single-items in SEM

The use of CFA allows the inclusion of single-item indicators in the analysis, especially when dealing with demographic variables, such as gender and age. However, even in CFA, the measurement error, meaning the amount of variance in the indicator that is not explained by the factor, cannot, obviously, be computed (Brown, 2006). However, researchers can fix the unstandardized value of the indicator to a predetermined value. Zero can be used when it is assumed that the indicator is perfectly reliable, such as demographics. Nevertheless, when measuring a more abstract construct, the unstandardized error can be fixed to a value based on the measure's sample variance estimate and known psychometric information, such as the internal consistency estimate (Brown, 2006). Unless no error should be present in measurement, in the case of demographics, when λ can be fixed at 1, conservative values are recommended for the λ parameters, for example, 0.95 ⋆ variance (Anderson and Gerbing, 1988; Sorbom and Joreskog, 1982). In addition, it is recommended that error variance be calculated as 'sample variance of the indicator ⋆ (1-scale reliability estimate)'. Moreover, this formula can also be used when not using pure single-item indicators in SEM, but hybrid single-item composite or mean scores for scales with multiple-items that cannot be modeled in SEM, especially due to a too large number of items.

Regarding the reliability estimate for single items, researchers can use a reliability value from another study or similar measure, if available (MacKenzie, 2001). If not possible to calculate a reliability estimate, a conservative arbitrary value such as 0.85 (Joreskog and Sorbom, 1982) is recommended.

Besides using single-item measures as latent variables, they can also be modeled in multiple group testing in SEM, such as in the case of gender, education and especially dichotomous variables that allow not only to test the model, but also if there are any differences regarding the significance of the model between the multiple samples. In this case, researchers need to pay attention to the sample size for each of the groups.

Overall, as Table 2 shows, there are different types of marketing variables that can be successfully measured and modeled in SEM through single-item indicators, even if indices such as reliability are not known.

CONCLUSIONS

This article analyzes the use of single-item indicators in marketing research and the utilization of this type of measures in SEM. The literature review regarding the debate of the use of single-item measures provides an overview of the arguments for and against their use in social sciences research and in SEM. The analysis of recent studies that use single-item indicators from top marketing journals provides information regarding the types of constructs fit for single-item measurement and the way these indicators are used in SEM.

The overview of practical and theoretical issues regarding single-item measures shows that, especially simple, easy-to-understand and concrete constructs can be successfully measured through one item. In addition, through different formulas and conservative values for reliability and measurement error, even behavioral constructs measured through single-items can be professionally and reliably included in structural equation models. Overall, we present clarifications to the debate regarding the use of single-item indicators in marketing research and give examples of types of constructs measurable through single-item indicators and their use in SEM.

Besides providing a structured picture of the practice of single-item measures in marketing research and contributing to the single-item debate, the article also brings information and recommendations that add knowledge to the empirical analysis and methodology domains of marketing research.

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