Journal of Business Research xxx (2016) xxx–xxx

Contents lists available at ScienceDirect

Journal of Business Research

Prediction-oriented modeling in business research by means of PLS path modeling: Introduction to a JBR special section

Gabriel Cepeda Carrión [a,*], Jörg Henseler [b,d], Christian M. Ringle [c,e], José Luis Roldán [a]

[a] Department of Business Management and Marketing, Universidad de Sevilla, Av. Ramón y Cajal, 1, 41018 Sevilla, Spain
[b] Department of Design, Faculty of Engineering Technology, University of Twente, 7500 AE Enschede, The Netherlands
[c] Hamburg University of Technology (TUHH), Am-Schwarzenberg-Campus 4 (D), 21073 Hamburg, Germany
[d] NOVA IMS, Universidade Nova de Lisboa, 1070-312, Lisboa, Portugal
[e] University of Newcastle, University Dr, Callaghan NSW 2308, Australia

ARTICLE INFO

Article history:
Received 1 August 2015
Received in revised form 1 February 2016
Accepted 4 March 2016
Available online xxxx

Keywords:
Partial least squares
Prediction-oriented modeling
Business research
Quantitative methods

ABSTRACT

Under the main theme "prediction-oriented modeling in business research by means of partial least squares path modeling" (PLS), the special issue presents 17 papers. Most contributions include content from presentations at the 2nd International Symposium on Partial Least Squares Path Modeling: The Conference for PLS Users, which took place at the Universidad de Sevilla (Spain) from June 16 to 19, 2015. This conference provided PLS users with a platform for the fruitful exchange of ideas on variance-based structural equation modeling. At the same time, the conference addressed the latest methodological advances and their use in research practice. Finally, the conference resumed and enriched the ongoing discussion on the strengths and weaknesses of PLS.
Researchers often emphasize that predictive capabilities is a strength of the PLS method. Nevertheless, methodological advances and applications in this direction are rare. The scientific committee therefore selected high-quality papers that mainly advance PLS and prediction. The special issue editors believe that these special issues will become the starting point for a more intensive use of predictive modeling in the social sciences discipline and for additional advances that will exploit PLS' capabilities in this area.

1. Introduction

Partial least squares path modeling (PLS; Chin, 1998; Dijkstra, 2010; Lohmöller, 1989; Wold, 1982) is a variance-based method to estimate composite-based path models (Hair, Hult, Ringle, & Sarstedt, 2017; Henseler et al., 2014). As numerous review studies show, PLS enjoys rapidly increasing usage in various business disciplines, such as accounting (Lee, Petter, Fayard, & Robinson, 2011), family business (Sarstedt, Ringle, Smith, Reams, & Hair, 2014), management information systems (Ringle, Sarstedt, & Straub, 2012), marketing (Hair, Sarstedt, Ringle, & Mena, 2012), operations management (Peng & Lai, 2012), strategic management (Hair, Sarstedt, Pieper, & Ringle, 2012), and tourism (do Valle & Assaker, in press). Even though the popularity of PLS continues to increase, researchers often call for more rigor when applying the method (e.g., Hair, Ringle, & Sarstedt, 2013; Rigdon et al., 2014; Roldán & Sánchez-Franco, 2012; Sarstedt, Ringle, Henseler, & Hair, 2014). At the same time, in the context of PLS, Rigdon (2014, p. 166) notes: "We have seen a long period where our choice of statistical tools has shaped our research goals, exalting parameter estimation and fit assessment and neglecting prediction. In the future, we need to have our choice of goals shaping our tools." However, new PLS developments primarily address the method's explanatory and confirmatory capabilities so far. Advances of the PLS include consistent PLS estimates for factor models (Dijkstra & Henseler, 2015b), the confirmatory tetrad analysis for testing the kind of measurement model and construct (Gudergan, Ringle, Wende, & Will, 2008), the heterotrait–monotrait ratio of correlations (HTMT) for assessing discriminant validity (Henseler, Ringle, & Sarstedt, 2015), methods for uncovering unobserved heterogeneity (e.g., Becker, Rai, Ringle, & Völckner, 2013; Ringle, Sarstedt, & Schlittgen, 2014), different multigroup analysis approaches (Chin & Dibbern, 2010; Sarstedt, Henseler, & Ringle, 2011), testing measurement invariance of composites (Henseler, Ringle, & Sarstedt, 2016), as well as the use of PLS for non-recursive models and overall goodness-of-fit measures (Dijkstra & Henseler, 2015a). All these changes culminate in revised guidelines for PLS' confirmatory research use (Henseler, Hubona, & Ray, 2016), as well as updated primers and new advanced PLS textbooks (Hair et al., 2017; Hair, Sarstedt, Ringle, & Gudergan, in press).

While PLS researchers concentrate their efforts largely on confirmatory research, PLS' use for predictive research problems is somewhat out of focus. Yet researchers often emphasize its predictive capabilities as a strength of the PLS method (e.g., Hair, Ringle, & Sarstedt, 2011). At the moment, methodological advances and applications in this direction are rare. Against this background, the "2nd International Symposium

* Corresponding author.
E-mail addresses: gabi@us.es (G. Cepeda Carrión), j.henseler@utwente.nl (J. Henseler), ringle@tuhh.de (C.M. Ringle), jlroldan@us.es (J.L. Roldán).

http://dx.doi.org/10.1016/j.jbusres.2016.03.048
0148-2963/

on Partial Least Squares Path Modeling: The Conference for PLS Users" worked with the Journal of Business Research (JBR) to develop a special issue that includes advances in PLS and prediction, as well as substantial PLS applications in marketing and management research that mainly have an orientation toward prediction. The purpose of the special issue is to establish a starting point for the more intensive use of predictive modeling in the social sciences discipline and to initiate additional advances to exploit PLS' capabilities in this area. Most papers included in the special issue are extended versions of papers presented at the 2nd International Symposium on Partial Least Squares Path Modeling: The Conference for PLS Users.

2. The 2nd international symposium on PLS: the conference for PLS users

From June 16 to 19, 2015, the Universidad de Sevilla, Spain, hosted the conference for PLS users. Gabriel Cepeda Carrión (University of Seville), Jörg Henseler (University of Twente and Universidade Nova de Lisboa), Christian M. Ringle (Hamburg University of Technology, TUHH, and The University of Newcastle), and José Luis Roldán (University of Seville) chaired the conference. The International Symposium on PLS was an ideal place to answer the challenges pertaining to advanced issues in PLS, such as its orientation toward prediction. The conference gathered scholars from more than 30 countries, who presented their contributions and obtained rich feedback from the participants. Given the tradition of the Department of Business Administration and Marketing at the Universidad de Sevilla regarding the application and diffusion of the PLS technique, the University was a perfect venue for this PLS meeting.

The scientific program committee handled more than 80 submissions and decided on the final conference program; this committee comprised the following members: Francisco J. Acedo (Universidad de Sevilla), Sönke Albers (Kühne Logistics University), Tomàs Aluja (Universitat Politècnica de Catalunya, Spain), Nicholas J. Ashill (American University of Sharjah), Jan.-Michael Becker (University of Cologne), Diogenes Bido (Universidade Presbiteriana Mackenzie), Pedro Simoes Coelho (Universidade Nova de Lisboa), Tim Coltman (University of Wollongong), Timothy Devinney (The Universtiy of Leeds), Theo Dijkstra (University of Groningen), Andreas Eggert (University of Paderborn), Vincenzo Esposito Vinzi (ESSEC), John Ettlie (Rochester Institute of Technology), Siegfried Gudergan (The University of Newcastle), Michael Haenlein (ESCP, France), Joe Hair (Kennesaw State University, U.S.A.), Andrew Hardin (University of Nevada), Geoffrey Hubona (Virginia Commonwealth University), John Hulland (University of Georgia), Tomas Hult (Michigan State University), Izani Ibrahim (University Kebangsaan Malaysia), Surinder Kahai (Binghamton University, State University of New York), Byron Keating (University of Canberra), George Marcoulides (University of California, Santa Barbara), David Midgley (INSEAD), Yuichi Mori (Okayama University), Aron O'Cass (University of Tasmania), Shintaro Okazaki (Universidad Autónoma de Madrid), David Xiaosong Peng (University of Houston), Arun Rai (Georgia State University), Thurasamy Ramayah (University Sains Malaysia), Edward E. Rigdon (Georgia State University), James Robins (Vienna University of Economics and Business), Gastón Sánchez (University of California, Berkeley), Marko Sarstedt (Otto-von-Guericke-University Magdeburg), Holger Schiele (University of Twente), Rainer Schlittgen (University of Hamburg), Judit Simon (Corvinus University of Budapest), Rudolf Sinkovics (Manchester Business School), Detmar Straub (Georgia State University), Dirk Temme (University of Wuppertal), Michel Tenenhaus (HEC), Jason Bennett Thatcher (Clemson University), Ron Thompson (Wake Forest University), Sunil Venaik (The University of Queensland), and Martin Wetzels (Maastricht University).

Many of the conference papers and sessions offered important developments in PLS' path modeling use. The conference primarily increased the applicability of PLS in the management and marketing field. Most of the sessions were truly unmissable. The plenary sessions had noteworthy keynote speakers in the PLS field, such as Edward E. Rigdon (Georgia State University), Theo K. Dijkstra (University of Groningen), Joseph F. Hair (Kennesaw State University), and Wynne W. Chin (University of Houston). The following videos of the conference's key moments are available:

- Conference opening: http://tv.us.es/videoembed/?numberpost=30259
- Keynote talk I: Reconciling composite-based and factor-based approaches to structural equation modeling (Edward E. Rigdon): http://tv.us.es/videoembed/?numberpost=30263
- Keynote talk II: PLS & CB SEM: A weary and a fresh look at presumed antagonists (Theo K. Dijkstra): http://tv.us.es/videoembed/?numberpost=30269
- Keynote talk III: On partial least squares' variance-based component SEM (VBSEM) versus covariance-based SEM (CBSEM) for confirmatory analysis: it's all about the components and variance explained (Wynne W. Chin): http://tv.us.es/videoembed/?numberpost=30273
- Featured talk: Confirmatory composite analysis (Jörg Henseler): http://tv.us.es/videoembed/?numberpost=30277
- Panel session: The future of PLS (Discussants: Edward E. Rigdon, Theo K. Dijkstra, Galit Shmueli. Moderator: Jörg Henseler): http://tv.us.es/videoembed/?numberpost=30281.

Several sessions, and specifically the panel session, were devoted to this special issue's topic: the prediction-oriented nature of PLS.

3. PLS and its prediction-oriented results assessment

Researchers and practitioners appreciate PLS' various advantageous features for practical applications (e.g., Hair, Sarstedt, Ringle, et al., 2012). Orientation toward prediction has been one of PLS' key building blocks since its creation (Jöreskog & Wold, 1982; Wold, 1985). Recent conceptual (Chin, 2010a; Sarstedt, Ringle, Henseler et al., 2014) and empirical studies (Becker, Rai, & Rigdon, 2013; Evermann & Tate, 2012) substantiate the suitability of PLS path modeling for predictive purposes. However, when researchers come to assess the predictive capabilities of PLS, the Stone-Geisser Q^2 criterion (Geisser, 1974; Stone, 1974) and the q^2 predictive effect size, which the blindfolding routine delivers (e.g., Hair et al., 2017), are the only standard evaluation criteria thus far (Chin, 1998, 2010b).

The special issue thus aims at providing methodological advances in PLS prediction and management and marketing applications that address this issue. The JBR editor-in-chief, Arch Woodside, the special issue editors, and the reviewers focus on the use of established predictive validity assessment. In addition, they suggest the use of holdout samples in PLS, as Hair, Sarstedt, Ringle, et al. (2012) call for, and the use of fuzzy-set qualitative comparative analysis (fsQCA) to test for causal asymmetry (Gigerenzer & Brighton, 2009; Woodside, 2013).

3.1. Assessing the predictive validity of PLS path models using holdout samples

There are strong recommendations for using cross-validation by means of holdout samples as a standard results assessment routine in PLS (Hair, Sarstedt, Ringle, et al., 2012). The holdout sample assessment allows for determining how well a predictive model will perform in practice, especially when the analysis follows prediction-oriented goals (Ebbes, Papies, & van Heerde, 2011). The use of holdout samples can encourage analysts to find a balance between model fit and prediction capability (Schorfheide & Wolpin, 2012). However, researchers rarely use holdout samples when evaluating their PLS results. Possible reasons for this may be the scarcity of guidelines on the use of holdout samples in the PLS context resulting in a lack of analysts' knowledge

Please cite this article as: Cepeda Carrión, G., et al., Prediction-oriented modeling in business research by means of PLS path modeling: Introduction to a JBR special section, *Journal of Business Research* (2016), http://dx.doi.org/10.1016/j.jbusres.2016.03.048