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Partial least squares structural equation modeling (PLS-SEM): A useful tool for family business researchers

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ABSTRACT

Structural equation modeling (SEM) has become a mainstream method in many fields of business research, but its use in family business research remains in its infancy. This lag in SEM's application holds especially true for partial least squares SEM (PLS-SEM), an alternative to covariance-based SEM, which provides researchers with more flexibility in terms of data requirements, model complexity and relationship specification. This article draws attention to PLS-SEM as an opportunity to advance the development and testing of theory in family business research by providing a non-technical introduction into the basic concepts and issues of PLS-SEM, bearing the needs of potential users in mind. To this end, a systematic procedure for PLS-SEM results evaluation is presented and applied to an annotated example. The article also illustrates the analysis of mediating effects, which researchers are increasingly testing in their models.

1. Introduction

Analytical rigour and sophistication in research methods are important to innovation in theory building in business research (Bird, Welsch, Astrachan, & Pistrui, 2002; Chandler & Lyon, 2001). However, the value of such new methods depends on scholars' willingness to learn, adopt and embrace these methods and think strategically about the research process (Zahra & Sharma, 2004). As far back as the early 1990s, Wortman (1994) noted that empirical studies in family business research used only rudimentary statistical techniques. Similarly, Bird et al.'s (2002) review of 148 family business research articles showed that only 35 (23.65%) used some type of multivariate analysis (e.g., analysis of variance, regression, or factor analysis), whereas the majority of studies relied on descriptive and bivariate (e.g., correlation) analyses or did not perform any statistical analysis. However, Bird et al. (2002) also show that more recent research places much greater emphasis on statistical modeling and analysis, concluding that "family business research is increasing in sophistication" (Bird et al., 2002, p. 346). Wilson et al. (2014) recently further substantiated this finding in their review of 30 years of research methods used by family business researchers. Other important fields of business research have undergone similar developments. For example, several decades ago, the top marketing journals contained articles that were virtually free of multivariate data analysis. Today, however, scholarly marketing journals are filled with articles describing and using sophisticated, quantitative methodologies (e.g., Babin, Hair, & Boles, 2008).

One of the most salient methods in this respect is structural equation modeling (SEM; e.g., Rigdon, 1998), which enables researchers to simultaneously examine a series of interrelated dependence relationships between a set of constructs, represented by several variables (e.g., scales), while accounting for measurement error. SEM's ability to simultaneously test relationships incorporated into an integrated model has contributed to its widespread application. However, although SEM has become a mainstream method in many fields of business research (e.g., Babin et al., 2008), its use in family business research remains at an early stage of development (Wilson et al., 2014). This condition holds especially true for partial least squares SEM (PLS-SEM), an alternative to covariance-based SEM (CB-SEM) for estimating theoretically established cause–effect relationship models, whose

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use has recently gained momentum in a variety of fields (Hair, Sarstedt, Pieper, & Ringle, 2012; Hair, Sarstedt, Ringle, & Mena, 2012; Ringle, Sarstedt, & Straub, 2012).

The PLS-SEM method has been designed as a prediction-oriented approach to SEM that relaxes the demands on data and specification of relationships set by CB-SEM (Dijkstra, 2010; Jöreskog & Wold, 1982; Rigdon, 2012). For example, PLS-SEM is able to reliably estimate very complex models using only few observations without imposing distributional assumptions on the data. In a nutshell, its statistical properties make PLS-SEM particularly useful for exploratory research settings that are "simultaneously data-rich and theory-primitive" (Wold, 1985, p. 589). However, its capabilities also support its use for theory testing (Hair, Ringle, & Sarstedt, 2011). As such, PLS-SEM meets the challenges faced by family business researchers who are confronted with an increasing complexity of theories and cause–effect models, over-surveyed respondents and decreasing response rates (Benavides-Velasco, Quintana-García, & Guzmán-Parra, 2013; Gedajlovic, Carney, Chrisman, & Kellermanns, 2012; Rogelberg & Stanton, 2007; Wright & Kellermanns, 2011).

Against this background, this article draws attention to PLS-SEM as an opportunity to advance the development and testing of theory in family business research. We first provide an overview of PLS-SEM compared to CB-SEM, highlighting not just its strengths but also its weaknesses. We then explain the stages involved in the evaluation of PLS-SEM results. The article then presents a family business research-related example of how to apply PLS-SEM and concludes with a discussion of further research avenues that warrant greater attention.

2. Partial least squares structural equation modeling (PLS-SEM)

2.1. What is structural equation modeling?

To start with, we briefly explain the fundamentals of SEM in accordance with Hair, Hult, Ringle, and Sarstedt (2014). The SEM method allows researchers to model, simultaneously estimate and test complex theories with empirical data. Fig. 1 presents an example of a potential structural equation model in the family business context. The structural model represents the underlying theory or concept with its constructs (i.e., variables that are not directly measured), which are represented in structural equation models as circles or ovals (Y_1 to Y_6), and hypothesized cause–effect relationships. When latent variables serve only as independent variables (i.e., single-headed arrows are going only out of them), they are called *exogenous latent variables* (Y_1, Y_2 and Y_3). Moreover, when latent variables serve only as dependent variables (i.e., single-headed arrows are only going into them), such as Y_6, or as both independent and dependent variables (i.e., single-headed arrows are going both into and out of them), such as Y_4 and Y_5, they are called *endogenous latent variables*.

In the structural equation model example in the family business context displayed in Fig. 1, the exogenous latent variables—often seen in family business research (Astrachan, Klein, & Smyrnios, 2002)—Family Power, Family Culture and Family Experience explain the endogenous latent variables Strategic Information Sharing and Innovation. The latter two constructs explain the final target construct Relationships Value. Because the purpose of this article is to demonstrate the application of PLS-SEM in the context of family business research, we do not provide detailed theoretical support for the model, which otherwise would be necessary. After the model estimation, the researcher obtains, among others, the relative strength of the cause–effect relationships between the constructs in the structural equation model. Moreover, the R^2 value of endogenous latent variables reveals how well other constructs in the model explain these constructs.

In SEM, the latent variables must be measured by observed variables (also often called indicators, items or manifest variables). The rectangles (x_1 to x_{30}) in Fig. 1 represent the raw data that, for example, stem from responses to a questionnaire. Measurement theory determines the relationships between the latent variables and their indicators. More precisely, each construct has a measurement model (also referred to as the outer model in

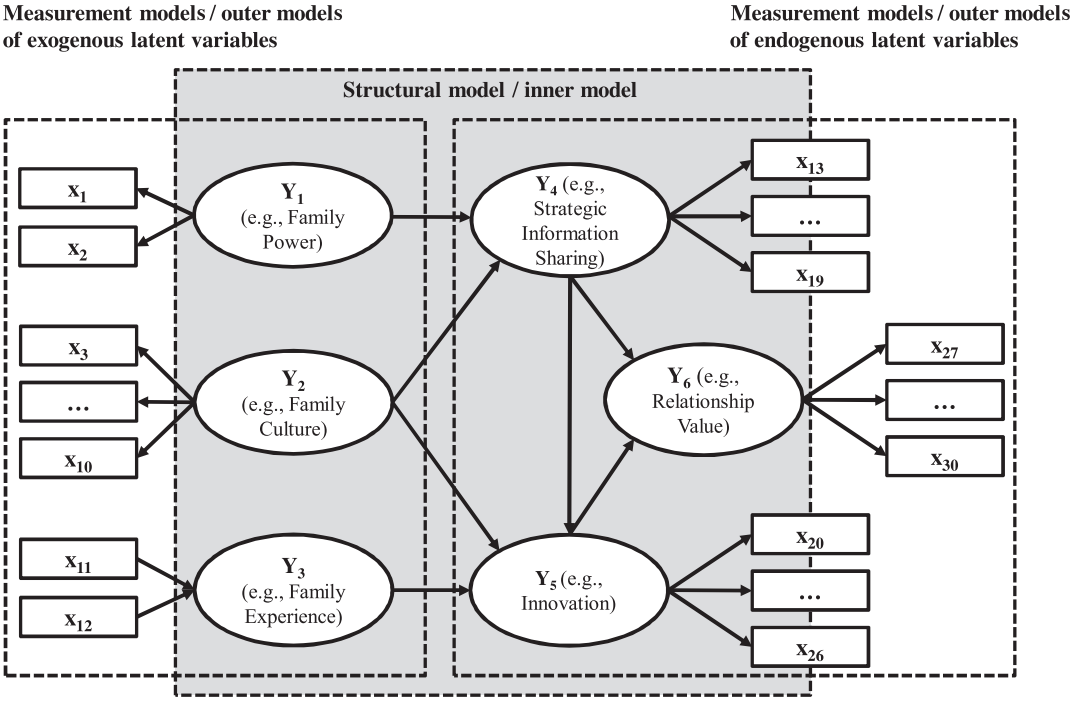

Fig. 1. A structural equations model in the family business context.