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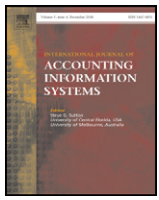

On the use of partial least squares path modeling in accounting research

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ABSTRACT

Partial least squares (PLS) is an approach to structural equation modeling (SEM) that is extensively used in the social sciences to analyze quantitative data. However, PLS has not been as readily adopted in the accounting discipline. A review of the accounting literature found 20 studies in a subset of accounting journals that used PLS as the data analysis tool. PLS allows researchers to analyze the measurement model simultaneously with the structural model and allows researchers to adopt more complex research models with both moderating and mediating relationships. This paper assists accounting researchers that may be interested in adopting PLS as an analysis tool. We explain the benefits of using PLS and compare and contrast this analysis approach with both ordinary least squares regression and covariance-based SEM. We also explain how the PLS algorithm works to derive estimates for the measurement and structural models. To further assist researchers interested in using PLS, we offer guidelines in the development of research models, analysis of the data, and the interpretation of these results with PLS. We apply these guidelines to the accounting studies that have used PLS and offer further recommendations about how researchers could apply PLS in future accounting research.

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1. Introduction

Partial least squares (PLS) path modeling is an approach to structural equation modeling (SEM) that has been in use for many years in the field of psychology and the social sciences, including many business disciplines such as marketing (e.g. Fornell and Bookstein, 1982) and information systems (e.g. Chin, 1998b). Studies utilizing PLS as a method for model estimation and testing routinely appear in leading information systems journals, as well as in leading multi-disciplinary business journals. However, despite frequent use of this technique in other business disciplines, the accounting discipline has been slower in its general acceptance of PLS and other SEM modeling techniques.

The reluctance to use PLS in accounting research perhaps may be due to a lack of understanding of PLS's benefits and applicability in accounting research. PLS, like other SEM techniques, enables a set of relationships among one or more independent variables and one or more dependent variables to be examined in a comprehensive model. Whereas traditional regression may require separate regression equations to analyze each hypothesized relationship, PLS allows the system of equations to be analyzed simultaneously. In addition, PLS and other SEM techniques allow for the analysis of both directly measured variables and latent variables.

Because PLS is closely associated with the analysis of latent constructs, it has been frequently used in survey-based research. However, PLS is not methodologically tied to surveys and has been used with data collected via other mechanisms, such as experiments (Feldman et al., 1998) and archival data (Ittner et al., 1997).

Our goal in this methodological note is to help eliminate barriers that might prevent accounting researchers from using PLS. Accounting researchers such as Hall et al. (2005) and Blanthorne et al. (2006) have recognized the potential benefits of using more sophisticated data analysis techniques such as SEM on traditional accounting data sets. To achieve this goal, we first provide a non-technical description of how PLS derives statistical parameters. Next, we provide guidelines for researchers to consider when conducting research to prevent common mistakes with PLS which could negatively impact the results, analysis, or possibility of publication. Finally, we examine selected accounting journals to identify the frequency of use of PLS, as well as the extent that the existing research conforms to the guidelines presented in this study. Not surprisingly, our review finds relatively infrequent use of PLS in published accounting research; nevertheless, the review does demonstrate that accounting research using PLS is generally consistent with our guidelines. Finally, we conclude with a discussion on limitations of this methodological note and suggest areas of future research.

2. Partial least squares and SEM

SEM is a collection of statistical techniques that allows for the simultaneous examination of a hypothesized set of relationships between one or more independent variables, either continuous or discrete, and one or more dependent variables, either continuous or discrete (Tabachnick and Fidell, 1996). SEM has been described as a second generation of multivariate analysis, with substantial advantages over "first-generation techniques such as principal components analysis, factor analysis, discriminant analysis, or multiple regression because of the greater flexibility that a researcher has for the interplay between theory and data" (Chin, 1998a, p. vii). SEM is a merger of two powerful approaches — factor analysis and path analysis, allowing researchers to simultaneously assess the measurement model (traditionally accomplished with factor analysis) and the structural model (traditionally accomplished with path analysis).[4]

With the use of SEM, we are able to comprehensively test the hypotheses associated with a research model. The theoretical understanding of the research model improves with SEM because any mediating variables are fully examined as part of the analysis. Additionally, the variance explained in the dependent variables is higher because of the consideration of both direct and indirect effects. With regression, each of the hypotheses within a mediated model must be tested using separate regressions where each potential mediator is examined in a multi-step process (e.g. Baron and Kenny, 1986). In more complex research models, the value of using SEM versus regression increases as both direct and indirect variables are assessed together in a comprehensive model. Furthermore, with SEM, the variables can be latent variables, which are those that are not measured

[4] Kline (2005) provides a general introduction to SEM. For more details on SEM in the accounting context, see Blanthorne et al. (2006).