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PARTIAL LEAST SQUARE STRUCTURAL EQUATION MODELING (PLS-SEM)

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Introduction

Structural Equation Modeling (SEM) is a multivariate statistical analysis tool that is increasingly used to analyze structural relationship by the researcher in the business field. Two primary SEM techniques are Covariance-based Structural Equation Modeling (CB-SEM) and Partial Least Squares Structural Equation Modeling (PLS-SEM). CB-SEM is primarily used to confirm or reject theories by determining how well a proposed theoretical model can estimate the covariance matrix for a sample dataset. On the other hand, PLS-SEM is primarily used to develop theories in exploratory research by explaining the variance in the dependent variables when examining the model.

Why PLS-SEM?

Among the two techniques, PLS-SEM has increasingly become a priority selection among the researchers in the social sciences field. PLS-SEM is originally developed by Wold (1985) and Lohmoller (1989) as an alternative to CB-SEM. It is an analytical alternative for weak theory and aims at improving theory testing and development. Many researchers have used PLS-SEM with the purpose to develop theories in exploratory research. Among the greatest features of PLS-SEM is, it can deal with problematic modelling issues that frequently occur in the social sciences researches such as to estimate path models comprising several constructs, many structural path relationships and many indicators per construct (Hair, *et al*., 2011). In fact, PLS-SEM allows for flexible handling of sophisticated model elements such as moderating and mediating variables. Furthermore, the PLS-SEM is able to specify the relationship between items and constructs, whether the measurement is reflective or formative (Hair, *et al*., 2014). The tool focuses on maximizing the prediction of hypothesized relationships rather than fit into a theory. The following Table 1 provides some points to be considered in choosing PLS-SEM for data analysis in a study.

Table 1. Summary of the Characteristics of PLS-SEM Application

Characteristics	When to use?
Sample	Small sample sizes when models comprise many constructs and a large number of items.
Distribution Assumptions	Non-normal data distribution
Secondary Data	Exploratory research with secondary data
Statistical power	Requires a high degree of statistical power
Goodness-of-fit	Do not rely on the concept of model fit

Components of Partial Least Square Structural Equation Modeling (PLS-SEM)

PLS-SEM comprises of measurement model or also named as an outer model and structural model or also called as an inner model. The measurement model shows the relationship between the model's constructs or also known as latent variables or unobservable variables and the indicator variables. It measures the psychometric properties of the measurement items (Chin, *et al*., 1996). This model is commonly conducted before performing the structural model. Measurement model determines the goodness of measurement used in the study's model in term of reliability and validity. However, before assessing the reliability and validity of the measurement model, it is necessary to determine the direction of the measurement model, whether it is formative or reflective.

Once the measurement model is confirmed to be reliable and valid, the evaluation of PLS-SEM proceeds with the evaluation of the structural model, the second component. The structural model demonstrates the relationship between the constructs included in the study's model. This model examines the relationship between the independent variable (exogenous variable) and dependent variable (endogenous variable) latent variables. The evaluation of structural model should include collinearity assessment, the structural model path of coefficients and hypothesis testing, assessment of determinant value (R^2), assess the level of f^2 and assessment of the predictive relevance (Q^2 and q^2).

Conclusion

The author believed that this paper is able to provide a meaningful overview of PLS-SEM for social sciences scholars as this statistical technique is increasingly being used to estimate structural models in the research studies.

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