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# 동일 데이터를 이용한 구조방정식(AMOS, LISREL and PLS) 툴 간의 비교분석

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## A Comparison Analysis among Structural Equation Modeling (AMOS, LISREL and PLS) using the Same Data

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### 요 약

구조방정식 모델링은 경로분석 및 확인적 요인분석을 동시에 수행해 주는 통계적 절차를 따르고 있다. 오늘날이 통계적 절차는 사회과학 분야의 연구자에게 필수적인 도구이다. 구조방정식 모델링 분석을 해주는 대표적인 도구로는 (AMOS, LISREL and PLS)가 있다. AMOS는 초보자가 사용할 수 있도록 편리한 그래픽 사용자 인터페이스를 제공해 주고 있다. PLS는 그래픽 사용자 인터페이스뿐만 아니라 정규분포에 대한 제약조건도 없다는 장점을 가지고 있다. 또한 사회과학 분야에서 가장 많이 사용하는 3가지 도구(Applications)를 비교분석 하였다. 이러한 결과를 바탕으로 연구의 한계와 시사점을 제시하고자 한다.

### ABSTRACT

Structural equation modeling is pointing to statistical procedures that simultaneously perform path analysis and confirmatory factor analysis. Today, this statistical procedure is an essential tool for researchers in the social sciences. There are as (AMOS, LISREL and PLS) representative tools that can perform structural equation modeling analysis. AMOS provides a convenient graphical user interface for beginners to use. PLS has the advantage of not having a constraint on normal distribution as well as a graphical user interface. Therefore, we compared and analyzed the three most commonly used tools in social sciences. This study suggests practical and theoretical implications based on the results.

### Key word

Structural equation, Regression analysis, Path analysis, Social sciences

## I. INTRODUCTION

In social science research, there are many researches applying structural equation modeling for empirical analysis. The paper applying structural equation modeling is an effective method for analyzing the causal relationship between latent variables and identifying the causal relationships between potential latent variables and the results [1]. Tools for analyzing structural equation modeling include PLS,

AMOS, and LISREL. Recently, research using PLS based on the partial least squares method is increasing. Thus, the PLS analysis method is relatively uncompromising in terms of sample size and residual distribution compared to AMOS and LISREL, and the evaluation of the theoretical structural model and the evaluation of the measurement model at the same time [2]. In addition, despite the many advantages of structural equation modeling, researchers have difficulty in analyzing research hypotheses and

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model tests in analytical procedures [3]. Many scholars have suggested various statistical criteria and guidelines that should be accepted for analysis procedures and results in research applying structural equation modeling. In addition, many other researchers have questioned the reliability and validity of the research results [1].

## II. RESEARCH METHODOLOGY

Using AMOS (analysis of moment structures), it can easily use SEM (structural equation modeling) to test hypotheses of complex variable relationships and gain new insights from the data. And, LISREL (linear structural relations) is a proprietary statistical software package used in structural equation modeling for manifest and latent variables. Also, PLS (partial least squares) is a statistical method that bears some relation to principal components regression, instead of finding hyper planes of maximum variance between the response and independent variables, it finds a linear regression model by projecting the predicted variables and the observable variables to a new space.

One of the programs that analyze the structural equation model, AMOS utilizes a different approach from SPSS statistic. SPSS statistic uses exploratory factor analysis and AMOS utilizes confirmatory factor analysis. Confirmatory factor analysis explains the latent variables describing the measured variables, and the parts not be explained is explained by measurement error. And exploratory factor analysis is a traditional factor analysis as a method to find out appropriate potential factors when there is no existing hypothesis or theory about potential factors [4]. On the other hand, in the confirmatory factor analysis, the analysis is performed in a state in which the number of factors (latent variables) and measurement variables constituting factors are already specified. This exploratory factor analysis is a factor analysis conducted by SPSS or SAS program. Therefore, confirmatory factor analysis is similar to the theoretical verification process [5] because it emphasizes the rationale of previous studies or theoretical background. Because of these characteristics, convergent validity, discriminant validity, and reliability analysis are

performed after confirmatory factor analysis is completed. In addition, model fit is also identified [4].

On the other hand, LISREL uses matrix summaries instead of raw data for input data types. One of the correlation matrix and covariance matrix can be used to summarize the matrix of raw data, one way is to use one of these methods, rather than doing true theory testing, since the focus is on the causal relationship type of the model, it is appropriate to use the correlation matrix. This analysis is the result of analyzing the correlation between the variables. As a result of analyzing the correlation between the variables, it is seen that the multi-collinearity among the variables generally has a problem with the multi-collinearity when the correlation coefficient exceeds .80. Tolerance and dispersion expansion coefficient (VIF) were calculated to further diagnose multi-collinearity between variables. Generally, multi-collinearity is high when the tolerance calculated by multiple correlations is less than 0.1 (or VIF value is more than 10).

Structural equation modeling techniques such as LISREL and PLS are second-generation statistical tools for high-quality statistical analysis of multivariate study models [6]. Structural equation modeling techniques can be classified into two types. LISREL is a common equation analysis based structural equation model and PLS is a structural equation model based on a principle component which is a total variance. PLS has several other features compared to LISREL. The PLS can be analyzed even if the number of samples is small, and there is no constraint on the normal distribution of the sample distribution [7,8]. In addition, PLS can also build models for formation indicators [9]. And PLS adopts a method to minimize errors of internal variables [9,10].

## III. RESULTS AND CONCLUSIONS

Structural equation modeling based on the same basic data was analyzed by AMOS, LISREL and PLS programs for analysis. The results are shown in Tables 1, 2, and 3. The comparative analysis of the detailed indicators will be left as a future research project, and the conference will be prepared.

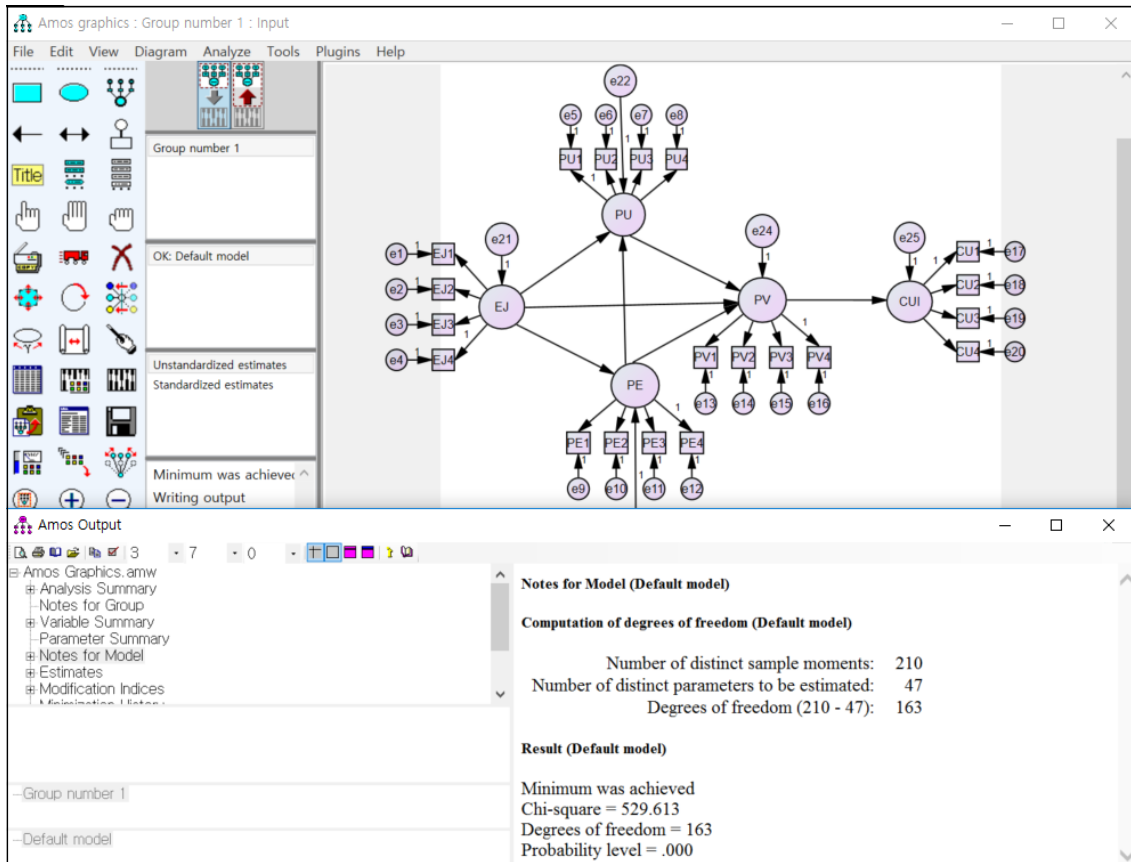


Fig. 1. AMOS (analysis of moment structures) Modeling.

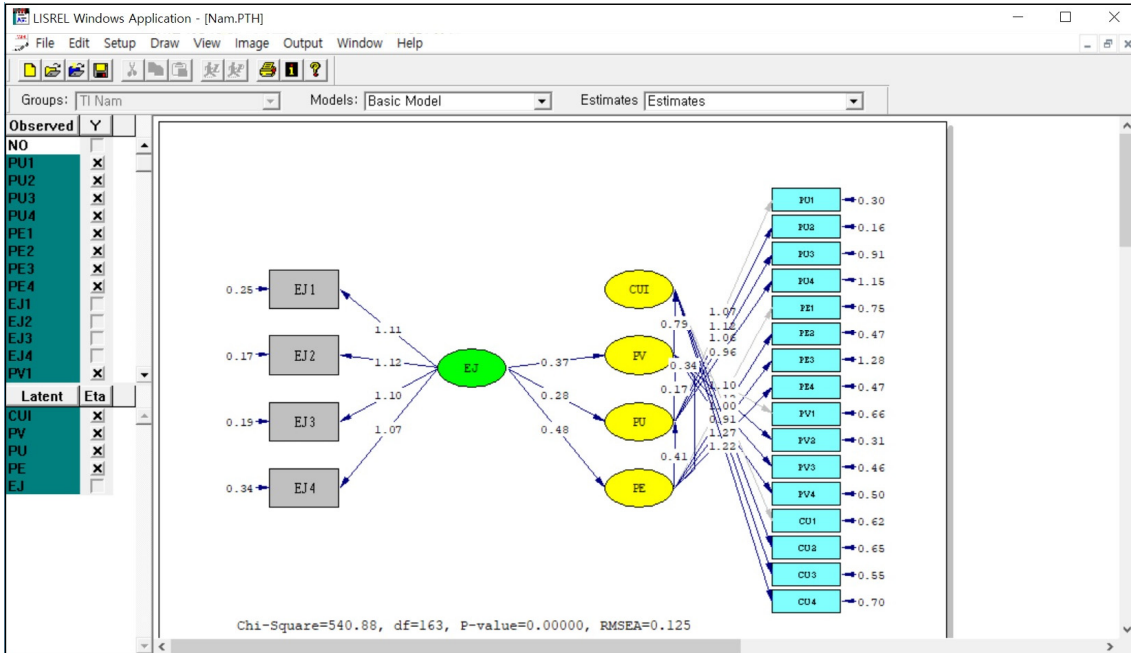


Fig. 2. LISREL (linear structural relations) Modeling.

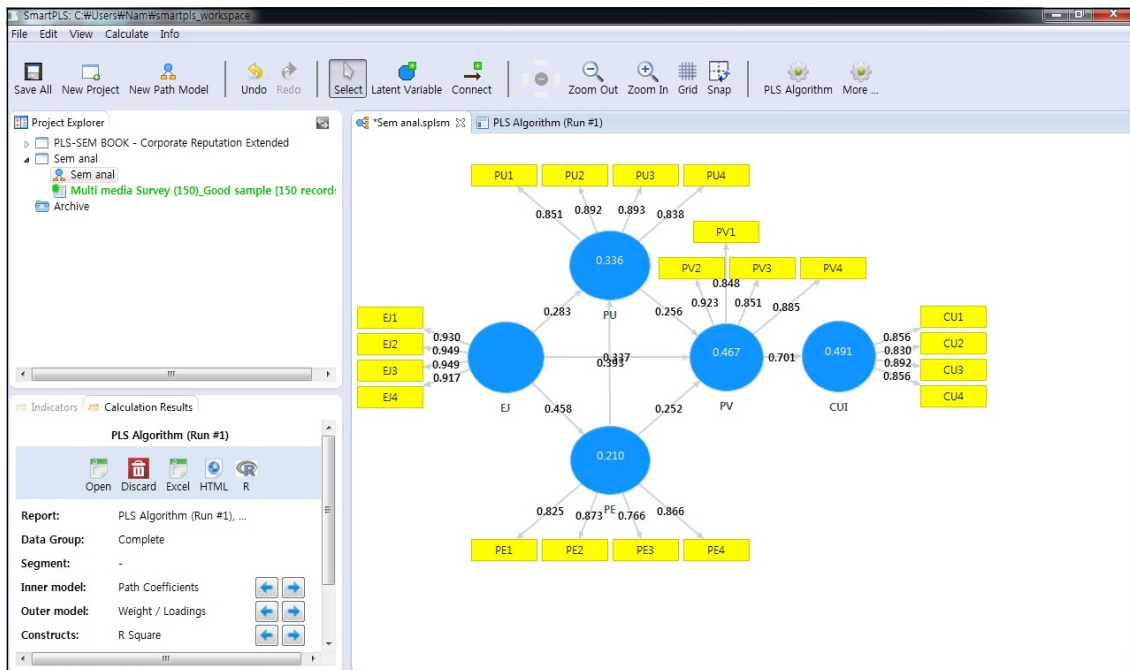


Fig. 3. PLS (partial least squares) Modeling.

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