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HIGHER ORDER CONSTRUCT USING FORMATIVE-FORMATIVE MEASUREMENT MODEL IN PARTIAL LEAST SQUARE STRUCTURAL EQUATION MODELLING (PLS-SEM)

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Abstract

Partial least square structural equation modeling was widely known and used among business and management researchers. The new software update of smartPLS with more user friendly package could help a researcher to achieve their objectives in research. This paper aims to design a higher order construct (HOC) in partial least square structural equation model (PLS-SEM) using financial ratios. In order to provide the full understanding for other researchers, the authors conducted this analysis with a real case study. Variables under study were entrepreneur orientation (EO), human resource management (HRM), market orientation (MO), information technology (ICT), financial ratios (FR) and SME performance based on growth revenues. A survey questionnaire was used in data collection in two areas: Selangor and Sabah. PLS algorithm and bootstrapping procedures were performed for model's significance and relevance. The results obtained from the analyses, however had indicated that financial ratios had negative relationships towards revenual growth of SME performance. Meanwhile, human resource management and market orientation showed significant influence with positive relationships. Thus, this paper would help SME's owners to consider a proper financial reporting in their future business endeavours.

Keywords: *financial ratios, higher order construct, partial least square, growth revenues, SME performance*

INTRODUCTION

Small and medium enterprises (SMEs) play an important role in any economy since they are capable of generating jobs and increase the growth of Gross Domestic Product (GDP). Empirical results emphasized that financial information provides better control and higher chance of success and good record keeping of a firm. On one hand, financial information acts as an early warning system to business failure. Therefore, financial management practices and reporting skills are important for the SMEs to strengthen their economic activities. According to Sarapaivanich (2003), SMEs often found accounting and financial management were the challenges due to poor record keeping, lack in using of accounting information in financial decision making, and the poor quality and reliability of financial data. In addition, proper accounting was useful in making economic decisions especially for the success of small and medium businesses. The misuse and poorly recorded and inaccurate accounting information lead SMEs to assess their financial situation inaccurately, and thus make poor financial decisions. These short comings might be the cause difficulties in succeeding and raising funds or borrowing money as well.

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Therefore, this study attempts to design a higher order construct (HOC) in partial least square structural equation model (PLS-SEM) using financial ratios.

METHODOLOGY

Hierarchical Component Model using PLS-SEM

According to Hair *et al.* (2014), higher order construct was to test the two-layers of constructs in structural model. There were four types of HOCs namely; reflective-reflective, reflective-formative, formative-reflective and formative-formative. In this study, formative-formative type was used in HOC. This type of HOC indicated a formative relationship between the HOC and lower order construct (LOCs), while each construct was measured by formative indicators. The following Figure 1 showed the illustration of four types of HOCs.

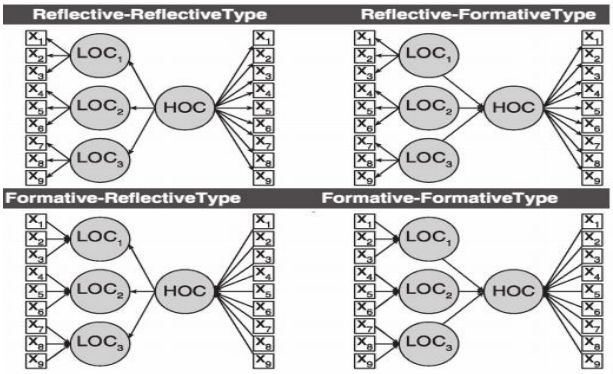

Figure 1: Four Types of HOCs

Wan (2014) addressed on the advantages of using HOC in modeling PLS-SEM;

1) Researchers could reduce the number of indicators in the structural model. Thus, easier to understand the whole model.
2) HOC proved valuable if the constructs were highly correlated.
3) In the formative indicators were highly correlated, thus researchers could split up the set of indicators and established newly latent constructs.
4) Formative measurement model was much easier to handle in PLS-SEM compared to CB-SEM.
5) Researchers could conduct a comparison between formative and reflective measurement models since PLS-algorithm provides results for both measurement models.
6) The structural model would be more meaningful in modeling HOC.

Assessing Formative Measurement Model

According to Hair *et al.* (2014), formative measurement model could be assessed through;

a) Convergent Validity => Measure the correlation between formative construct and reflective construct. Ringle e*t al.* (2012) suggested that the correlation between the constructs should be higher than 0.80.
b) Collineairty => The collinearity issues of the formative indicators in measurement model could be assessed by using Variance Inflation Factor (VIF) less than 5.0 in SPSS version 20.
c) Significance and Relevance of each indicator => It was observed through the outer wieght which was obtained from PLS algorithm in SmartPLS 2.0. The significant outer weight was greater that 0.5. Otherwise, if the outer loading of the indicator was greater than 0.5, thus the indicator should be remained in the model with a strong supporting theory. However, if both outer weight and outer loading were not significant, hence, the indicator should be eliminated from the model.

SCOPE OF STUDY

The scope of this study was on financial ratios among SMEs in Malaysia. Data were collected by using structured questionnaires, and distributed to owners-managers of SMEs in the services sector in Shah Alam, Selangor and Kota Kinabalu, Sabah. Only 279 questionnaires were valid and reliable for this study. In addition, there were seven variables used under this study, where SMEs performance as a dependent variable, whereby entrepreneur orientation (EO), human resource management (HRM), market orientation (MO, information technology (IT) and financial retios (FR) as independent variables. These seven variables which were included in a structural model, will be tested to undergo the process of HOC.

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RESULTS AND ANALYSIS

Figure 2 presented a structural model for first order construct with SMEs performance (SMEPerf) as an endogenous (dependent) variable and four exogenous (independent) variables namely; entrepreneur orientation (EO), human resource management (HRM), market orientation (MO), and information technology (IT). The model presented in Figure 2 had achieved the requirements in both formative measurement and structural models. The aim of this study was to design a higher order construct (HOC) in partial least square structural equation model (PLS-SEM) using financial ratios. Therefore this study will be focusing more on higher order constructs of the model.

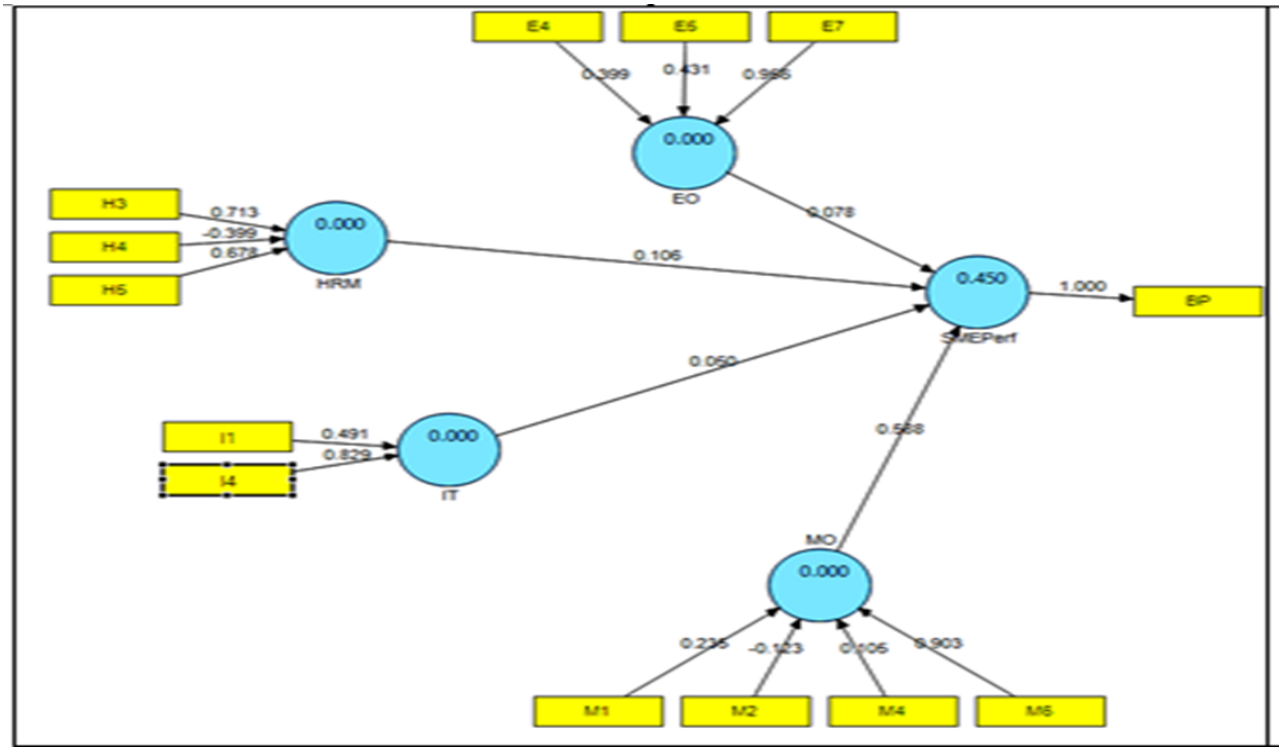

Figure 2: Original Model

Once the model in Figure 2 had achieved all the requirements for formative measurement model, hence another exogenous construct namely Financial Ratios (FR) was constructed as a higher order construct (Figure 3). FR construct consist 10 manifest variables namely, operating ratio (OR), net profit margin ratio (NP), return on assets (ROA), return on equity (ROE), acid test ratio (ACD), current ratio (CR), debt ratio (DBT), leverage ratio (LVR), fixed asset turnover ratio (FIXOVER) and total asset turnover ratio (TATO) (Figure 3).

As could be seen from Figure 3, financial ratios had formative indicators which were pointing towards the FR construct. Conceptually, these formative indicators need to be evaluated with the same formative measurement model assessment until the model meets the validity of the formative measurement model. The convergent validity test for financial ratios (FR) construct was shown in Figure 4.

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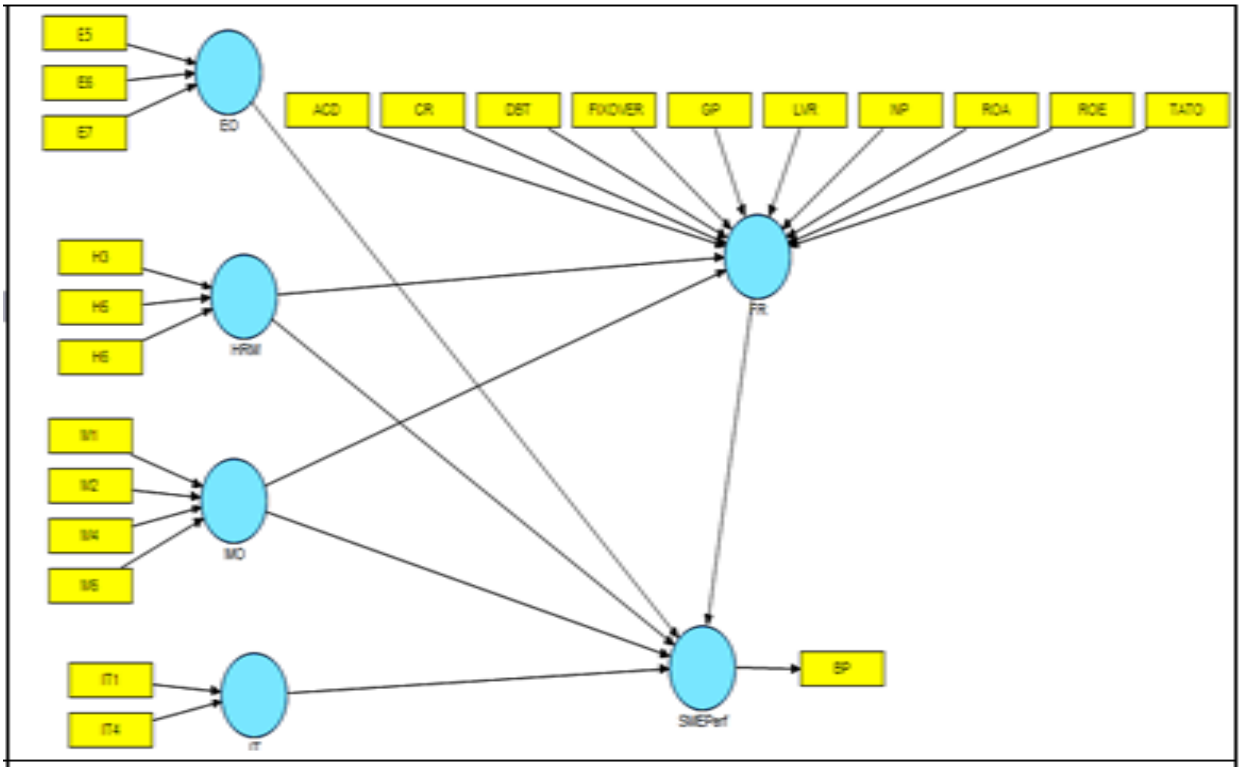

Figure 3: HOC All Variables

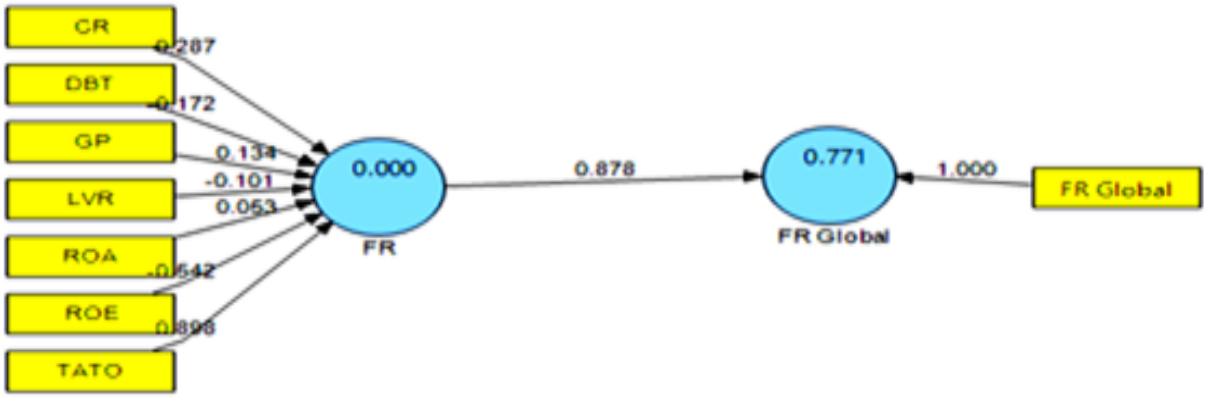

Figure 4: Financial Ratios (FR) Convergent Validity

The path coefficient between FR and FR Global was 0.878 as shown in Figure 4. In addition, the R^2 value for FR Global was 0.771. This indicated that the formative construct of FR had achieved sufficient level of convergent validity. Thus, FR did contribute to its intended content.

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These manifested variables were then constructed as formative indicators. Before proceeding to HOC analysis, these manifested variables must meet the requirements of formative measurement model. The collinearity assessment was carried out on each manifest variable by using SPSS version 20. As suggested by Ringle *et al.* (2012), variable which was best free from collinearity issue when the variance inflation factor (VIF) value ranged from 0.2 to 5.0. The following Table 1 showed the initial VIF value for each manifest variable. Table 1 showed that there were five variables with VIF values greater than 5.0 namely, OR, NP, ROE, ROA, and TATO (highlighted in blue). The variable which had the highest VIF value was removed first from the model, and then rerun the reduced model. This procedure was sequentially run until all the VIF values of the variables were uniformly below 5.0.

In the case of multicollinearity removal, NP and ACD variables were removed from the model after 2 runs (highlighted). The new VIF values presented in Table 2 indicated that the manifested variable were free from collinearity issues in the formative measurement model since all the VIF values were below 5.0.

Table 1: Initial VIF value on each manifest variable

Ratios	VIF
OR	**8.022**
NP	**10.754**
ROE	**5.149**
ROA	**6.547**
CR	**1.539**
ACD	**3.972**
DBT	**3.093**
TATO	**8.666**
LVR	**2.773**
FIXOVER	**2.522**

Table 2: New VIF value on each manifest variable

Ratios	VIF
OP	2.426
NP	Removed (1st run)
ROE	3.373
ROA	2.291
CR	2.384
ACD	Removed (2nd run)
DBT	1.908
TATO	1.512
LVR	2.321
FIXOVER	1.623

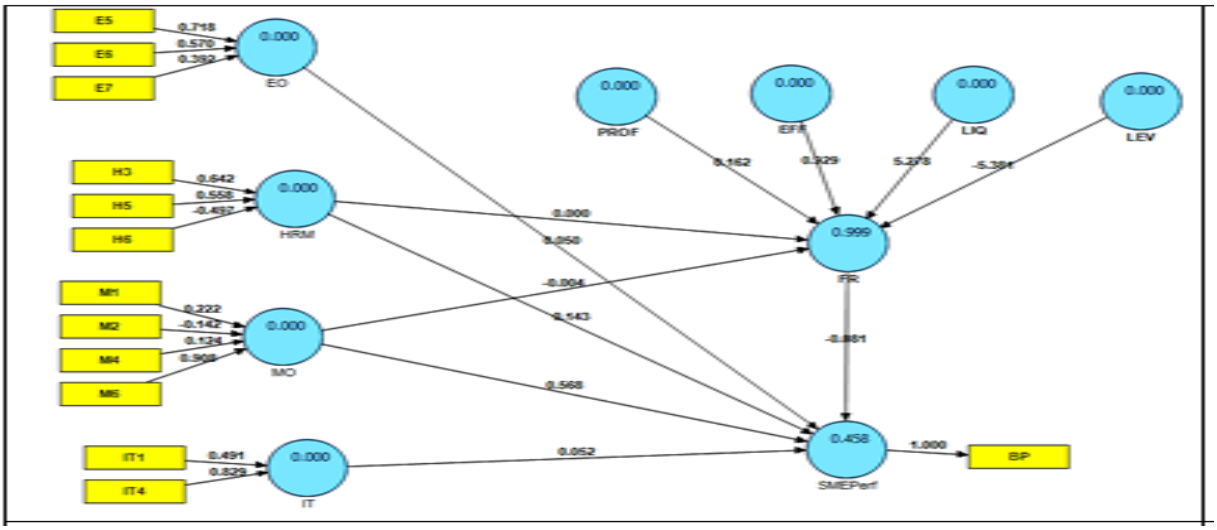

Figure 4: Four Latent Constructs

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Next, all manifested variable associated in the FR construct were condensed into four newly latent constructs. In other words, the manifested variables were divided into each established latent construct (e.g: profitability ratio (PROF), efficiency ratio (EFF), liquidity ratio (LIQ) and leverage ratio (LEV)). These new establishing latent constructs could help in understanding the results in a structural model. Additionally, four latent constructs were built as formative construct towards FR. Once the setup model was completed, the normal analysis was rerun using PLS-algorithm and bootstrapping procedures so as to determine the significance and relevance of the model.

As shown in Figure 5, the explained variance in FR construct showed was 0.999 of total variation. This indicated that the total variation that was explained by the four latent constructs in FR was approximately 99.9 per cent. The result obtained was overestimated due to HOC implementation. In order to overcome this situation, Hair *et al.* (2014) suggested to use a two-stage approach where single-item measure should be employed. In the context to create HOC without overestimated explained variance, a single-item measure should be employed as shown in Figure 5. These single-item measures used latent variable scores which were obtained through PLS-algorithm results in SmartPls. Thus the explained variance for FR construct and endogenous construct could then be examined. Based on Figure 5, the explained variance of SMEPerf showed 0.457, while FR construct, the explained variance showed only 0.017. This implied that financial ratios had only explained 1.7 percent by the profitability, efficiency, liquidity and leverage ratios. Since this study was also intended to address whether financial ratio had a significant importance in the performance of SMEs in Malaysia, therefore, the results of path coefficients between endogenous and exogenous variables were further assessed by means of bootstrapping procedures to evaluate its significance and relevance towards the HOC structural model.

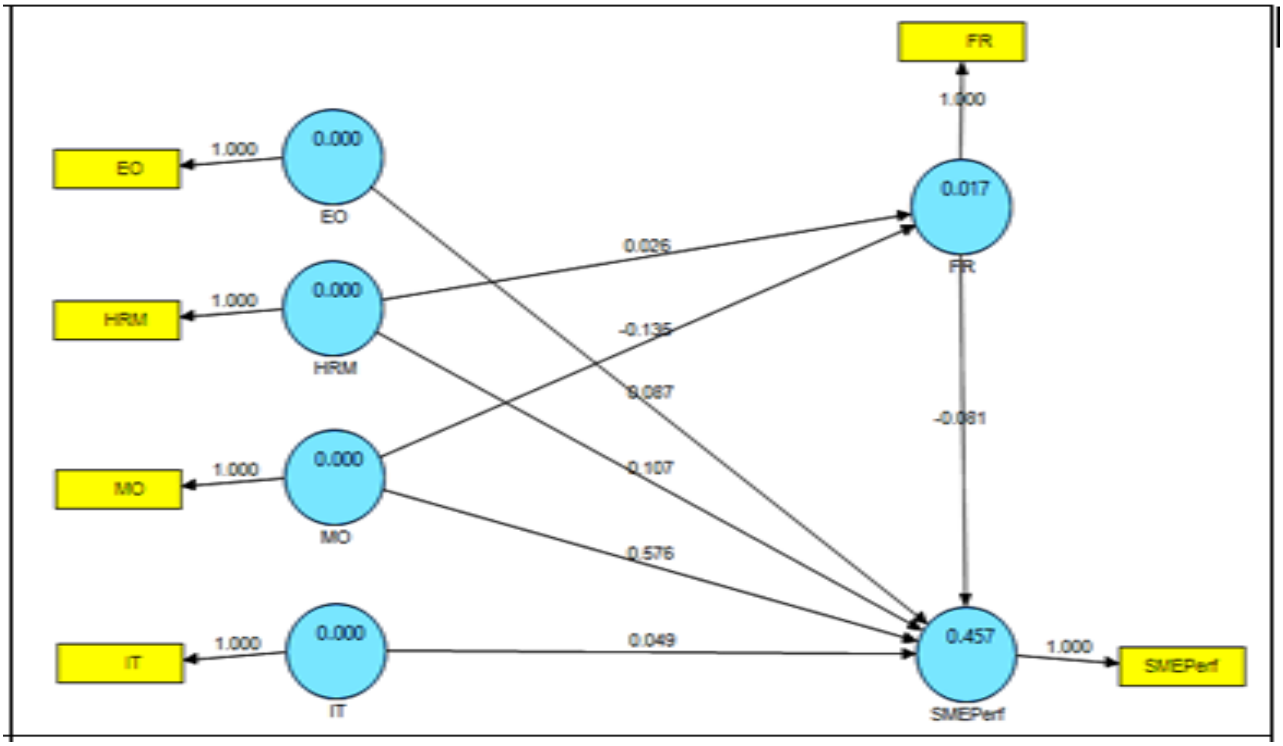

Figure 5: Overestimate Construct

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Table 3: Path Coefficients of HOC Construct

	Path Coefficients	t-values	Significance
EO -> SMEPerf	0.0872	1.466	Not significant
HRM -> SMEPerf	0.1067	2.245	Significant
IT -> SMEPerf	0.0494	0.921	Not significant
MO -> SMEPerf	0.5758	9.886	Significant
FR -> SMEPerf	-0.0806	2.545	Not significant

Based on the analysis which was reported in Table 3, financial ratio construct coefficient value was -0.0806. A negative sign of the coefficient value indicated that there was a negative relationship of the financial ratio was towards the performance of SMEs in terms of growth revenues. However, the t-value of the financial ratio showed significance at p-value greater than 0.05. From Table 3, only market orientation (MO) and human resource management (HRM) were significant factors that influence in the revenual growth performance of SMEs.

DISCUSSIONS AND CONCLUSION

The significant factors that influence the revenual growth of SMEs performance, namely, market orientation and human resource management were found to be the same determinants that affect the transformation for economic development (Noraini and Nurul, 2015). Higher order construct was also known as a second order construct structure which consists two layer of constructs. One of the main reasons to implement a HOC in this study was due to the high collinearity issues. Hence, financial ratio (FR) construct was built as a HOC with four latent constructs (e.g; PROF, EFF, LIQ and LEV). The aim of this study was to design a higher order construct in PLS-SEM using financial ratios. Thus, the results obtained from HOC analysis indicated that the introduction of HOC in PLS-SEM had produced a more relevant model where the explained variance was increased from 0.450 to 0.457. Although the model had increased in variance by 0.007, the results had proven that financial ratios were negatively related towards the performance of SMEs. This study was supported by several researchers which had also found similar results such as Sarapaivanich (2003). According to Sarapaivanich (2003), financial ratios were negatively related to the performance of SMEs due to the limited access in obtaining financial statements from SMEs. It was difficult to obtain their financial statement due to privacy issues. Besides, most of the SMEs were even still lacking in proper financial reporting. Thus, this might lead to incorrect interpretation of the analysis. As a conclusion, HOC had not only helped to produce a powerful method in modeling PLS-SEM, but also was able to overcome such collinearity issues. The model developed in this study could provide a useful insight to other researchers who are interested to implement formative-formative type of construct in HOC in their works. At the same time, this study would like to address that more accounting knowledge among SMEs owners-managers should be invested, and proper financial reporting practices being administered for SMEs development in Malaysia. This was because, most of the big companies had used financial ratios as a tool to observe the trends of their business performance.

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