INTERNATIONAL JOURNAL OF ACADEMIC RESEARCH IN BUSINESS & SOCIAL SCIENCES
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To Link this Article: http://dx.doi.org/10.6007/IJARBSS/v12-i5/13289 DOI:10.6007/IJARBSS/v12-i5/13289

Received: *09* March 2022, ***Revised:*** *13* April 2022, ***Accepted:*** *28* April 2022

Published Online: 07 May 2022

In-Text Citation: (Haji-Othman & Yusuff, 2022)

To Cite this Article: Haji-Othman, Y., & Yusuff, M. S. S. (2022). Assessing Reliability and Validity of Attitude Construct Using Partial Least Squares Structural Equation Modeling (PLS-SEM). *International Journal of Academic Research in Business and Social Sciences*, *12*(5), 378 – 385.

Vol. 12, No. 5, 2022, Pg. 378 – 385

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Assessing Reliability and Validity of Attitude Construct Using Partial Least Squares Structural Equation Modeling (PLS-SEM)

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Abstract
Voluminous studies use Partial Least Squares Structural Equation Modeling (PLS-SEM) to analyze data. One of the reasons for using PLS-SEM is when the structural model is complex. Studies employing complex structural models with many constructs and indicators lead to PLS-SEM selection for the analysis. The purposes of assessing the measurement model are to examine basic dimensions for construct variables, validate the dimensions, and determine the number of dimensions for each construct. Assessment of measurement model includes composite reliability and average variance extracted (AVE) to assess reliability and validity, respectively. This study tests the validity and reliability of the attitude construct in the context of compliance behavior of income *zakat* that other studies can use. This study assesses the measurement model to examine basic dimensions for construct variables, validate the dimensions, and determine the number of dimensions for each construct. Assessment of measurement model includes composite reliability and average variance extracted (AVE) to assess reliability and validity, respectively. This study hopes future research can adapt and adopts the attitude items used in this study in their future research.
Keywords: Reliability, Validity, Attitude, Construct, PLS-SEM.

Introduction

Voluminous studies use PLS-SEM in the analysis of data. One reason for using PLS-SEM is when the structural model is complex (Hair et al., 2011). Studies that employ complex structural models with many constructs and indicators lead to PLS-SEM selection for the analysis. Furthermore, according to Hair et al. (2011), the selection of PLS-SEM is more appropriate when extending an existing theory, which many studies attempt to do. Moreover, the advantage of PLS-SEM is that it can estimate measurement models and structural models simultaneously.

This study tests the validity and reliability of the attitude construct in the context of compliance behavior of income *zakat* that other studies can use. This study assesses the measurement model to examine basic dimensions for construct variables, validate the dimensions, and determine the number of dimensions for each construct. Assessment of

measurement model includes composite reliability and average variance extracted (AVE) to assess reliability and validity, respectively.

Operational Definitions and Measurement of Attitude

According to Aronson & Pratkanis (1993), the attitude has cognitive, affective, and behavioral elements that are interconnected. Therefore, the attitude of respondents consists of components such as acceptance or rejection, like or hate, comply or not comply, positive or negative on income *zakat* payment.

A few steps need to be taken based on the Likert procedure to build a construct of attitude. At the early stage, this study gathers statements representing cognitive elements such as satisfying or encouraging, affective elements such as like or undecided, and behavior such as will pay or will certainly pay. This study adapts and adopts the items in the attitude construct following (Bidin, 2008; Haji-Othman, 2017; Haji-Othman et al., 2020; Haji-Othman et al (2019); Haji-Othman et al., 2019; Haji-Othman et al., 2017).

There are 24 items in this construct. Every item is measured using a Likert scale of 5. This study gives a score of 1 to "strongly disagree," score 2 for "disagree," score 3 for "not sure," score 4 for "agree," and score 5 for "strongly agree." However, for negative statements, the score for each item is the opposite of positive statements. It means that every answer "strongly agree," "agree," "not sure," "disagree," and "strongly disagree" is given score 1, 2, 3, 4, and 5, respectively. The highest score of 120 points (24 items x 5 points) shows the most positive attitude towards *zakat* payment. On the other hand, the lowest score of 24 points (24 items x 1 point) reflects the most negative attitude towards *zakat* payment.

The Assessment of The Measurement Model

The purposes of assessing the measurement model are:

1. To examine basic dimensions for construct variables.
2. To validate the dimensions and
3. To determine the number of dimensions for each of the construct.

Assessment of measurement model includes composite reliability and average variance extracted (AVE) to determine reliability and validity, respectively.

Composite Reliability

The purpose of assessing composite reliability is to examine the internal consistency and reliability of a construct. On the other hand, assessing the average variance extracted evaluates convergent validity (Hair et al. 2014).

A reliability test is essential to determine the consistency and stability of instruments with the concepts to be measured (Sekaran, 2003). A reliability test is an early indicator to assess the quality of an instrument (Churchill, 1979). Traditionally, many studies use Cronbach's alpha procedure to determine the reliability of a construct. This procedure is the most basic reliability test for any research (Churchill, 1979). However, Cronbach's alpha assumes that all items are equally reliable; all items have equal outer loadings on the construct (Hair et al., 2014). However, this study suggests using PLS-SEM, which prioritizes the items according to their individual reliability. Because of the limitation of Cronbach's alpha, this study chooses composite reliability to measure internal consistency. Composite reliability takes into consideration the different outer loadings of the items in the construct. The formula of composite reliability is:

$$\rho_c = \frac{(\sum_{i=1}^{n} L_i)^2}{(\sum_{i=1}^{n} L_i)^2 + (\sum_{i=1}^{n} var\,(e_i)^2}$$

Where L_i stands for the standardized outer loading of item i of a construct, e_i is the measurement error of item i, and var(e_i) represents the variance of measurement error which we define as $(1 - L_i^2)$.

The composite reliability values range between 0 and 1. The higher the composite reliability, the higher the level of reliability. According to Hair et al. (2014), it is acceptable if composite reliability values between 0.60 and 0.70. Composite reliability values of less than 0.60 show a lack of internal consistency reliability.

Convergent Validity

Convergent validity refers to how an item correlates positively with alternative items of the same construct. The items of a specific construct should converge, which means they share a high proportion of variance (Hair et al., 2014). This study suggests the assessment of the outer loadings of the items, together with average variance extracted (AVE) to evaluate the convergent validity,

If outer loadings of items in a specific construct are high, then it means that the items have much in common, which the construct captured. This situation is called indicator reliability. All outer loadings of all items should be statistically significant and should be at least 0.708 (Hair et al., 2014).

If the outer loadings are less than 0.708, then this study examines the effect of removing the item on composite reliability. Hair et al (2014) suggested that researchers remove the items having outer loadings between 0.40 and 0.70 if deleting the items leads to an increase in composite reliability and average variance extracted (AVE). Researchers must eliminate the items from the construct if the items have outer loadings of less than 0.40 (Hair et al., 2011).

This study suggests using average variance extracted (AVE) to establish convergent validity recommended by Hair et al. (2014). AVE is defined as the mean value of the squared loadings of the items associated with a specific construct. It measures the sum of the squared loadings divided by the number of items in the construct.

The average variance extracted (AVE) is calculated as the mean-variance extracted for the items loading on a construct. We calculate AVE using the following formula:

$$AVE = \frac{\sum_{i=1}^{n} L_i^2}{n}$$

Where L_i is the standardized factor loading, and i is the number of items. An AVE of 0.5 or higher shows adequate convergence.

The minimum acceptable value of AVE is 0.50 because an AVE of 0.50 or higher means that the construct explains more than half of the variance of its items. If AVE is less than 0.50, it means that, on average, more errors remain in the items than the variance explained by the construct (Hair et al., 2014).

The rules for outer loading testing are summarized as follows:

1. If outer loading is less than 0.40, delete the item.
2. If outer loading is more than 0.40 but less than 0.70, then analyze the effect of deleting the item on AVE and composite reliability. If deletion increases AVE and composite

reliability above the threshold, then delete the item. However, if item deletion does not increase AVE and composite reliability above the threshold, retain the item.

3. If outer loading is greater than 0.70, retain the item.

This study then decides the dimensions/factors to be included in the study based on those criteria. The next step is to name the items. Names given to the items must be related to the components which they represent.

According to the rules of outer loading testing, the items that this study retains are then subjected to factor analysis validation. The purpose is to evaluate the generalizability and stability of the data structure from the sample with a population (J.F. Hair, Black, Babin, Anderson, & Tatham, 2006).

Assessment of Measurement Model of Items in Attitude Construct

At the initial stage, there are 24 items in this construct. However, some of the items in this construct are deleted after the 1st Run of the PLS-SEM Path Model because it failed to achieve the minimum acceptable level of AVE and composite reliability. This study deleted the items until this construct reaches the minimum adequate level of AVE and composite reliability, as shown in Table 1. Table 1 indicates average variance extracted (AVE) and composite reliability for the construct, together with the outer loading of each item in the construct.

This study deletes items having low outer loadings to achieve the acceptable level of AVE and Composite Reliability. According to Hair et al. (2014), if it is loaded less than 0.7, consider deletion only if deletion leads to increased AVE or composite reliability. Among the items deleted are ATT14, ATT15, RATT24, ATT21, RATT19, RATT20, RATT22, and RATT23. Table 1 displays the items retained for further analysis.

Table 1: Items in the Construct of Attitude

Items	Outer Loading	AVE	Composite Reliability
		0.547	0.949
ATT1	0.718		
ATT2	0.760		
ATT3	0.800		
ATT4	0.723		
ATT5	0.835		
ATT6	0.842		
ATT7	0.846		
ATT8	0.796		
ATT9	0.856		
ATT10	0.754		
ATT11	0.665		
ATT12	0.761		
ATT16	0.739		
ATT18	0.678		
RAT17	0.532		

Note: ATT refers to items of attitude. Numbers that follow the items represent item numbers.
: AVE and composite reliability are more than 0.5 and 0.7, respectively.

After dropping these items, this study performs a reevaluation of the factor model. Table 1 shows that the result of model reevaluation indicates that there are fifteen items retained. Notice that all items retained have outer loadings greater than 0.4. Furthermore, the Average Variance Extracted (AVE) and composite reliability for attitude are 0.547 and 0.949, respectively. According to Hair et al. (2014), the acceptable level of AVE and composite reliability are 0.5 and 0.7, respectively. Average Variance Extracted (AVE) and composite reliability values indicate that the attitude construct passes the validity and reliability test, respectively.

Conclusion

This study tests the reliability and validity of a construct, namely attitude, in the context of compliance behavior of income *zakat*. This study assesses the measurement model to examine basic dimensions for construct variables, validate the dimensions, and determine the number of dimensions for each construct. Assessment of measurement model includes composite reliability and average variance extracted (AVE) to assess reliability and validity, respectively. This study hopes future studies can adapt and adopts the attitude items used in this study in their future research.

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Appendix

The Items in the Attitude Construct

No	**Items**	Strongly Disagree	Disagree	Not Sure	Agree	Strongly Agree
1	Paying *zakat* to Kedah State Zakat Board purifies my income.	1	2	3	4	5
2	I am happy to pay income *zakat* to Kedah State Zakat Board because it is managed by trained staff.	1	2	3	4	5
3	I support the idea that income *zakat* is paid to Kedah State Zakat Board.	1	2	3	4	5
4	I am satisfied to pay *zakat* to Kedah State Zakat Board.	1	2	3	4	5
5	I like to pay income *zakat* to Kedah State Zakat Board.	1	2	3	4	5
6	I like to pay income *zakat* to Kedah State Zakat Board.	1	2	3	4	5
7	Paying income *zakat* to Kedah State Zakat Board is the right thing to do.	1	2	3	4	5
8	Paying income *zakat* to Kedah State Zakat Board is a responsibility that needs to be carried out.	1	2	3	4	5
9	I trust Kedah State Zakat Board.	1	2	3	4	5
10	Paying *zakat* to Kedah State Zakat Board can help other Muslims.	1	2	3	4	5
11	There are many benefits that I get when I pay income *zakat* to Kedah State Zakat Board.	1	2	3	4	5
12	Paying *zakat* to Kedah State Zakat Board is encouraged because *zakat* brings *barakah*.	1	2	3	4	5
13	I doubt whether *zakat* is distributed transparently and efficiently.	1	2	3	4	5
14	I will seek information on how to calculate income *zakat* from Kedah State Zakat Board.	1	2	3	4	5

15	I comply if the Kedah State Zakat Board makes it compulsory for me to pay income *zakat*.	1	2	3	4	5
16	I feel relieved if I could pay income *zakat* to Kedah State Zakat Board because paying *zakat* is a religious obligation.	1	2	3	4	5
17	I feel unsure of paying income *zakat* to Kedah State Zakat Board.	1	2	3	4	5
18	I am sure to pay income *zakat* to Kedah State Zakat Board even though I do not receive instructions.	1	2	3	4	5
19	It is better to pay income *zakat* directly to the poor.	1	2	3	4	5
20	There is no need to pay income *zakat* to the Kedah State Department of Zakat because previous Islamic scholars did not do so.	1	2	3	4	5
21	Income *zakat* must be paid to Kedah State Zakat Board because zakat managemen*t* is not my responsibility.	1	2	3	4	5
22	I am worried about the way Kedah State Zakat Board distributes zakat.	1	2	3	4	5
23	I will ignore instructions if Kedah State Zakat Board orders me to pay income *zakat* to them.	1	2	3	4	5
24	I will pay income *zakat* to Kedah State Zakat Board only if I am fined.	1	2	3	4	5