3.1 Introduction

This chapter deals with a statistical validation of an empirical model that explains in the equity investment in terms of demographic variables like monthly income and level of awareness, factors influencing investment decision, intention to invest and level of satisfaction towards stock market investment. It offers a predictive analysis of the data resulting in a theoretical confirmation that was conceived as the conceptual framework of the study by employing the structural equation model using the partial least square technique. This analysis is aimed to understand the structure and validation of theoretical models related to effectiveness of stock market investment.

3.2 Structural Equation Model

The concept of Partial Least Squares (PLS) was introduced by Hermann Wold in his paper Principal Component Analysis\(^1\). The first PLS model with the latent variables was published by Wold in 1979. PLS path modeling is a soft modeling technique with no assumptions about the distribution of the data variables and requires relatively small samples to carry it out\(^2\). This is opposed to the heavy modeling proposed by Joreskog which requires precise assumptions about the distribution of the data variables and large sample sizes. Covariance based methods are undoubtedly the most well known methods to estimate structural equation models. PLS presents several advantages when compared to

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covariance based methods. It is a convenient and powerful technique that is appropriate for many research situations, such as complex research models with sample sizes that would be too small for covariance based SEM techniques. PLS model is a combination of confirmatory factors analysis and path analysis. The main aim is to analyze the interdependent relationship between factors and the unidimensionality of factors in one analysis algorithm. It consists of two stages, initially, the assessment of proposed structural model and subsequently, measurement of the model. The structural model is assessed by using the technique of $R^2$, path co-efficient, bootstrapping and model effect. Measurement of the model is effected using loadings, weights, composite reliability, and average variance extracted and cross loading. The following PLS results were discussed

3.2.1 $R^2$ Value

It is an important measure to assess the predictive ability of the model (Goodness of fit) and is equivalent to the regression $R^2$ value.

3.2.2 Latent Variable

It is simply the construct used as predictor variables in a conceptual model measured using other component variables. The value of these constructs is derived from the measurement of their component variables. Constructs are generally from the basic building blocks of a theory in social science.

3.2.3 Indicator

It is a variable that is actually operationally measured in a research study. It is known as a manifest variable or an observed variable. Every construct is
measured in terms of indicators. The indicators can be reflective or formative. In the case of reflective indicators, the constructs are being reflected in the indicators, while in the case of formative indicators, the indicators are reflected from the construct.

3.2.4 Path Co-efficient

It indicates the strength of relationship between constructs and is expressed in standardized form to permit comparison of the relative strength\(^3\). To assess the significance of path co-efficient, bootstrapping techniques is used.

The basic premise of any theory is to examine the relationship between the underlying constructs being studied. Each relationship is considered hypothetically and is to be tested. Being non-parametric method, the hypothesis cannot be directly tested. Testing is done by means of two re-sampling methods namely bootstrap or jack knife, either of which are used for estimating the precision of the PLS estimates. In this technique, samples are taken from the observed data such that each sample consists of randomly sampled cases from the original data set. The size of each sample equals the number of samples collected in the study. Bootstrap is then performed by collecting a large number of such re-samples and using their means to test the hypothesis using the t-test. For a good stable result, the number of re-samples should not exceed 500.\(^4\) The cut off value for t-coefficient depends on the assumed significance level. A commonly assumed

\(^3\) Yue W, “Predicting the Citation Impact of Clinical Neurology Journal Using Structural Equation Modelling with Partial Least Squares”, University of New South Wales, 2004

significance level in a two tailed test at 5 per cent level of significance is indicated by t values is greater than 1.65, p value is less than 0.05 and applied to assess the significance level. If the computed value of t-statistic happens to be higher than it implies, then the path considered is significant.

3.2.5 Loading and Weights

It is obtained from the bootstrapping procedure. Loadings are used to measure how well the indicators reflect their Latent Variables like factor analysis loadings. The weights score indicates its contribution to the development of relevant construct.

3.2.6 Composite Reliability

It is the internal consistency of the constructs used. It is similar to one of the most popular measures of reliability, cronbach alpha. A construct is said to have sufficient reliability if the value of alpha is more than 0.7 and newly proposed construct is said to be reliable if the value of alpha is more than 0.5. Composite reliability of the component should be greater than 0.7. It can be obtained using the bootstrapping procedure.

3.2.7 Average Variance Extracted (AVE)

The convergent validity of each construct is checked by examining the AVE values. Constructs having an AVE value greater than 0.5 are said to be have a convergent validity or unidimensionality. AVEs may be used to measure the

discriminant validity and reliability of the constructs as well. AVEs of each latent variable, if greater than the square of the correlations between any two latent variables together considered at any point of time, will indicate that the constructs are more discriminated from each other and that the formative indicators within each constructs are more correlated.

3.2.8 Cross Loading

It is another test of discriminant validity. It is obtained by finding the correlation between latent variable component score and other observed variables (indicators). When the correlations load is higher on the respective latent variables than other latent variables, it means that the latent variable predicts each variable in its construct better than the other constructs.

3.3 Execution of the Research Model By Visual PLS

The population of the present study comprises all the investors trading with the stock brokers in Madurai city. More specifically, the population covers both registered and non registered stock broking houses that have trading in the stock. The respondent groups of the study covered 500 sample respondents belonging to the study area.

The operational model used for evaluating and validating the model on ‘investment satisfaction’ as predicted in this research study is depicted in the figure below. This research has employed five latent variables and their formative indicators such as (1) Monthly Income, (2) level of awareness background subsuming the formative indicators of risk, rights of a shareholder, derivate market and role of SEBI in the Stock Market within its fold, (3) factors influencing
investment decision having general, company, political and economical, financial, market and psychological, (4) intention to invest in the stock market and (5) level of satisfaction covering Stock brokers, depository, SEBI procedure and regulations and market conditions.

3.4 Proposed Model

Figure 3.1 depicts the proposed operational model positing as the monthly income as directly considered of the intention to invest in the stock market; level of awareness influencing the intention directly, factors influencing investment decision connected to intention and intention to invest influencing the level of satisfaction in the stock market.

![Proposed Model](image-url)
Legend of the terms used in model

MIN : Monthly Income
LA : Level of Awareness
FIID : Factors Influencing Investment Decision
INT : Intention to Invest
LS : Level of Satisfaction

Figure 3.1 shows that the various factors like monthly income, level of awareness and factors influencing investment decision lead a person to have some intention to invest in the stock market. After investing in the stock market the investors got satisfaction.

3.5 Operational Model

The operational model is depicted in figure 3.2. The figure amplifies every latent variable, given in the proposed model, explicating the formative indicators that make up each of them.
Figure 3.2

Diagrammatic Representations of Formative Indicators and Latent Variables

Expanded names of each of the formative indicators listed below.

**Latent Variables and the Formative Indicators**

<table>
<thead>
<tr>
<th>Monthly Income</th>
<th>Level of Awareness</th>
<th>Factors Influencing Investment Decisions</th>
</tr>
</thead>
<tbody>
<tr>
<td>MIN - Monthly Income</td>
<td>RA – Risk</td>
<td>GF – General</td>
</tr>
<tr>
<td></td>
<td>SRA – Rights of a Shareholder</td>
<td>CF – Company</td>
</tr>
<tr>
<td></td>
<td>EDA – Derivative Market</td>
<td>PEF – Political &amp; Economic</td>
</tr>
<tr>
<td></td>
<td>RSA – Role of SEBI in the Stock Market</td>
<td>FF – Financial</td>
</tr>
</tbody>
</table>

**Intention to Invest**

<table>
<thead>
<tr>
<th>ITI- Intention to Invest</th>
<th>Level of Satisfaction</th>
</tr>
</thead>
<tbody>
<tr>
<td>SB - Stock Brokers</td>
<td></td>
</tr>
<tr>
<td>DS - Depository</td>
<td></td>
</tr>
<tr>
<td>SP - SEBI Procedure and Regulation</td>
<td></td>
</tr>
<tr>
<td>MC - Market Conditions</td>
<td></td>
</tr>
</tbody>
</table>
3.6 Validated Structural Equation Model

The proposed operational model was estimated and validated using structural equation modeling with partial least square technique. Figure 3.3 depicts the validated model of satisfaction in the stock market. Validation of the model resulted in the refinement of the latent variables. The formative indicator of monthly income defines the element as monthly income. As regards level of awareness profile, only four dimensions of risk, rights of a shareholder, derivative market and role of SEBI in the stock market were accepted by the model as important. The factors influencing investment decision behind the variables were general, company oriented, political and economical, financial, market and psychological factors. Among the indicators of intention to invest, validation procedure was retained. Unlike in the cases of other latent variables, the validation procedure had retained all the indicators included in the original set under the dependent variable of the investment satisfaction namely, stock brokers, depository, SEBI procedure and regulation and market condition.

The validated model also explains the indirect influence of the latent variables on the level of satisfaction and can be stated as follows. The monthly income of the investors, awareness of stock market, factors influencing investment decision, all these influence the intention to invest which in turn influence the level of satisfaction towards stock market.
Figure 3.3
Validated Model for Attitude of Investors

Source: Computed from Primary data

3.7 AVE and Reliability

The composite reliability, Average Variance Extracted (AVE), and Cronbach alpha values of monthly incomes, level of awareness, factors influencing investment decision, intention to invest and level of satisfaction are depicted in Table 3.1 below and it reveals that all the five latent variables employed in the estimation are reliable and valid. Composite reliability calculated by PLS is similar to cronbach alpha without the assumption that all indicators are equally weighed and the composite reliability was more than 0.7 and therefore the model is validated.
It could be understood from Table 3.1 that the composite reliability values of the latent variables in the validated model vary between 0.69 and 0.98. The latent variables such as monthly income, level of awareness, factors influencing investment decision, intention to invest and level of satisfaction had composite reliability values were 0.69, 0.99, 0.97, 0.92 and 0.97 respectively and these values are indicate that the constructs were all reliable. The AVEs of the latent variables are: monthly income (0.69) level of awareness (0.64), factors influencing investment decision (0.66), intention to invest (0.79) and level of satisfaction (0.59) showing acceptable levels of convergent validities for these constructs. Crónbach alpha values showed the internal consistency of the constructs that varies between 0.87 and 0.99 in the validation model. Thus the present validated model exhibits acceptable levels of reliability and validity measures for the constructs.
Average Variance Extracted (AVE), as already indicated, may also be used to infer on the discriminant validity among the latent variables or constructs. A measure of discriminant validity sheds light on the potential problem of one construct overlapping another in a conceptual model. The model is evaluated by comparing the AVEs of the latent variables and the correlations that existed between any two latent variables. In the present study AVE of the latent variables (monthly income, level of awareness, factors influencing investment decision, intention to invest, level of satisfaction) should be greater than the square of the correlation between a pair of any two latent variables or the square root of AVE for every latent variable should be greater than the correlations between any two latent variables compared.

Table 3.2 shows the discriminant validities for each the five construct were employed in the study.

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7 Fornell, C and Larker, D, Evaluating Structural Equation Models with Unobservable Variables and Measurement Error, Journal of Marketing Research, 19, 1981, pp.440-452
Table 3.2

Discriminant Validity of the Latent Variables

<table>
<thead>
<tr>
<th>Constructs</th>
<th>AVE (1)</th>
<th>AVE (2)</th>
<th>R</th>
<th>r²</th>
<th>AVE 1 &gt; r²</th>
<th>AVE 1 &gt; r²</th>
<th>Discriminant Validity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monthly Income and intention to invest</td>
<td>0.694897</td>
<td>0.792602</td>
<td>0.027</td>
<td>0.000729</td>
<td>*</td>
<td>*</td>
<td>**</td>
</tr>
<tr>
<td>Monthly Income and level of awareness</td>
<td>0.694897</td>
<td>0.655188</td>
<td>0.109</td>
<td>0.011881</td>
<td>*</td>
<td>*</td>
<td>**</td>
</tr>
<tr>
<td>Monthly Income and factors influencing decision</td>
<td>0.694897</td>
<td>0.640858</td>
<td>0.034</td>
<td>0.001156</td>
<td>*</td>
<td>*</td>
<td>**</td>
</tr>
<tr>
<td>Monthly Income and level of satisfaction</td>
<td>0.694897</td>
<td>0.593866</td>
<td>0.044</td>
<td>0.001936</td>
<td>*</td>
<td>*</td>
<td>**</td>
</tr>
<tr>
<td>Level of awareness and intention to invest</td>
<td>0.655188</td>
<td>0.792602</td>
<td>0.567</td>
<td>0.321489</td>
<td>*</td>
<td>*</td>
<td>**</td>
</tr>
<tr>
<td>Level of awareness and factors influencing decision</td>
<td>0.655188</td>
<td>0.640858</td>
<td>0.720</td>
<td>0.5184</td>
<td>*</td>
<td>*</td>
<td>**</td>
</tr>
<tr>
<td>Level of awareness and level of satisfaction</td>
<td>0.655188</td>
<td>0.593866</td>
<td>0.643</td>
<td>0.413449</td>
<td>*</td>
<td>*</td>
<td>**</td>
</tr>
<tr>
<td>Factors influencing decision and intention to invest</td>
<td>0.640858</td>
<td>0.792602</td>
<td>0.610</td>
<td>0.3721</td>
<td>*</td>
<td>*</td>
<td>**</td>
</tr>
<tr>
<td>Factors influencing decision and level of satisfaction</td>
<td>0.640858</td>
<td>0.593866</td>
<td>0.606</td>
<td>0.367236</td>
<td>*</td>
<td>*</td>
<td>**</td>
</tr>
<tr>
<td>Intention to invest and level of satisfaction</td>
<td>0.792602</td>
<td>0.593866</td>
<td>0.508</td>
<td>0.258064</td>
<td>*</td>
<td>*</td>
<td>**</td>
</tr>
</tbody>
</table>

**Source:** Computed from primary data

**Note:** * AVE of the latent variable (constant) is greater than the square of the correlation of any two latent variable compared

** ** Discriminant validity of the constructs
From the Table 3.2 it can be understood that all the constructs AVE values are greater than the square of the correlation of the monthly income, level of awareness, factors influencing investment decision, intention to invest and level of satisfaction. It is concluded that the AVE values of the latent variables were more than 0.5, which is these values were based to accept for the further development of conceptual model.

Table 3.3 shows the correlation between different latent variables.

**Table 3.3**  
**Correlation between Different Latent Variables**

<table>
<thead>
<tr>
<th>Latent Variables</th>
<th>Monthly Income</th>
<th>Level of Awareness</th>
<th>Factors influencing investment decision</th>
<th>Intention to invest</th>
<th>Level of satisfaction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monthly income</td>
<td>1.000</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Level of awareness</td>
<td>0.109</td>
<td>1.000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Factors influencing</td>
<td>0.034</td>
<td>0.720</td>
<td>1.000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>investment decision</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intention to invest</td>
<td>0.027</td>
<td>0.567</td>
<td>0.610</td>
<td>1.000</td>
<td></td>
</tr>
<tr>
<td>Level of satisfaction</td>
<td>0.044</td>
<td>0.643</td>
<td>0.606</td>
<td>0.508</td>
<td>1.000</td>
</tr>
</tbody>
</table>

*Source: Computed from Primary data*

These values established the discriminant validity among the different latent variables in that they do not statistically overlap each other and were free from the problem of multicollinearity.

### 3.8 Direct and Indirect Effect

The direct and indirect effects of independent constructs (monthly income, level of awareness, factors influencing investment decision and intention to invest)
on the dependent constructs (level of satisfaction) were also explored. PLS did not validate any direct monthly income and intention to invest on level of awareness. The indirect effects of personal constructs on level of satisfaction could be estimated by multiplying the path co-efficient of monthly income → intention to invest, level of awareness → intention to invest, factors influencing investment decision → intention to invest and intention to invest → level of satisfaction. These indirect effects indicated that all the construct except intention to invest in the stock market. The productiveness of the above model is assessed by the $R^2$ values for the dependent variables.

From the figure 3.3 it is seen that the constructs viz., monthly income, level of awareness and factors influencing investment decision with the intention to invest have an $R^2$ value of 0.402 whereas intention to invest along with level of satisfaction is attested by an $R^2$ value of 0.251 that stands for 25.1 per cent variation.

### 3.9 Construct Paths in the Validated Model

Table 3.4 gives the path co-efficient values and the related t- statistics which test the significance of the path co-efficient and the extent of relationship between constructs. The inferences under the table have been indicated by $t > 1.65; p > 0.05$.

Results indicate that the path co-efficient of monthly income on intention to invest is ($\beta = -0.038$, $t = -0.5980$, $p < 0.05$ and $R^2$ value is 0.402) implicating that the monthly income influenced by the intention to invest in the stock market. The path co-efficient between level of awareness and intention to invest are ($\beta$}
= 0.357, \( t = 3.7000, p < 0.05 \) and the \( R^2 \) value is 0.402). This indicates that there is significant correlation between level of awareness (risk, rights of a shareholder, derivative market and role of SEBI in the stock market) and intention to invest.

Table 3.4
Structural Model – Boot Strap

<table>
<thead>
<tr>
<th>Variables</th>
<th>Entire Sample Estimate</th>
<th>Mean of Sub samples</th>
<th>Standard Error</th>
<th>T-Statistic</th>
<th>( R^2 )</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monthly income and Intention to invest</td>
<td>-0.038</td>
<td>-0.0916</td>
<td>0.0671</td>
<td>-0.5980</td>
<td>0.402</td>
<td>S</td>
</tr>
<tr>
<td>Level of awareness and intention to invest</td>
<td>0.357</td>
<td>0.2753</td>
<td>0.0892</td>
<td>3.7000</td>
<td>0.402</td>
<td>S</td>
</tr>
<tr>
<td>Factors influencing investment decision and intention to invest</td>
<td>0.329</td>
<td>0.4179</td>
<td>0.0894</td>
<td>3.3990</td>
<td>0.402</td>
<td>S</td>
</tr>
<tr>
<td>Intention to invest and level of satisfaction</td>
<td>0.501</td>
<td>0.5095</td>
<td>0.0581</td>
<td>7.7830</td>
<td>0.251</td>
<td>S</td>
</tr>
</tbody>
</table>

Source: Computed from primary data

The path co-efficient between factors influencing investment decision and intention to invest are (beta = 0.329, \( t = 3.3990, p < 0.05 \), and \( R^2 \) value is 0.402). It indicates the factors that were influencing to intend to investment in the stock market. The path co-efficient between intention to invest and level of satisfaction (beta = 0.501, \( t = 7.7830, p < 0.05 \) and \( R^2 \) value is 0.251), were sufficiently high indicating significant correlation between intention to invest and level of satisfaction (Stock brokers, depository, SEBI procedure and regulation and market conditions) at five per cent significant level.

The path co-efficient between intention to invest and level of satisfaction was found to be sufficiently high indicating significant correlation between three
statements of intention to invest dimensions and the four dimensions of level of satisfaction. The findings of the present study, reveals that there is correlation between before investment ideas like level of awareness and factors influencing investment decision to encourage to investing in the stock market.

This validated model sufficiently explains level of satisfaction towards stock market investments and investments in the market for avoiding risks. Hence, while selecting the factor intent to invest in stocks should be given to the identified latent variables and its formative indicators that may lead to enhanced level of satisfaction.

3.10 Conclusion

The operational model of investors attitude comprised five latent variables namely, monthly income (with one formative indicator), level of awareness (with four formative indicators), factors influencing investment decision (with six formative indicators), intention to invest (with three formative indicators) and level of satisfaction (with four formative indicators). Finally PLS procedure arrived at a validated model retaining all the five latent variables with revised sets of formative indicators associated with each of the latent variables. The path coefficient revealed that intention to invest is influenced mostly by the level of satisfaction. It is observed that all the four path coefficients are statistically significant as probability value is less than five per cent level.