INDUSTRY FINANCIAL RATIOS – APPLICATION OF FACTOR ANALYSIS IN MALAYSIAN INDUSTRIAL SECTOR

by

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Dissertation submitted in partial fulfillment of the requirements for the degree of Master of Science in Statistics

June 2010

ACKNOWLEDGEMENTS

Alhamdulillah, I would like to appraise Allah S.W.T for giving me the opportunity to complete my dissertation.

First of all, I would like to express my deepest gratitude to Dr. Shamsul Rijal bin Muhammad Sabri for his dedication of being my supervisor and gives such a great inspiration to motivate in order to accomplish the dissertation with wholeheartedly. I also would like to thank him for his encouragement, patience and assistance.

I am also indebted to my second examiner, Puan Zalila bt Ali who have provided me with invaluable suggestions, comments and constructive discussion during the period of this study.

I appreciate the guidance and help from En. Syed Mohamad Hussein Syed Osman a computer technician of School of Mathematical Sciences, USM who has assisted me to complete the dissertation with least obstacles.

I also would like to acknowledge my family and my fellow friends for their endless encouragement and moral support.

Last but not least, I would like to thank everyone who has contributed to the achievement of this dissertation, directly or indirectly.

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ABSTRAK

Sektor perindustrian mempunyai pengaruh besar dalam ekonomi negara dan bertanggungjawab untuk pertumbuhan sektor-sektor lain. Nisbah-nisbah kewangan ialah petunjuk-petunjuk yang berguna bagi prestasi syarikat dan kedudukan kewangan. Nisbah-nisbah kewangan digunakan dengan meluas oleh pelabur, pemiutang-pemiutang, pembekal-pembekal dan kerajaan untuk membuat keputusan-keputusan yang lebih baik. Tujuan kajian ini adalah untuk mengenal pasti penunjuk-penunjuk paling penting yang menyumbang untuk sektor perindustrian Malaysia dan untuk menganalisa aliran kewangan dari tahun 2000 hingga 2008. Data kewangan untuk syarikat-syarikat perindustrian dikutip dari Bursa Saham Kuala Lumpur (BSKL). Ini termasuk maklumat dari 185 syarikat-syarikat perindustrian dan lima belas nisbah-nisbah kewangan telah dipilih untuk kajian ini. Analisis faktor digunakan bagi mencari faktor-faktor di antara nisbah-nisbah kewangan yang diperhatikan. Lima faktor telah dikenal pasti sebagai penunjuk-penunjuk utama yang menyumbang untuk sektor perindustrian Malaysia. Penunjuk-penunjuk telah dikenal pasti sebagai faktor pelarutan dan liabiliti, faktor perolehan aset dan hutang, faktor keumpilan kewangan, faktor pertumbuhan dan faktor liabiliti jangka panjang. Skor-skor faktor digunakan untuk menganalisa aliran kewangan industri dari tahun 2000 hingga 2008.

ABSTRACT

The industrial sector has large influence in the national economy and responsible for the growth of other industries. The financial ratios are useful indicators of company performance and financial situation. Financial ratios are extensively used by investors, creditors, suppliers and government to make better decisions. The purpose of this study is to identify the most important indicators that contribute to Malaysian industrial sector and to analyze the financial trend from year 2000 to 2008. Financial data for industrial companies are collected from Kuala Lumpur Stock Exchange (KLSE). This includes information from 185 industrial companies and fifteen financial ratios are selected for this study. The factor analysis is utilized to find factors among observed financial ratios. Five factors are identified as the main indicators that contribute to the Malaysian industrial sector. The indicators are identified as solvency and liabilities factor, asset and debt turnover factor, financial leverage factor, growth factor and long-term liabilities factor. Factor scores are used to analyze the financial trend of the industry from year 2000 to 2008.

CHAPTER ONE

INTRODUCTION

1.1 BACKGROUND ON FACTOR ANALYSIS

Factor analysis is used widely in operations research, social sciences, marketing, behavioral sciences and product management which deal with large quantities of data. Cattell developed 16 Personality Factor Model with aims to achieve integration as it relates to language and personality, (Fehriinger, 2004). That is, to identify the personality relevant in the language relating to specific traits. With the intent of generality, Cattell's sample was representative of several age groups including adolescents, adults and children as well as representing several countries including the U.S, Britain, Australia, New Zealand, France, Italy, Germany, Mexico, Brazil, Argentina, India and Japan. Through factor analysis, Cattell identified what he referred to as surface and source traits. Surface traits represent clusters of correlated variables and source of traits represent the underlying structure of the personality. The identified source traits became the primary basis for the 16 Personality Factor Model; warmth, reasoning, emotional stability, dominance, liveliness, rule-consciousness, social boldness, sensitivity, vigilance, abstractedness, privateness, apprehension, openness to change, self-reliance, perfectionism and tension.

The essential purpose of factor analysis is to describe the relationships among many variables in terms of a few underlying, but unobservable called factors, (WorldLingo, 2010). The factor analysis is utilized to find factors among observed variables. The observed variables are then modeled as linear combinations of the factors, plus error terms. The information of interdependencies can be used later to reduce the set of variables in a dataset. Factor analysis is effective when the variables are more than 150. The steps of factor analysis includes selecting and measuring a set of variables by preparing the correlation matrix, extracting a set of factors from the correlation matrix, determining the number of factors, rotating the factors to increase interpretability and explaining the results (Tabachnick and Fidell, 1996).

The early development of factor analysis was carried out by Charles Spearman in the field of psychology, (Bryan, 2005). While studying the correlations between students test scores of various types, he noted that many observed correlations could be accounted for by a simple model. He obtained the matrix of correlations for boys in a preparatory school for their scores on tests in classics, French, English, mathematics, discrimination of pitch and music. He discovered that school students test scores on the subjects were positively correlated. Then, he postulates general mental ability in the field of intelligence research which is known as g theory. Few years later, Raymond Cattell expanded Spearman's idea of a two-factor theory of intelligence after performing his own test and factor analysis. He used a multi-factor theory to explain intelligence. Cattell also developed several mathematical methods such as similarity coefficients and scree test.

The extraction techniques calculate a set of factors that in combination to reproduce the matrix of correlations, (Tabachnick and Fidell, 1996). The extraction techniques discussed are principal components analysis (PCA) and maximum likelihood method. PCA is used to extract maximum variance from the data set with each component. The first principal component is the linear combination of observed variables that maximally separates subjects by maximizing the variance of their component scores. The second component is formed from residual correlations, where it is the linear combination of observed variables that extracts maximum variability uncorrelated with the first component. Subsequent components also extract maximum variability from residual correlations and are orthogonal to all previously extracted components. The principal components are ordered, with the first component extracting the most variance and the last component the least variance.

The most often used procedures to determine the number of factors was proposed by Kaiser (1958). He excluded those principal components whose eigenvalues less than the average. The average eigenvalue was also the average variance of the original variables. He stated that when the factors are extracted from the correlation matrix, the average is one. Therefore, he recommended that factors with eigenvalues greater than one are retained.

The maximun likelihood method was developed originally by Lawley in the 1940s, (Tabachnick and Fidell, 1996). Maximum likelihood extraction estimates population values for factor loadings by calculating loadings that maximize the probability of sampling, the observed correlation matrix from a population. Within constraints imposed by the correlations among variables, population estimates for factor loadings are calculated which have the greatest probability of yielding a sample with the observed correlation matrix.

The unrotated factors are tough to interpret. Thus, rotation is used to improve the interpretability of the factors, (Tabachnick and Fidell, 1996). The orthogonal rotations which comprise the three techniques are varimax, quartimax and equamax. The varimax rotation is used to simplify factors by maximizing the variance of the loadings within factors, across variables. The spread in loadings is maximized where loadings that are high after extraction become higher after rotation and loadings that are low become lower. Interpreting a factor is easier because it is obvious which variables correlate with it. Varimax also tend to reapportion variance among factors so that they become relatively equal in importance. Variance is taken from the first factors extracted and distributed among the later ones.

Quartimax does for variables what varimax does for factors. It simplifies variables by increasing the dispersion of the loadings within variables and across factors, (Tabachnick and Fidell, 1996). Varimax operates on the factors of the loading matrix, quartimax operates on the variables. Quartimax is not nearly as popular as varimax because one is usually more interested in simple factors than in simple variables. Equamax is a hybrid between varimax and quartimax that tries simultaneously to simplify the factors and the variables. Equamax tends to behave erratically unless the researcher can specify the number of factors with confidence.

1.2 BACKGROUND ON FINANCIAL RATIOS

An annual report contains financial information about an organization, (Answers Corporation, 2010). The required financial statements are formal records of the financial activities of a business or person which comprise income statement and balance sheet, and frequently also include statement of cash flow. The financial statements is based on the accounting method and accounting standards used by the company. The income statement reports on a company's income, expenses and profits over a period of time. The balance sheet referred to as statement of financial position on a company's assets, liabilities and ownership equity at a given point of time as well as the statement of cash flow describes a company's cash flow activities such as operating, investing and financing activities.

Financial ratios are useful indicators of a company's performance and financial situation, (UKessays, 2010). Most financial ratios can be calculated from information provided by the financial statements. Financial ratios can be predictive in order to provide lead indications of potential problem areas. Financial ratios are mainly used to compare a company's financial performance with its competitor within the same industry, allow comparison between companies and also allow comparison itself over time. The intent of financial ratios is to provide information about the changes in financial position of a company.

The type of information required from the analysis of financial statements may vary depending upon the user, (Rawi, Kiani, Vedd, 2008). The financial analysis are extensively used by the interested parties such as investors, debtors, creditors, suppliers, government and customers to acquire company's financial situation. Investors are interested in financial information that enables them to asses the ability of the company to pay dividends for their stocks and to decide whether they should buy, hold or sell. Lenders interested in determining if their loans will be paid when due. Suppliers need information to decide whether to sell to the enterprise while creditors interested in information to decide whether amounts owed to them will be paid when due. Customers have interest in information about the continuance of an enterprise. Government and their agencies are interested in the allocation of resources and the activities of a company to provide a basis for national income and economic statistics.

The selection of ratios needs a careful consideration based on the objective of the study. According to empirical studies by Chen and Shimerda (1981), there is no constant and set rule which may be useful in selecting the ratios. They discussed the significance of financial ratios in evaluating the performance and financial positions of the companies in their research. They have grouped ratios into seven financial classes. There are return on investment, capital turnover, inventory turnover, financial leverage, receivable turnover, short-term liquidity and cash position.

Osteryoung *et al.* (1992) compared financial ratios of small, medium and large companies. They concluded that there is a significant difference among the financial ratios. Financial ratios of retail business naturally will be different from the manufacturing business. Therefore, they stated that financial ratios from the same sector are more significant to be compared in the study.

Muslumov and Karatas (2001) used sample consists of 70 manufacturing companies which actively traded in Istanbul Stock Exchange (ISE). The financial data are collected from year 1992 to 1998. These companies are selected from 33 textile industry, 26 from food industry and 11 from cement production industry in order to study the effects on Asian crisis to Turkish companies. This research monitored of 21 financial ratios and they acknowledged that these financial ratios cover most of the information about financial dimensions of the companies. The results of the PCA suggest that all 21 financial ratios can be condensed in five orthogonal financial factors. The factors is named as capital turnover and return on investment factor, profitability margins factor, short-term liquidity factor, financial leverage and equity turnover factor and also shareholder's profitability and debt cost factor. Moreover, these five factors explained 78% of variation in the analysis. They predicted that profitability margins decreased to reflect decreasing competitiveness power in international markets and decreasing demand in domestic market, turnover declined to reflect the downtrend caused by deteriorating market conditions, financial leverage increased due to abnormally high real interest returns and liquidity increased due to the investment in public securities. This study reported that profitability margin was found to be significant discriminating factor of textile industry by using stepwise discriminant analysis. However, no significant discriminating factors are found for both food and cement production.

Regarding to Ege and Bayrakdaroglu (2007), the factor analysis method is used to measure the stocks performances of firms. The financial data are collected from ISE that consists of 35 industrial firms. In this paper, 18 financial ratios are calculated according to the balance sheets and income statements. The group of financial ratios such as liquidity, activity, profitability and financial structure ratios are defined in the study.

According to Salmi *et al.* (1990), the empirical classification of financial ratios using statistical techniques has been inductive by using factor analysis. In this approach, a large number of measured variables will be reduced into a smaller number of latent variables and followed by giving interpretative names to these latent variables. In this study, the data are collected from 32 traded Finnish companies from year 1974 to 1984. The factor analysis is applied based on the PCA in the initial solution estimation. The three factors summarized as accrual ratios, cash flow ratios, and market-based ratios. The final solutions are then developed by using varimax rotation to improve the interpretability of the three factors.

According to Ocal *et al.* (2005), factor analysis is a data reduction and classification technique, which can be applied in financial analysis. The financial data are collected from ISE for a five year period between years 1997 and 2001. In this paper, there were about 25 financial ratios are chosen due to importance to the construction companies. The study pointed out five factors was identified based on PCA with variance greater than one. The study also stated that varimax rotation was used as a rotational method to enhance the meaning of the factors. Then, names were given based on the classification of financial ratios that are common used. These appeared as liquidity factor, capital structure and profitability factor, activity efficiency factor, profit margin and growth factor and assets structure factor.

Altman (1968) developed a model that involved two groups of distressed and non-distressed companies. The sample is composed of 66 companies in each of the two groups over the period 1946 to 1964. A list of 22 potential financial ratios is compiled for evaluation. There are classified into five standard categories, including liquidity, profitability, leverage, solvency and activity ratios. He stated that financial ratios are chosen on the basis of their popularity in literature and potential relevancy to the study. He proved that the discriminant model had given 95% accurate results in predicting distressed and non-distressed companies. He also reported that debt ratios had significant predictive ability.

Mohamed *et al.* (2001) compared the multiple discriminant analysis (MDA) and the logit model in the analysis of bankruptcy. Their sample consists of 26 distressed companies and 79 non-distressed companies. This research considered eleven financial ratios that are divided into four broad categories. There are four profitability ratios, three leverage ratios, and two each for liquidity and efficiency ratios. The mean values of each financial ratio for distressed companies and non-distressed companies are then compared over time from year 1991 to 1996. The results explained in comparison with the distressed companies, non-distressed companies have higher profitability ratios, lower leverage ratios, higher liquidity ratios and higher efficiency ratios. They also found that when using MDA, debt ratio and total asset turnover were significant but when logit analysis is used, an additional variable, interest coverage was also found to be significant. Thus, Mohamed et al. (2001) highlighted the importance of leverage ratio as a predictor of a failure. The logit model predicted 80.7% of the companies in the estimation sample which better than MDA. Thus, in line with Altman (1968), this study emphasizes the debt ratio as a predictor of failure.

Later, Abdullah *et al.* (2008) analyzed the comparison between three methodologies for identifying financially distressed companies, MDA, logistic regression and hazard model. They used a sample of 52 distressed companies and non-distressed companies. This paper consists of financial ratios that can be classified into five categories. There are leverage ratios (interest coverage and total debt to total assets), profitability ratios (net income to total assets), cash flow ratios (cash to total assets and cash to current liabilities), size (total assets employed) and growth (change in net income and change in sales). They discovered that mean for interest coverage that categorized into leverage ratios was lower for the non-distressed companies for both the MDA and logit model as well as the hazard model. The study explained that the estimation sample of the hazard model had given an overall accuracy rate of 94.9% which was higher than the MDA and logit model which reported 80.8% and 82.7% respectively. The study also stated that debt to total assets which categorized into leverage ratios appeared as a consistent indicator of financially distressed companies in all the models.

1.2.1 INDUSTRIAL SECTOR

The industrial sector has large influence in the national economy and responsible for the growth of other industries, (Michigan State University, 2010). The development of miscellaneous machinery led to the industrial revolution. The yield of the industry includes a variety of machinery starting from farm and factory equipment to smaller machinery used in many households, the same as smaller industrial products such as hardware, glass and paper products.

There are four key industrial economic sectors, (Houghton Mifflin, 2009). The primary sector is mainly raw material extraction industries such as mining and farming whereas the secondary sector concerning construction, refining and manufacturing. The tertiary sector pertaining to the distribution of manufacturing goods and the last sector is relatively focusing on technological research, design and development.

Industry of manufacturing became a key sector of production and labour in European and North American countries during the industrial revolution, (Citizendium, 2008). Industrial revolution is a transition from an agrarian economy to an industrial economy with greater focuses on manufacturing. The rapid advance in technology such as coal and steel production has continued to develop into new types and sectors today.

1.2.2 MALAYSIAN INDUSTRIAL SECTOR AND THE NATIONAL ECONOMY

Malaysia transformed into an industrial or production-based economy in the 1960s that led to major changes in physical infrastructure, financial system and education system, (Jarjis, 2006). The Government invested to shift goods and services, financial and fiscal incentives to attract foreign investments, education and training systems to provide the industries with skilled labour and technical workforce.

During the period from 1991 to 2005, Malaysia exports grew at an average annual rate of 13.5 percent and in 2006 Malaysia is the eighteenth largest trading nation. The role of knowledge is becoming increasingly critical in the new economy as technology becomes more complex and economic growth is driven by knowledge-intensive industries.

Malaysia is currently a growing and moderately open state-oriented market economy, (Johnleemk, 2007). In 2007, the Malaysia economy was the 29th largest economy in the world with a growth rate of 5 percent to 7 percent. As one of three countries that control the Strait of Malacca, international trade plays a major role in its economy.

The investment in key industrial sectors in Malaysia remained robust in 2007, (Arend, 2008). In the manufacturing and services sectors, investments worth US$39 billion are approved by the Malaysian Industrial Development Authority (MIDA) in 2007, up from $32 billion in 2006. The increased investments in the industrial sector were primarily due to capital-intensive projects, mainly in the electronics and electrical industry, petroleum products together with petrochemicals, basic metal projects and paper, printing and publishing.

The Malaysian economy was affected by the Europe and Asian financial crisis in 2008, (Malaysian Investment Development Authority, 2009). This resulting with the fluctuation in oil price and quick increase on food prices which also affected the world economies. In 2008, The Malaysian economy gross domestic product (GDP) decreased to 4.6 percent compared to 2007. Multinational corporations from more than 40 countries have invested in over 5000 companies in Malaysia's manufacturing and services sectors which encouraged by the infrastructure, conducive business environment and high levels of global integration.

1.3 PURPOSE OF THE STUDY

The intention of this study is to present the industry financial ratios using factor analysis in Malaysian industrial sector with the aim:-

1. To identify the correlation between the financial ratios.
2. To identify factors extracted from the financial ratios.
3. To apply factor rotation to enhance the interpretability of the extracted factors.
4. To determine the most important factors of financial Malaysian industrial sector.
5. To analyze the Malaysian financial trend from year 2000 to 2008.

1.4 ORGANIZATION OF THE STUDY

This study is organized into five chapters. Chapter one provides the background on factor analysis and the background on financial ratios. Malaysian industrial sector and the national economy is discussed in chapter one. Purpose of the study and the organization of the study are also described. The methodology discussed in chapter two elaborates the concept of factor analysis. The fifteen financial ratios and the categories of financial ratios are presented in chapter three.

Data are organized using Microsoft Office Excel and analyzed using MINITAB software. The analysis and results are explained in chapter four. The empirical results are reported and discussed that relate with the purpose of the study. The conclusions and recommendations of the study are presented in chapter five. The chapter ends by proposing suggestions for further research.

CHAPTER TWO

FACTOR ANALYSIS

A correlation matrix is conducted for all variables. The adequacy of variables is verified using Kaiser-Meyer-Olkin (KMO) and Barlett's test of sphericity (BTS). Factors are extracted from the correlation matrix based on the correlation coefficients of the variables. The factors are then rotated in order to maximize the relationship between the variables and some of the factors.

2.1 CORRELATION BETWEEN VARIABLES

Variables are selected and a correlation matrix is conducted including all variables. A correlation matrix is a k x k (where k equals the number of variables) array of the correlation coefficient of the variables with each other. The correlation coefficients express the degree of linear relationship between row and column variables of the matrix, (Rummel, 1976). Variables must be related to each other for the factor model to be appropriate. The relationship are weak if coefficient closer to zero but the relationship are strong if coefficient closer to one. A negative sign indicates that variables are inversely related. The principal diagonal normally contains correlation of a variable within itself, which always one. The Pearson correlation between variable i and variable j is

$$r_{ij} = \frac{\sigma_{ij}}{\sigma_i \sigma_j} \quad (2.1)$$

where

r_{ij} is the product moment correlation between variable i and variable j

σ_{ij} is the covariance between variable i and variable j

σ_i is the standard deviation of variable i

σ_j is the standard deviation of variable j

KMO and BTS tests of sampling adequacy are initially performed on the data and verified the appropriateness of conducting factor analysis. KMO measure of sampling adequacy is calculated for all variables. KMO test provides a value between 0 and 1. Small value of KMO implies that a factor analysis of the variables may not be suitable since the correlations between variables cannot be explained by the other variables. KMO value that greater than 0.5 is considered satisfactory for factor analysis to proceed.

The general KMO model which states that

$$\text{KMO} = \left(\Sigma\Sigma r^2_{ij}\right) / \left(\Sigma\Sigma r^2_{ij} + \Sigma\Sigma a^2_{ij}\right) \quad (2.2)$$

where

r^2_{ij} is the coefficient of determination between variable i and variable j

a^2_{ij} is the variance between variable i and variable j

Table 2.1 explains the relationship between KMO values and the degree of common variance.

Table 2.1: KMO Values and Degree of Common Variance

KMO value	Degree of common variace	Explanation
0.90 - 1.00	Superb	Factors account for substantial amount of variance
0.80 - 0.89	Great	Factors account for substantial amount of variance
0.70 - 0.79	Good	Factors account for sufficient amount of variance
0.60 - 0.69	Mediocre	Factors account for sufficient amount of variance
0.50 - 0.59	Barely acceptable	Factors account for small amount of variance
0.00 - 0.49	Not acceptable	No factor

The determinate of the matrix of the sums of products and cross-products ($\mathbf{S}$) from the correlation matrix is derived. Then, the determinant of the matrix $\mathbf{S}$ is converted to a chi-square statistics and tested for significance. The null hypothesis is that the correlation matrix comes from a population in which the variables are an identity matrix. The BTS shows that the correlation matrix is at an appropriate level to perform factor analysis if significance level of $p < 0.001$. The factor model is inappropriate if the correlation matrix is an identity matrix.

In matrix algebra, the determinate of an identity matrix is equal to 1. It is shown below:-

$$\mathbf{I} = \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix} \tag{2.3a}$$

$$|\mathbf{I}| = \begin{vmatrix} 1 & 0 \\ 0 & 1 \end{vmatrix} \tag{2.3b}$$

$$\mathbf{I} = (1\times1) - (0\times0) = 1 \tag{2.3c}$$

The χ^2 calculation for BTS test is as follows:-

$$\chi^2 = -\left[(n-1) - 1/6(2p+1+2/p)\right]\left[\ln|\mathbf{S}| + p\ln\left(1/p\sum l_j\right)\right] \tag{2.4}$$

where

p is the number of variables

n is the number of components

$\mathbf{S}$ is a matrix of the sums of products and cross-products

l_j is the jth eigenvalue of $\mathbf{S}$

with $df = (p-1)(p-2)/2$

BTS should show that the correlation matrix is not an identity matrix by showing a significance value smaller than 0.001.

2.2 THE FACTOR MODEL

The general factor analysis model is stated as

$$V_i = \alpha_{i1}F_1 + \alpha_{i2}F_2 + \ldots + \alpha_{im}F_m + e_i \tag{2.5}$$

where

V_i is the *ith* variable

α_{i1} is the factor loading for the *ith* variable

F_1 to F_m are m uncorrelated common factors

e_i is a factor specific or residual

2.3 FACTOR EXTRACTION

An appropriate number of factors underlying is extracted from the correlation matrix. The method of extraction used to estimates the initial factors is obtained using PCA. PCA is the most commonly used extraction method, (Kaiser, 1958). The determination of the number of factors is done by considering factors with a variance greater than one. Thus, the relevant factors are required to be extracted.

The method for finding unrotated factors is as follows. With p variables, there will be the same number of principal components. The linear combinations of the original variables

$$Z_p = \beta_{p1}V_1 + \beta_{p2}V_2 + \ldots + \beta_{pp}V_p \qquad (2.6)$$

where the β_{p1} to β_{pp} values are given by eigenvectors of the correlation matrix. This transformation from variable V_i to principal component Z_i is orthogonal, so that the inverse relationship is simply

$$V_p = \beta_{1p}Z_1 + \beta_{2p}Z_2 + \ldots + \beta_{pp}Z_p \qquad (2.7)$$

For a factor analysis, only m of the principal components are retained, so the last equation become

$$V_p = \beta_{1p} Z_1 + \beta_{2p} Z_2 + \ldots + \beta_{mp} Z_m + e_p \quad (2.8)$$

The principal components $Z_1, Z_2, \ldots, Z_m$ must have scale unit variances, as required for factors. Therefore, Z_i must be divided by its standard deviation, which is $\sqrt{\lambda_i}$, the square root of the corresponding eigenvalue in the correlation matrix. The equation then become

$$V_p = \sqrt{\lambda_1}\beta_{1p} F_1 + \sqrt{\lambda_2}\beta_{2p} F_2 + \ldots + \sqrt{\lambda_m}\beta_{mp} F_m + e_p \quad (2.9)$$

where $F_i = Z_i / \sqrt{\lambda_i}$. The unrotated factor model is then

$$V_p = \alpha_{p1} F_1 + \alpha_{p2} F_2 + \ldots + \alpha_{pm} F_m + e_p \quad (2.10)$$

where $\alpha_{ij} = \sqrt{\lambda_j}\beta_{ji}$

The factor loadings are the correlation coefficients between variables (row) and factors (column). The squared of factor loading multiplied by 100 gives the percent of variation that a variable has in common with an unrotated pattern (factor). The first unrotated factor pattern represents the largest pattern of relationships in the data. The first pattern explains the greatest amount of variation while the last pattern shows the least. The communality is the sum of squared factor loadings for all factors for a given ratio (row). In other words, communality is the variance in a variable accounted for by all the factors. The communality is given by

$$h_i^2 = \sum \alpha_{im}^{\ 2} \qquad (2.11)$$

where $\alpha_{im}^{\ 2}$ is the squared of factor loading for each variable.

From factor analysis model in equation 2.5, we can generate variance as

$$Var(V_i) = \alpha_{i1}^{\ 2} + \alpha_{i2}^{\ 2} + \ldots + \alpha_{im}^{\ 2} + Var(e_i) \qquad (2.12)$$

where

$\alpha_{i1}^{\ 2} + \alpha_{i2}^{\ 2} + \ldots + \alpha_{im}^{\ 2}$ is called the communality of variable i

$Var(e_i)$ is called the specificity of variable i

The squared correlation describes the proportion of variance in common between two variables. The percent of variance can be obtained by multiplying correlation coefficient with 100. That is

$r^2_{ij} \times 100 =$ percent of variance in common between variable i and variable j (2.13)

The meaning of correlation can be easier to understand by squaring correlations and transforming covariance to percentage.

CHAPTER THREE

FINANCIAL RATIOS

3.1 THE FIFTEEN FINANCIAL RATIOS

Fifteen financial ratios are being considered in this study. There are current ratio, debt to equity, debt ratio, equity ratio, fixed ratio, long-term ratio, current asset turnover, fixed asset turnover, total asset turnover, stockholder's equity turnover, current liabilities turnover, long-term liabilities turnover, total liabilities turnover, long-term debt to equity and equity multiplier.

The current ratio is used to indicate company ability to pay back its short-term liabilities (debt and payables) with its short-term assets (cash, receivables, inventory). High current ratio means that company has the capability to pay its short-term liabilities. This reflects that company has good short-term financial strength. The current ratio is also known as liquidity ratio, cash asset ratio and cash ratio. It is calculated by dividing short-term asset with short-term liability.

$$\text{Current ratio} = \frac{\text{Short-term asset}}{\text{Short-term liability}} \qquad (3.1)$$

The debt to equity indicates how much money a company should safely able to borrow for long periods of time. This attain by comparing the company total debt (short-term and long-term liabilities) and dividing it by the amount of shareholder's equity. The answer obtain is the percentage of the company indebted or leveraged. The normal level of debt to equity has changed over time and depends on economic factors.

$$\text{Debt to equity} = \left(\frac{\text{Short-term liability} + \text{Long-term liability}}{\text{Shareholder} + \text{Minority interest}} \right) \tag{3.2}$$

The debt ratio measures the proportion of a company's debt relative to its assets. This shows how much company relies on debt to finance assets. The company has less potential risks if the company reliance on debt for asset is low. However, the excessive debts result to a very heavy interest and principal repayment burden.

$$\text{Debt ratio} = \left(\frac{\text{Short-term liability} + \text{Long-term liability}}{\text{Short-term asset} + \text{Long-term asset}} \right) \tag{3.3}$$

The equity ratio is a good indicator of the level of leverage used by a company. The ratio measures the proportion of the total assets that are financed by stockholders and not creditors. A low equity ratio will generate good results for stockholders as long as the company earns a rate of return on assets which greater than the interest paid to creditors.

$$\text{Equity ratio} = \left(\frac{\text{Shareholder} + \text{Minority interest}}{\text{Short-term asset} + \text{Long-term asset}} \right) \tag{3.4}$$

The fixed ratio measures the proportion of the long-term assets that are financed by stockholders. A low fixed ratio will generate good results for stockholders as long as the company earns a rate of return. The fixed ratio attains by dividing the stockholder's equity with respect to long-term asset.

$$\text{Fixed ratio} = \frac{(\text{Shareholder} + \text{Minority interest})}{\text{Long-term asset}} \tag{3.5}$$

The long-term ratio is used to indicate company ability to pay back its long-term liabilities with its long-term assets. High long-term ratio means that company has the capability to pay its long-term liabilities. This reflects that company has good long-term financial strength. The long-term ratio obtains by dividing the company long-term asset with respect to long-term liability.

$$\text{Long-term ratio} = \frac{\text{Long-term asset}}{\text{Long-term liability}} \tag{3.6}$$

The current asset turnover indicates how sufficient company uses its short-term asset to generate revenues. This ratio shows how many times company has generated revenue as compared to its short-term asset. A low turnover shows that company is not generating a sufficient volume of business. The ratio attains by dividing the company revenue with respect to short-term asset.