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A Study on the Application of Factor Analysis and the Distributional Properties of Financial Ratios of Malaysian Companies

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Abstract

This paper investigates the use of factor analysis on financial ratios as well as examines their distributional properties. With an initial set of 28 financial ratios, seven ratios with the highest factor loadings were selected, and subsequently were assessed for normality. All seven ratios were found to be positively skewed. After removal of outliers and transformation of values, only one ratio achieves normality, while another ratio approaches normality. This study shows that it is not necessary to use many ratios for assessing financial performances. It also shows that financial ratios generally do not display a normal distributional pattern and normality can be improved for certain ratios only after remedial actions are taken.

Key Words

Financial ratios, Factor analysis, Distributional properties, Normality.

I. INTRODUCTION

A ratio is a comparison of one figure or set of figures with another figure or set of figures from the financial statements in order to gain useful perspectives about the company's performances and financial positions. It is not one ratio but a combination of various ratios

that are usually used. Ratios are typically used to track a company's financial trend over time, to ascertain whether revenues and costs are moving in the desired directions, whether profitability is on positive trajectory, whether cash flow positions are healthy and whether the company is able to meet its short and long-term fixed commitments. Ratios can be used to spot areas of strength and areas of weaknesses. Areas of concern can be highlighted through interpreting certain ratios and remedial actions can then be taken by management to address such concerns.

Due to the large number of ratios available, it is necessarily to identify a smaller set of ratios that can still meet the objectives of the study regardless of whether the ratios are used for prediction of bankruptcy, loan defaults, ratings of bonds and equity or financial performance. In fact, it is questioned that which ratios among the so many found in the literature are useful in evaluating the financial performance and financial condition of a company [3]. Reference [14] found that it is not needed to have a large number of ratios to predict business failures and all that is needed is a set of dominant ratios derived from a larger set of related ratios. Reference's [19] study started with eighty potentially useful ratios and ended up with just four. Therefore, the first objective of this study is to use factor analysis to reduce the large number of financial ratios into a smaller more significant and useful set of ratios.

Factor analysis is a statistical method used to describe variability among observed variables in terms of a potentially lower number of unobserved variables called factors. This means that the variations in say, three or more observed variables can be explained by the variation in a single unobserved variable or the variation in a reduced number of variables. Therefore, a large number of variables can be combined into a smaller number or just a single variable. Factor analysis is a multivariate statistical tool that is used for data reduction and summarization.

Factor analysis as a statistical tool that is used to analyze the interrelationships among a large number of variables and to explain these variables in terms of their common underlying factors with a minimum loss of information [9]. These factor patterns have the property of retaining the maximum amount of information contained in the original data matrix [16].

Most studies using financial ratios for financial performance evaluations often assume that the ratios are normally distributed. Statistical models especially multivariate statistical models have been used for classification of companies according to their financial performance and financial positions without any proven evidence that the variables used conform to or approximate to a normal pattern. When models are constructed and decisions made with assumptions of normality and where these assumptions are not present, which often has been the case, then such inferences and decisions made may be inaccurate or wrong. The accuracy of statistical models constructed depends on the goodness-of-fit. If the goodness-of-fit is poor, using such data may not be useful or effective to forecast future trends as these trends may probably not follow a similar pattern. The normal distribution of the data is important as otherwise the findings may not be representative of the entire population used in the analysis. Significant skewness and high kurtosis of the data used and presence of extreme observations will distort the means and standard deviations of the data. Therefore, any comparisons of a company's performance using financial ratios as independent variables with other companies' performances may be misleading since the ratio means used as benchmarks are distorted and

are not representative of industry averages. Reference [4] found that ratios are generally not normally distributed except the Debt to Total Asset ratio. However, Reference [17] found evidence of normality in their study of commercial banks. Different studies found that most financial ratios do not follow the normal distribution and there are differing degrees of non-normality with different ratios, in different industries and in different countries where the accounting, taxation and market conditions are different [4], [6], [17]. Therefore, the other objective of this study is to examine whether a set of financial ratios as selected after factor analysis are normally distributed and if not, to take remedial actions to try to improve the distributional pattern so that decisions and inferences made from using these financial ratios can be made more reliable.

II. REVIEW OF PAST STUDIES

Reference [3] found that financial ratios have played an important part in evaluating the financial conditions of business entities and that over the years, empirical studies have repeatedly demonstrated the usefulness of financial ratios. They analyzed 26 studies done on failure prediction, market returns, bond ratings and mergers that used more than 100 financial items out of which 65 are accounting ratios. Reference [11] identified 48 ratios and ranked them according to their usefulness as portrayed in 53 studies carried out between 1966 and 2002. Different studies have used different ratios and the choice of ratios used depended on the researchers own preferences or based on their popularity in previous studies.

Reference [1] used 42 financial ratios and after applying factor analysis, five factors were found to be significant. Reference [20] used the factor analysis on 29 financial ratios in found 8 underlying factors. Reference [15] applied factor analysis on 25 financial ratios and found five underlying factors.

Reference [16], in their attempt to develop empirically based classifications of financial ratios using factor analysis concluded that there are seven financial patterns for industrial firms. A number of studies on the distributional patterns of financial ratios found that financial ratios are approximately normal but positively skewed [4], [6], [7], [10]. Many past studies using financial ratios have assumed that ratios are normally distributed. When using multivariate analyses techniques, the normality assumptions is important as otherwise the findings will not be representative, suspect or even not valid. The violation of the normality assumption may make the tests of significance and the estimated error rates biased [5]. Reference [2] found that many financial ratios do not conform to the normality assumption because of skewness and extreme outliers. He further states that most available normality tests are for univariate and not multivariate normality and that in the case of non-normality of the data, it is a common procedure to use certain transformations to transform data.

The results of studies indicating non-normality distribution of financial ratios have led other researchers to look for ways to address this problem. To restore normality, removal of outliers and transformation techniques are often studied and used. The outright removal of extreme outliers or an overall trimming of outliers have been found to improve normality. Data transformation to a more normal distribution is commonly used before the confidence interval is determined. It helps with the interpretability of the data. The common transformation methods applied in trying to improve normality are lognormal, square root and the reciprocal.

In a study on multivariate normality in relation to bankruptcy prediction states that using multiple discriminant analysis is valid only when the variables in the groups showed joint multivariate normality and that the group dispersion matrices are equal across the groups [13]. The technique used to test for normality is the Shapiro Wilkes test instead of the more commonly used chi-square test. According to them the chi-square test is the weakest technique to test for univariate normality. They used fifty companies in their analysis and found that of fifty ratios tested for normality; only nine were found to be normally distributed. According to them, deviations from the (multivariate) normality assumption at least in economics and finance appear more likely to be the rule rather than the exception.

Reference [18] said that financial ratios are found to be valuable for bankruptcy prediction, rating of bonds, ascertaining market returns and the study of mergers. He said that in studies applying financial ratios and using either univariate or multivariate methodology, they all assumed that the normality assumptions of the ratios are maintained although empirical evidence proved otherwise. According to him, the distributional properties of financial ratios are important to both practitioners and researchers. He gave the example of a credit manager who may give a decision of extending a line of credit to a customer based on financials using ratios that are assumed to be normally distributed but his decision to extend credit may be different if the ratios are found to be non-normal and skewed. His analysis of eleven ratios found that removing of outliers does improve the normality approximations to some extent

Reference [4] used eleven ratios and only one ratio, total debts to total assets is found to be normal and also not for every year in the analysis. Of the 19 years he analyzed, only 15 of the years were found to be normally distributed and all the 15 years occurred with the ratio of total debts to total assets. He found that using certain transformation techniques like square root and lognormal transformation, some normality can be achieved in certain cases though his study gave no guidelines on which transformation technique is most suitable. His analysis was carried out on only companies in the manufacturing sector for a period of 19 years. He concluded that even though it may be questionable to rely on models based on financial ratios where distributional properties may be suspect, it is still better with such estimates than no estimates at all. The important thing is whether the estimates or the models used is useful for decision making rather than the estimates and models are not conforming to certain statistical assumptions.

The Reference's [7] study extended the study by Reference [4] by further examining the effects of outliers on the distributional patterns of selected financial ratios. Their study covers a period of 30 years on manufacturing companies using the same eleven ratios. They highlighted the prevalence of the appearance of outliers in ratio distributions and to improve on the ratio distribution normality, they removed the outliers in their study. They contend that ratios can be assumed to have a gamma distribution and by using a square root transformation on a gamma distribution, an approximately normal distribution can be obtained. Reference [8] also pointed out this same problem about the numerous occurrences of outliers in the distributional properties of ratios. There is only one study on the distributional properties of financial ratios, in Malaysia focusing on the normality of financial ratios [21]. They found that outlier trimming improves the normality of variables and after data transformation; the technique is more effective on specific industry compare to a mixed industry grouping. They also found that among the three transformation techniques they used, namely natural log, square root and square, the natural log outperforms the other two

techniques and that the square transformation was the least effective.

III. METHODOLOGY

A. Sample Size

In this study, financial statements from the annual reports of companies from the Trading and Services sector as listed in the Bursa Saham Malaysia (Malaysian Stock Exchange) are used in this study. The companies would be randomly selected and analyzed over a period of five years from 2006 to 2010.

B. Selection of Variables

Twenty eight ratios are initially selected and classified into five groups. The ratios are chosen because they are commonly used in company financial performance forecasts [11], [16], [20]. The ratios are selected to ensure that all the financial characteristics of the companies are not excluded. The ratios are grouped under five main categories to illustrate and represent the companies' short-term liquidity and cash positions, profitability performance, solvency and leverage status and the efficient utilization of the company's assets. Table 1 below shows the groupings, the financial ratios and their codes used in the study.

TABLE 1: FINANCIAL RATIOS

Group 1: Short- term Liquidity		**Group 2: Profitability**	
Working Capital Ratio	WCR	Earnings B. Interest and Tax/Sales	EBITTS
Quick Ratio	QR	Earnings B. Interest and Tax/Total Assets	EBITTA
Interest Cover	IC	Net Profit Margin	NP
Working Capital/Sales	WCS	Net Income/Total Assets	NITA
Cash Flow/Sales	CFS	Net Income/Shareholders Fund	NISF
Cash Flow/Total Assets	CFTA	Net Income/Total Debts	NITD
Cash Flow/Total Debts	CFTD	Retained Profit/Total Assets	RPTA
Group 3: Cash Position		**Group 4: Solvency & Leverage**	
Cash/Sales	CS	Total Debts/Total Assets	TDTA
Cash/Total Assets	CTA	Long Term Debt/Shareholders Fund	LTDSF
Cash/Current Liabilities	CCL	Total Debts/Shareholders Fun	TDSF
Cash/Total Debts	CTD	Long Term Debt/Total Assets	LTDTA
Group 5: Operating Asset Efficiency			
Debtors Turnover	DT	Inventory Average Days	ID
Debtors Collection Days	DD	Total Assets Turnover	TAT
Inventory Turnover	IT	Current Assets Turnover	CAT

C. Analysis Techniques

C1. Factor Analysis and Principal Component Analysis

Principal component analysis reduces the dimensionality of a data set where there are a large number of interrelated variables, and at the same time retaining as much as possible of

the variation present in a set of data [12]. The reduction will result in a new set of variables called the principal components which are not correlated and where the first few components retain most of the variation that was present in all the original variables.

In principal component analysis, it is assumed that the random vector $Y = \begin{bmatrix} Y_1 \\ \vdots \\ Y_p \end{bmatrix}$ has the covariance matrix $\sum$ and that the mean vector is 0. The variance of l^tY is E(l^tYY^{t}l) = l^t Σl.

The i'th Principal Component, usually denoted by PC_i, can be defined inductively. The first principal component PC_1 is the linear combination where $l_1^t Y$ where l_1 is the vector which maximizes Var ($l_1^t Y$) subject to $l_1^t l_1$ = 1.

The second component PC_2 is the linear combination $l_2^t Y$ where l_2 maximizes Var($l_2^t Y$) subject to $l_2^t l_2$ = 1 and $Cov(l_1^t Y, l_2^t)$ = 0. Similarly, the *i*'th principal component $PC_1 = l_i^t Y$ where l_i maximizes $Var(l_i^t Y)$ subject to $l_i^t l_i$= 1 and $Cov(l_k^t Y. (l_i^t Y)$ = 0 for k < i.

Thus, the first principal component has the largest variance among all standardized linear combinations of Y. Similarly, the second principal component has the largest variance among all standardized linear combinations of Y uncorrelated with the first principal component, and so on.

The objective of using this technique is to obtain the minimum number of factors to explain a maximum proportion of the variance found in the original variables. Principal component analysis (PCA) will be applied to the 28 ratios to reduce the number of interrelated variables and to obtain only the more significant variables which are uncorrelated for further analysis. Only factors with an eigenvalue of more than 1 will be considered as significant and will be extracted. The value of 1 will decide how many factors to extract. A more conservative criterion can be set by requiring a higher eigenvalue. Tests of appropriateness will be undertaken with the test of sphericity as well as tests to measure of sampling adequacy (MSA) will be utilized. The measure of sampling adequacy is measured by the Kaiser-Meyer-Olkin (KMO) statistic. A minimum requirement of 0.5 is necessary for the adequacy of the sampling adequacy. The communalities show the proportion of the variance in the original variables that is accounted for by the factor solution. The factor solution should explain at least half of each original variable's variance, so the communality value for each variable should be 0.50 or higher.

C2. Tests of Distributional Properties

The distributional properties of the representative financial ratios as selected after factor analysis will first be assessed for normality. An initial examination of the skewness and kurtosis as well as a visual check of the histogram of a financial ratio will give an indication of whether that ratio examined is normally distributed. If it is not, then steps must be taken to reduce any extreme non-normality to an acceptable level before the data can be used for further univariate or multivariate analyses. To ensure a skewness of zero or close to zero is not possible as doing so may actually change the nature of the relationship among the

variables. In this study, each ratio is examined as to skewness, kurtosis and using the Box plot to identify the outliers. The values of the outliers are transformed to the next highest or lowest non-outlier value after which the new set of values is anlaysed again to check for normality. This process is repeated several times until all outliers as displayed in the Box plot is removed or up to a maximum of 30% of the total cases are transformed, whichever comes first. There are three popular techniques to test for normality namely, the Kolgomorov-Smirnov (K-S) test or the Lilliefor test which is an adaptation of the K-S test, the chi-square goodness-of-fit test and the Shapiro-Wilk test. As the sample size is small, the Shapiro-Wilk test will be used. After the test, the results are examined for any extreme skewness of kurtosis. To improve the normality and improve on the homoscedasticity of the distribution of the ratios, transformation will be applied and outliers will be removed. The values of the variables are transformed to the next nearest value. After the transformations, the Shapiro-Wilk test will be applied to see whether there are any more improvements in the distributional properties. This process is repeated several times until all extreme outliers are removed.

D. Findings and Discussions

D1. Results of factor analysis

Using factor analysis technique from the SPSS, with Principal Component Analysis as the extraction method and Varimax as the rotation method, the initial 28 ratios are then factor analysed. The sample consists of 40 companies over a period of 5 years giving a total of 200 cases. Seven ratios were selected and the Table 2 below shows the selected ratios, the categories they belong to and their factor loadings:

TABLE 2: SELECTED RATIOS AFTER FACTOR ANALYSIS

Factor	Ratio	Code	Factor Loading	Category
1	Cash to Current Liabilities	CCL	0.934	Cash Position
2	Earnings B Int. & Tax /Total Assets	EBITTA	0.887	Profitability
3	Current Asset Turnover	CAT	0.866	Asset Efficiency
4	Cash Flow to Sales	CFS	0.905	Short-term Liquidity
5	Total Debts to Total Assets	TDTA	0.904	Solvency and Leverage
6	Total Debts to Shareholders' Funds	TDSF	-0.880	Solvency and Leverage
7	Long Term Debts to Total Assets	LTDTA	0.913	Solvency and Leverage

The Kaiser-Meyer-Olkin measure of sampling adequacy is 0.630 which is acceptable. A value greater than 0.5 is considered the minimum value for Factor Analysis to proceed. The Bartlett's Test of Sphericity is significant with a p-value of 0.00. A significant p-value is necessary as it would mean that the correlation matrix is not an identity matrix. The first variable, CCL has an eigenvalue of 7.119 while the last variable, LTDTA has an eigenvalue of 1.661. The cut-off eigenvalue is set at 1.000 and above. Table 3 below showed the data for the communalities. The communalities showed how much of the variance in the ratios are explained by the extracted factors. For instance over 92.9% of the variance in CCL is

explained and accounted for while 90.1% of the variance in EBITTA is explained and accounted for.

TABLE 3: COMMUNALITIES BEFORE AND AFTER EXTRACTION

Ratios	**CCL**	**EBITTA**	**CAT**	**CFS**	**TDTA**	**TDSF**	**LTDTA**
Initial	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Extraction	0.929	0.901	0.792	0.876	0.913	0.870	0.915

The results from the factor analysis showed that out of an initial 28 popularly and commonly used ratios used in company performance evaluations, only seven ratios are found to be significant in this study of 40 companies in the trading and services sector in Malaysia. Ratios that measure leverage and solvency are found to be prominent in that three of the seven ratios selected after factor analysis are from this category with one ratio each that measures cash position, short-term liquidity, asset efficiency and profitability.

Table 4 below shows the detailed results of the factor analysis for all the 28 ratios and their factor loadings:

TABLE 4: ROTATED COMPONENT MATRIX

	Factors						
	1	2	3	4	5	6	7
CR	.872	.146	.092	.121	-.169	.127	-.149
QR	.894	.179	.038	.088	-.112	.083	-.128
WCS	.559	-.066	-.427	-.233	-.067	.318	.074
CFS	-.169	-.106	.058	**.905**	-.033	.018	.111
CFTA	.089	-.005	.062	.657	.682	.024	.113
CFTD	.083	-.097	.093	.882	-.038	.042	-.043
IC	.291	.525	-.097	.355	-.126	-.084	-.244
CS	.550	.191	-.293	-.620	.076	.026	.194
CTA	.772	.174	-.003	-.109	.341	.029	-.077
CCL	**.934**	.186	.087	-.052	-.073	.012	-.074
CTD	.890	.161	.103	-.106	-.033	-.009	-.178
EBITS	.179	.809	.181	-.274	.071	.129	.171
EBBITA	.107	**.887**	-.107	.049	-.203	.201	-.081
NI	.175	.797	.195	-.309	.071	.133	.171
NITA	.092	.886	-.126	.010	-.221	.210	-.070
NISF	.017	.379	-.035	.031	-.026	.859	.049
NITD	.329	.774	-.178	-.072	-.108	-.012	-.152
RPTA	.024	.252	-.033	.357	-.773	.053	-.115
TDSF	-.159	-.165	-.081	-.060	.167	**-.880**	-.071
TDTA	-.190	-.112	-.147	.053	**.904**	-.150	-.024
LTDSF	-.212	-.061	-.185	-.034	-.036	-.097	.887
LTDTA	-.182	-.009	-.184	.045	.093	.055	**.913**
DT	.204	-.188	.811	.038	-.046	.070	-.076
DD	.002	-.273	-.735	-.179	.109	.062	.043
IT	-.079	.023	.191	.034	-.093	-.603	.414
ID	-.027	-.287	-.345	-.009	-.214	.224	.235
TAT	.079	-.130	.616	.089	.619	.118	-.206
CAT	-.057	-.151	**.866**	-.009	.027	-.067	-.100

D2. Results of analysis on the Distributional Properties of the Financial Ratios

Table 5 below display the descriptive statistics of 40 companies over a period of five years for the mean, the standard deviation, skewness and kurtosis for all the financial ratios obtained through factor analysis before any attempts to remove outliers or transformation of any values. Examining the boxplot for each of the seven ratios, it was found that many have extreme outliers and most of the outliers are found above the median line. All the seven ratios except EBITTA have skewness of above 1.00. All seven ratios have high kurtosis readings except LTDTA. All seven ratios in this sector have been examined and actions taken to reduce as much as possible the non-normality by transforming the outlier values to the next highest or lowest non-outlier values.

TABLE 5: DESCRIPTIVE STATISTICS FOR TRADING AND SERVICES BEFORE NORMALISATION

	N	Mean	S D.	Skewness	Kurtosis
CCL	200	0.645	0.772	2.290	6.260
EBITTA	200	0.035	0.112	-0.963	11.671
CAT	200	1.749	1.359	3.043	14.189
CFS	200	0.044	0.300	-0.909	121.889
TDTA	200	0.338	0.412	10.297	129.121
TDSF	200	0.990	2.470	10.137	122.648
LTDTA	200	0.122	0.128	1.268	0.842

Table 6 below showed the descriptive after removal and transformation of outliers. All the seven ratios have been skewness and kurtosis reduced to below 1.000 with EBITA achieving normality at -0.016.

TABLE 6: DESCRIPTIVE STATISTICS FOR TRADING AND SERVICES AFTER NORMALISATION

	N	Mean	S D.	Skewness	Kurtosis
CCL	200	0.536	0.481	0.900	-0.544
EBITTA	200	0.043	0.067	-0.016	-0.228
CAT	200	1.589	0.851	0.582	-0.652
CFS	200	0.071	0.101	0.421	-0.023
TDTA	200	0.308	0.169	0.801	-0.165
TDSF	200	0.647	0.496	0.981	-0.218
LTDTA	200	0.114	0.109	0.881	-0.400

Table 7 below shows the normality tests before attempts at normalization. The K-S test results confirm the observations of the skewness and kurtosis in that all the ratios do not follow a normal distribution.

TABLE 7: TESTS OF NORMALITY OF TRADING AND SERVICES BEFORE NORMALISATION

	Kolmogorov-Smirnov		Shapiro-Wilk	
	Statistic	Significance	Statistic	Significance
CCL	.204	.000	.738	.000
EBITTA	.146	.000	.826	.000
CAT	.164	.000	.743	.000
CFS	.268	.000	.373	.000
TDTA	.259	.000	.356	.000
TDSF	.356	.000	.273	.000
LTDTA	.169	.000	.844	.000

Table 8 below shows the tests of normality after the removal and transformation of the values of outliers. Only one ratio, EBITTA achieve a K-S test value of 0.200 which indicates normality and a slight improvement for CFS which gave a post transformation significant value of 0.003 from 0.000 before transformation. As the sample size is 40, the Shapiro-Wilk test is also evaluated and it shows that EBITTA has also become normal after transformation with a significant value of 0.311 from the original value of 0.000 before transformation while CFS with the Shapiro-Wilks test results showing an improvement from 0.000 to 0.006 after transformation. The rest of the ratios are still not normally distributed even after outliers removal and transformation.

TABLE 8: TESTS OF NORMALITY OF TRADING AND SERVICES AFTER NORMALISATION

	Kolmogorov-Smirnov		Shapiro-Wilk	
	Statistic	Significance	Statistic	Significance
CCL	.152	.000	.848	.000
EBITTA	.044	.200	.992	.311
CAT	.105	.000	.938	.000
CFS	.081	.003	.980	.006
TDTA	.122	.000	.928	.000
TDSF	.175	.000	.862	.000
LTDTA	.148	.000	.865	.000

From the different analyses and findings above, it is evident from this study that financial ratios are, firstly, almost all do not conform to the normal distribution assumption and secondly most of them will remain not normal even after efforts to normalize them through the removal of outliers and the transformation of their values. EBITTA has normalised from 0.000 to 0.200 while CFS has improved slightly from 0.000 to 0.003. Most past studies have found that financial ratios are positively skewed and only slight improvement in the normality situation after various techniques to normalise have been carried out. Therefore, the distributional pattern of the most financial ratios is not normally distributed. The conclusion from this study is that some ratios can become a normal distribution or may approximate to a normal distribution with removal and transformation of outliers. This is in line with the results from some past studies [4], [13], [18], [21].

IV. CONCLUSION

The purposes of this study are to identify the financial ratios that are significant and specific to different industry sectors and to test whether the distributional properties of financial ratios are normal. Factor analysis is applied on 28 selected financial ratios from 40 companies in the in the trading and services sector. Out of the original 28 ratios, a total of seven different ratios were selected as represented of all initial ratios used. It is found that ratios that measure solvency and leverage are significant with three ratios selected namely, Total Debts to Total Assets, Total Debts to Shareholders' Funds and Long-Term Debts to Total Assets. The results showed that it is not necessary to have many ratios to evaluate financial performance and that a representative set of seven ratios is sufficient. It is further found that some ratios are more significant in two or more of the sectors and that at least one ratio that measure profitability, short-term liquidity, cash position, leverage and efficiency are selected in the representative set of ratios after factor analysis. It is also found that sampling adequacy is acceptable and that the correlation matrix is not an identity matrix.

To check whether ratios as selected after factor analysis are normally distributed, removal of outliers and transformation of values is performed. It is evident from this study that the financial ratios tested are firstly, almost all do not conform to the normal distribution assumption, secondly most of the ratios are positively skewed and finally, most of them remained not normal even after efforts to normalize them. However, after efforts to remove the outliers and the transformation of their values, only Earnings Before Interest and Tax to Total Assets (EBITTA) was normalized with a slight improvement in normality for Cash Flow to Sales (CFS).

Identification of key financial ratios for each industry sector would be a contribution to investors and corporate analysts of company financial performance. This study will contribute to a further understanding of the distributional properties and normality of financial ratios especially with regards to an emerging economy like Malaysia where the economic, market and operating conditions are different from the developed economies in Western countries where many such studies have been carried out in the past. This study will definitely add to a better appreciation and understanding of the nature and characteristics of financial ratios in the Malaysian context and perhaps in the Asian environment as there are very limited studies and researches done in Malaysia and its surrounding countries.

Future research could expand the number of companies in the analysis as only about 23% of the total number of companies listed in the trading and services sector are used. Study of companies in the other sectors may show material differences in the choice of financial ratios that are useful compared to this study as companies in the other sectors have different capital structures, trading policies and processes as well as governed by different government and statutory regulations. Studies that compared the analysis of companies in other neighboring countries may be useful as globalization and the intra-regional trade and commerce have gained great importance in the economic well-being of the regional countries. It is recommended that future research should lengthen the sample period as the present study covers a period just before the onset of the economic crisis that started in the United States in 2008 and many companies may have been more severely affected and may not have recovered by 2010 where their financials are not normal. However, it must be borne in mind that the

larger time span the companies are covered, there is the possibility that the findings may still not be entirely reliable as the economic and market conditions at one end of the time span may be significantly different from the conditions at the other end of the time period.

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