THE NORMALITY OF FINANCIAL RATIOS DISTRIBUTION: AN EMPIRICAL EVIDENCE OF MALAYSIAN FIRMS

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ABSTRACT

Many prior researches regarding financial ratios have shown that financial ratio distributions are not normal. Several researches suggest that one of the reasons why the distribution is not normal is because of the presence of outliers. Some suggest that the data should be transformed to square root or natural log if it is found that the distribution is not normal. Knowledge about the distribution of financial ratios is important especially in financial analysis. It can also help us to determine the function of financial ratios. In this research, the distribution of financial ratios from all listed companies in manufacturing and financial services industries between 1990-1995 is studied. The result shows that all ratios in manufacturing industry are not normally distributed, but after removing the outliers and being transformed, the distribution is close to normal. As for the financial industry, there are some ratios that are normally distributed. However, some ratios are still not normal although the ratios are transformed and outliers are removed. These findings indicate that using industrial average as a benchmark and parametric test is not an appropriate approach when carrying out an analysis connected with financial ratios.

INTRODUCTON

Financial ratio analysis is normally done to evaluate the financial performance of a company. There are two approaches of financial analysis. One is time series analysis, which involves the search for identifiable trends in past performance with a view to predict future performance. The other approach is cross-sectional analysis, which involves the comparison of results of a specific company against some 'benchmark' (usually the industry average).

Knowledge of the statistical distribution of financial ratios is important when undertaking cross-sectional analysis for a number of reasons. Primarily, if one knows the mean and standard deviation of a particular distribution, and that distribution approximates normality, then one can

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determine the relative position of a specific company ratio within the industry. In addition, knowled of the existence of extreme values in a distribution allows one to determine their impact upon the me of a ratio. For example if a certain ratio is characterised by a number of outliers, either positive negative, then a comparison of a company's ratio against some industry mean might be potential misleading since this benchmark might have suffered some distortion. In such a situation, it wou seem inappropriate to use the mean value as a benchmark for comparative purposes. In addition, using non-parametric approach, Konings and Roodhooft (1997) showed that financial ratios did n converge towards the industry average.

According to Kolari, Mc Inish and Saniga (1989) the financial ratios distribution characteristics m have important implications for the interpretation of financial ratios. For example, if a particular value a financial ratio falls in the 99th percentile, and if the distribution is normal, this particular firm is outlier on the high end. If the distribution is U-shaped, the particular ratio may simply be a number the group having relatively high values. They further note that information concerning th distributional characteristics of financial ratios also has implications for the monitoring of bank financial condition by regulatory agencies.

The distributional characteristics of ratios could also help to refine the rating process. Norm distributions are easily divided into five part (plus or minus) one or two standard deviations. Howeve a five point scoring system does not seem the best way to evaluate a ratio that has a J-shaped or U-shaped distribution. Such distributions might be better suited to a three-point scale ratin Moreover, regulators might benefit from knowledge of the distributional forms in making inference For example, since regulators seek to identify specific troubled banks, information about type I erro (the probability of classifying a failing bank as nonfailing) is necessary. Information about type II erro (identifying nonfailing banks as failing) would be important in establishing appropriate changes an regulations for risk-base evaluation systems. Similar extensions to financial analysis of non-financi firms are also possible.

Martikainen et al. (1995) carried out an empirical analysis of 10 ratios on Finnish listed firms. The resu revealed that a large part of the time-series instability *(The distribution form and parameters of financial ratio remain stable through the various years)* of financial ratios pattern is caused by th irregularities in financial ratio distribution. They also mentioned that if the distribution irregularities a not paid due attention, the interpretation of the underlying financial factors of firms may be affecte

According to So (1987) the finding of non-normality distribution of financial ratios is important to both practitioners and researchers. From the investors' point of view, the specification of the distribution of financial ratios is very useful in assessing the uncertainty of their forecast. In fact, the usefulness of financial ratios in predicting bankruptcy and bond rating is determined by the underlying probability model that best describes the behaviour of financial ratios. For example, a credit manager who uses financial ratio analysis (and assumes normal distribution of these ratios) to determine the credit line of his customers may reach a decision that is greatly different from the one that assumes non-normal and skewed distribution. The finding on the probability distribution of financial ratios will also influence theoretical modeling. Some findings might rule out the use of some empirical methodologies, i.e., the ordinary least square (O.L.S) and discriminant analysis, which are commonly used for predicting bankruptcy and rating bonds. So (1994) also suggested that the non-normal stable Paretian distribution which has a fatter tail compared to the normal distribution is a good candidate to describe the financial ratio distribution compared to lognormal and mixture distribution. He also reported that the empirical evidence does not support the lognormal and gamma distributions. The fatter tails of the non-normal stable Paretian indicates that greater probability of observation occur in the tail of the distribution.

Lau et al. (1995) tried to model some ratio distributions with finite moment Pearson (1985) and Ramberg-Schmeiser (1974) systems distribution and to model some others with the stable Paretian distribution. The study showed that the different yearly distributions of a given ratio could often be reasonably modelled by a single parent population, in spite of the apparent great fluctuations in the standard deviations, skewness and kurtosis among these distributions.

Foster (1970) mentioned that the treatment of outliers is an important, yet little discussed problem in ratio analysis. While systematic techniques such as trimming, 'winsorization' (changing the outlier's value to that of the closest non-outlier) and various forms of transformation have been suggested, most techniques are somewhat ad-hoc. The general tendency of most researchers is to ignore the presence of outliers and their possible effects.

Deakin (1976) claimed that if the empirical distributions of financial accounting ratios were known then a distribution function could be found for a linear combination of ratios that could be used in a classification model. In his study he found that ten of eleven ratios analysed for manufacturing firms, were not normally distributed and standard transformation techniques also did not result in improving the normality of the distribution. Frecka and Hopwood (1983) extended the study made by Deakin (1976) and they claim that the presence of outliers has tremendous influence on the parameter estimates for the distributions. After removing outliers, normality or approximate normality was achieved for mos of the distributions. They argued that (i) the ratios can be assumed to be gamma distributed, sinc applying a square root transformation to the gamma distributions gives an approximately norma distribution, (ii) the procedures suggested by Barrett and Lewis (1978) can be used to remove outlie until the distribution becomes normal. Watson (1990) considered the joint distribution of several ratio and attempted to improve their multivariate normality by removing multivariate outliers from th empirical distribution.

Bougen and Drury (1980) conducted a study of 700 manufacturing firms for the year 1975 in U.K an they found that most of the ratios were not normally distributed as a result of the existence of extrem values. Cochran (1963) suggests that removal of extreme values from the population may reduce th skewness and improve the normal approximation.

PURPOSE OF THE STUDY

Three competitive distributions are offered by the literature to explain the non-normality and the skewnes of the cross-sectional distribution of financial ratios: (i) mixture of normal distribution (ii) the lognorma distribution (iii) the gamma distribution. This study is conducted to examine the existence of non-normality of financial ratio distributions in companies in the financial services and manufacturin industry, listed on the Main Board of KLSE. In addition, the appropriateness of several transformatio techniques that were recommended by prior researchers will be tested. Hence, the following nul hypothesis will be tested:

H_{01} : The cross-sectional distribution of non-transformed financial ratios in each industry is normal.

H_{02}: The cross-sectional distribution of transformed financial ratios in each industry is normal

SAMPLE AND DATA

All firms taken as the study sample are listed on the Main Board of the KLSE. Financial data o companies in financial services and manufacturing industries from 1990 until 1995 are used. These tw industries are chosen due to the fact that they were experiencing a fast growth rate comparable to th high growth of the Malaysian economy. In addition, the number of companies in both industries ar large and this allows a sample that can represent the true population. The manufacturing industr comprises two sectors, namely the industrial products sector and the consumer products sector. Th two sectors are combined to obtain a larger sample size and because the nature of their operations ar similar. The study undertaken by Deakin (1976) combined several sectors within the manufacturin industry in his sample.

The financial services industry comprises the banking, finance, share broking and insurance sectors. The sample size in each year for both industries will vary according to the number of companies listed on KLSE. The ratios chosen are representative and can be said to cover the whole spectrum of a company's activities. More specifically, the ratios analysed are profitability ratios (ROE, ROA, Operating Margin), liquidity ratios (Cash ratio, Current Ratio), debt ratios (Debt to Equity Ratio), activity ratios (Total Assets Turnover).

NORMALITY TEST

Deakin (1976), Frecka and Hopwood (1983) used the chi-square test to test the normality of the distribution. The method is found to have some weaknesses as claimed by So (1987) especially when dealing with small samples. Ezzamel et al (1987) noted that a requirement of the chi-square test is that the expected frequencies in each category be not too small (less than 30), or the results may be meaningless. When the number of degrees of freedom exceeds one, Cochran (1954) argues that the test should not be used if more than 20% of the expected frequencies are smaller than five. Ezzamel et al (1987) also noted some disadvantages using χ^2 test. First, the number and character of class intervals used are arbitrary. Second, all information concerning sign and trend discrepancies is ignored and finally, for small samples, the number of cells tends to be very small.

In order to resolve the problems and disadvantages of χ^2 test, Kolmogorov-Smirnov with Lilliefors critical values, and Shapiro-Wilk test are used in this study. Both of these methods provide D and W test statistic respectively.

The Kolmogorov-Smirnov method is usually used by many researchers to test the normality of the distribution as shown by So (1987) and Othman (1990). The Kolmogorov-Smirnov test treats observations separately and thus information loss resulting from aggregation of categories is avoided. Moreover, the test is distribution free and is suited to small sample size. The Shapiro-Wilk test has been shown to be an effective test for normality even for samples of less than 20. According to Shapiro and Wilk (1968), the Shapiro-Wilk test was reported to be very sensitive to asymmetry, long-tailedness and outliers. They also claimed that the test seems to be the most powerful test to test the null hypothesis of normality. However, the tables are not available if n is greater than 50 (Royston, 1982). Consequently, the Kolmogorov-Smirnov test with Lilliefors critical values will be employed if the sample size exceed 50. Otherwise, the Shapiro-Wilk test will be conducted to test the normality. Bird and Mc Hugh (1987) used this method when they tried to examine the normality of financial ratios of companies, which are listed on the Sydney Stock Exchange.

TECHNIQUES OF TRANSFORMATION

If raw data does not exhibit normality then a systematic transformation technique will be undertaken. Even though Bujink and Jegers (1986) proposed several forms of transformation such as inversion, cube root, natural log and square root, nevertheless Kirk (1968) and Ezzamel et al. (1987) claimed that the most suitable form of transformation is either natural log or square root. In this study, either natural log or square root is used to transform the raw data. In addition, both methods are employed in order to preserve the comparability of results with previous evidence, which were obtained using these two techniques. The decision on which technique to be used first is arbitrary. The technique of removing the outliers is also used if the transformation technique fails to improve the degrees of normality. This is consistent with the study made by Frecka and Hopwood (1983) who found that one of the reasons for non-normality was due to the presence of outliers. Finally, the technique of transformation and removing the outliers are employed if the raw data fails to exhibit normality after undergoing the process of removing the outliers. The steps of transformation can be summarised as follows: (1) The square root or the log transformation is used if the raw data fails to exhibit normality (the choice is arbitrary); (2) Outliers will be removed if both techniques mentioned above fails to improve the normality of the distribution; (3) Square root or log transformation and removing the outliers will be employed if non-normality still exists after undergoing the process mentioned in step (2).

CHARACTERISTICS OF THE DISTRIBUTION

Arithmetic mean, coefficient of variation, kurtosis and skews were used to describe the characteristics of the distribution. In the SPSS procedure, values of skewness and kurtosis are zero if the observed distribution is exactly normal. Norusis (1995) mentioned that for samples from a normal distribution, measures of skewness and kurtosis will not be exactly zero but will fluctuate about zero because of the sampling variation.

Arithmetic mean measures the central tendency of a distribution. To measure the distribution's dispersion, coefficient of variation is used and will be calculated as follows

$$\frac{\sigma}{\bar{x}} * 100\%$$

Skewness measures the lopsidedness of the distribution and will be calculated according to the formula below

$$\frac{m_3}{\hat{\sigma}^3}$$

Where m_3 is the third moment

A positive value of skewness indicates that the distribution is skewed to the right. Kurtosis measures the peakedness of a distribution, and the formula for kurtosis is as follows: -

$$\frac{m_4}{\hat{\sigma}^4}$$

Where m_4 is the fourth moment.

Based on the SPSS procedure, the distribution is normal if the kurtosis value is zero. It is leptokurtic if the kurtosis is greater than zero, and platykurtic if the kurtosis is less than zero.

FINDINGS

Table 1 to table 7 contains a summary result of the statistical characteristics of the ratios being studied across time. Table 1 presents the result of ROE distribution characteristics. Except for companies in the financial services industry in the years 1990 and 1992 in general most of the raw data exhibited non-normality. Kurtosis showed an overwhelming value particularly for companies in the manufacturing industry in the years 1992 (34.68) and 1994 (46.74). These high values indicate that in 1992 and 1994, for all listed companies in the manufacturing industry the ROE ratio concentrated around the mean value.

Table 1
Distribution Characteristics for Return On Equity (%)

	1990		1991		1992		1993		1994		1995	
	Manu	Financial	Manu	Financial	Manu	Financial	Manu	Financial	Manu	Financial	Manu	Financial
Mean	1.365	4.204	16.341	8.204	15.788	9.195	13.278	10.933	14.038	12.961	14.750	12.987
Skewness	2.014	1.486	1.558	0.855	5.147	0.232	1.390	-0.185	2.660	0.247	5.900	0.631
Kurtosis	7.159	1.216	4.402	1.062	37.368	0.050	3.431	-0.995	12.376	-0.314	46.740	-0.330
Std Dev	11.423	4.673	10.186	4.947	13.579	4.411	8.330	5.303	10.593	6.097	14.590	6.838
C.V(%)	8.368	0.656	0.620	0.603	0.860	0.480	0.627	0.485	1.325	0.470	0.989	0.527
Transformation	Square	none	Square	**	Square*	none	Square	**	Square	**	***	Square
n	70	23	66	32	65	35	103	39	111	39	111	41
D-Stat¹	0.142		0.129		0.106		0.18		0.145		0.202	
W-Stat¹	-	0.952		0.943		0.983		0.955		0.977		0.948
Prob<W/D¹	0.001	<0.01	0.008	0.132	0.000	0.871	0.000	0.219	0.000	0.861	0.000	0.040

square – square root
ln – lognormal
ln* – lognormal and removal of outliers
square* – square root and removal of outliers

C.V(%) – Coefficient of variation
manu – manufacturing
1 – D-Stat, W-Stat and Prob < W/D are values referring to the raw data

Std Dev – Standard Deviations
** – No transformation is needed (the raw data is already normally distributed)
none – The normality of the distribution cannot be improved.
*** – Removal of outliers only

The ROA distribution characteristics for both industries are shown in Table 2. The results show tha the distributions for both industries across time were not normally distributed. In addition, all of the distributions in each year were positively skewed. Negative kurtosis value was found in the year 1990 (financial services industry, -0.85) and 1991 (manufacturing industry, -0.176). The negative values show that distribution peakedness was less than in normal distribution and the values were more spread from the mean.

However, after undergoing the process of transformation and removal of outliers, all of the distributions for both industries across time were close to normal distribution.

Table 2
Distribution Characteristics for Return On Asset (%)

	1990		1991		1992		1993		1994		1995	
	Manu	Financial	Manu	Financial	Manu	Financial	Manu	Financial	Manu	Financial	Manu	Financia
Mean	10.859	7.697	12.881	3.334	11.315	3.779	9.920	9.025	10.613	4.693	10.280	4.356
Skewness	0.735	0.362	0.703	1.422	0.792	1.418	1.121	1.878	1.880	1.854	1.880	1.813
Kurtosis	0.014	-0.852	-0.176	1.272	0.511	1.401	1.579	3.714	6.504	3.198	5.460	2.905
Std Dev	6.369	5.053	7.066	3.401	0.936	3.517	6.020	3.711	7.510	4.899	7.370	4.101
C.V (%)	0.583	1.112	0.549	1.02	0.083	0.931	0.607	0.922	0.708	1.044	0.717	0.941
Transformation	square	**	**	ln	square	ln	square	ln	ln	ln	ln*	ln*
n	69	23	66	24	104	36	108	39	112	40	111	41
D-Stat[1]	0.113		0.106		0.093		0.102		0.107		0.148	
W-Stat[1]	.	0.01		0.812		0.819		0.771		0.757		0.754
Prob < W/D[1]	0.029	0.383	0.07	< 0.01	0.027	< 0.01	0.008	< 0.01	0.030	< 0.01	0.000	< 0.01

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none – The normality of the distribution cannot be improved.
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C.V (%) – Coefficient of variation
manu – manufacturing
1 – D-Stat, W-Stat and Prob < W/D are values referring to the raw data

Table 3 contains the results of the distribution characteristics of operating margin. It is observed that except for companies in the financial services industry (-0.053) in the year 1990, all of the distributions were positively skewed. This phenomenon is probably due to the existence of the negative extreme values. As for the peakedness of the distribution measured by the kurtosis, the values fluctuate across time. The values for companies in the manufacturing industry were high in 1990 (40.00) and low in 1995, while for companies in the financial services industry, a negative kurtosis was reported in 1990 (-1.143). Variations of values of kurtosis indicate that in each year, the values of operating margin are not homogeneous among companies.

Table 3
Distribution Characteristics for Operating Margin (%)

	1990		1991		1992		1993		1994		1995	
	Manu	Financial	Manu	Financial	Manu	Financial	Manu	Financial	Manu	Financial	Manu	Financial
Mean	35.411	11.365	14.387	14.278	12.862	15.750	12.964	21.441	12.759	24.589	12.270	24.622
Skewness	6.282	-0.053	2.204	4.174	1.437	4.635	3.348	4.713	1.502	5.136	8.349	2.67
Kurtosis	40	-1.143	6.327	20.813	2.220	24.818	17.75	25.114	2.507	29.14	2.050	8.874
Std Dev	471	6.095	10.982	15.464	9.212	16.856	10.617	16.517	9.085	28.903	1.300	16.591
C.V%	4.042	0.536	0.763	1.083	0.716	1.07	0.819	1.237	0.712	1.175	0.106	0.674
Transformation	ln*	**	square	***	square	ln	ln	ln*	ln	ln*	ln*	square
n	70	22	65	33	104	35	107	38	111	39	110	40
D-Stat¹	0.495		0.167		0.13		0.177		0.143		0.138	
W-Stat¹		0.951		0.568		0.519		0.447		0.457		0.904
Prob<W/D¹	0.000	0.391	0.000	<0.01	0.000	<0.01	0.000	<0.01	0.000	<0.01	0.000	<0.01

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square* — square root and removal of outliers
*** — Removal of outliers only

Std Dev — Standard Deviations
C.V(%) — Coefficient of variation
manu — manufacturing
1 — D-Stat, W-Stat and Prob < W/D are values referring to the raw data

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none – The normality of the distribution cannot be improved.

The results for debt to equity for both industries across time are shown in Table 4. As reported in the table, the P-value for W and D test statistics indicate that the null hypothesis of normality is rejected in all the distributions across years. However, the distributions' normality was improved after undergoing the process of transformation. The distributions for both industries across years are positively skewed but an overwhelming kurtosis value can be observed for the manufacturing industry in 1990 (27.369) and 1991 (37.75). These overwhelming values indicate that the data is concentrated more towards the mean value. In other words, the debt to equity ratios for all companies across time is homogeneous.

Table 4
Distribution Characteristics for Debt to Equity

	1990		1991		1992		1993		1994		1995	
	Manu	Financial	Manu	Financial	Manu	Financial	Manu	Financial	Manu	Financial	Manu	Financial
Mean	0.633	0.456	0.584	0.584	0.530	0.75	0.73	0.613	0.566	0.637	0.790	[illegible]
Skewness	4.641	1.521	5.689	2.362	1.170	2.797	6.601	1.894	1.662	1.741	2.210	[illegible]
Kurtosis	27.369	1.444	37.753	5.753	3.270	8.712	51.712	4.140	2.978	3.115	5.750	[illegible]
Std Dev	1.155	0.546	1.184	0.832	0.580	1.066	1.519	0.699	0.606	0.726	0.940	[illegible]
C.V (%)	1.825	1.197	2.027	1.425	1.094	1.421	2.081	1.14	1.372	1.14	1.117	[illegible]
Transformation	ln	ln	ln*	ln	square	ln	square*	ln	ln*	ln	ln*	ln
n	67	21	61	27	95	29	99	30	105	31	103	32
D-Stat[1]	0.242		0.311		0.18		0.315		0.175		0.199	
W-Stat[1]	.	0.773		0.717		0.66		0.794		0.799		[illegible]
Prob < W/D[1]	0.000	<0.01	0.000	<0.01	0.000	<0.01	0.000	<0.01	0.000	<0.01	0.000	[illegible]

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Std Dev – Standard Deviations
C.V (%) – Coefficient of variation
manu – manufacturing
1 – D-Stat, W-Stat and Prob < W/D are values referring to the raw data

Current ratio distribution characteristics are shown in Table 5. The distributions for both industries were skewed to the right and it is also observed that the manufacturing companies' distributions are more skewed compared to the distributions of companies in the financial services industry. Positive extreme kurtosis values were seen mostly for distributions in the manufacturing industry, with the highest value in 1995 (97.550). This high value indicates that the distribution departs from the normal distribution in which the kurtosis should be 0. This phenomenon also shows that the current ratio in 1995 for manufacturing companies is distributed near to the mean value. Except for the distributions in the financial services industry in 1992, all the distributions were close to normal after being transformed and outliers removed.

Table 5
Distribution Characteristics for Current Ratio

	1990		1991		1992		1993		1994		1995	
	Manu	Financial	Manu	Financial	Manu	Financial	Manu	Financial	Manu	Financial	Manu	Financial
Mean	1.726	1.613	1.522	1.158	1.811	1.253	1.783	1.472	1.869	1.883	1.910	1.219
Skewness	6.354	2.600	1.236	2.654	8.554	3.585	7.737	3.343	8.411	5.965	9.430	4.786
Kurtosis	48.62	7.546	1.959	9.227	82.567	14.093	72.078	12.868	78.872	36.696	97.550	24.626
Std Dev	1.645	1.579	0.738	0.745	2.502	1.295	1.992	1.710	25.650	4.812	3.070	1.659
C.V(%)	1.342	0.979	0.485	0.643	1.382	1.034	1.117	1.162	1.071	2.555	1.190	1.36
Transformation	ln*	ln	square	ln*	ln	none	ln*	none	square	ln*	square	ln*
n	77	21	76	27	110	29	114	30	102	31	122	41
D-Stat¹	0.246		0.133		0.275		0.249		0.277		0.319	
W-Stat¹	-	0.68		0.721		0.549		0.544		0.269		0.581
Prob<W/D¹	0.000	<0.01	0.004	<0.01	0.000	<0.01	0.000	<0.01	0.000	<0.01	0.000	<0.01

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ln — Lognormal
ln* — Lognormal and removal of outliers
square* — square root and removal of outliers
*** — Removal of outliers only

Std Dev — Standard Deviations
C.V(%) — Coefficient of variation
manu — manufacturing
1 — D-Stat, W-Stat and Prob < W/D are values referring to the raw data

** = No transformation is needed (the raw data is already normally distributed)
none = The normality of the distribution cannot be improved.

Overwhelming values of kurtosis were also shown for cash ratio distribution especially for the manufacturing industry across the years (Table 6). The highest value of kurtosis is in 1995 for the manufacturing industry (113.50). The raw data distribution was not normally distributed but after being transformed, the distribution is close to normal. The interesting part is that all the distributions achieved normality by transforming the data to natural log. It can also be observed that all the distributions are positively skewed.

Table 6
Distribution Characteristics for Cash Ratio

	1990		1991		1992		1993		1994		1995	
	Manu	Financial	Manu	Financial	Manu	Financial	Manu	Financial	Manu	Financial	Manu	Financial
Mean	0.476	0.342	0.331	0.307	1.326	0.393	0.534	0.660	0.613	1.045	0.660	0.346
Skewness	7.126	1.757	3.196	3.831	9.370	4.774	9.349	4.169	9.966	6.086	10.490	4.271
Kurtosis	56.664	4.232	12.066	17.829	91.732	25.097	94.495	18.286	105.303	37.881	113.500	19.670
Std Dev	1.246	0.329	0.555	0.403	7.859	0.799	1.850	1.428	2.328	4.090	3.020	0.613
C.V (%)	2.618	0.962	1.677	1.313	2.927	2.038	3.464	2.164	3.798	3.914	4.576	1.772
Transformation	ln	ln	ln	ln	ln	ln	ln	ln	ln	ln*	ln	ln
n	77	24	70	34	108	37	114	40	121	40	122	40
D-Stat[1]	0.351		0.275		0.433		0.386		0.396		0.414	
W-Stat[1]	.	0.843		0.606		0.431	.	0.43		0.24		0.588
Prob < W/D[1]	0.000	< 0.01	0.000	< 0.01	0.000	< 0.01	0.000	< 0.01	0.000	< 0.01	0.000	< 0.01

square – square root
ln – Lognormal
ln* – Lognormal and removal of outliers
square* – square root and removal of outliers
*** – Removal of outliers only

** – No transformation is needed (the raw data is already normally distributed)
none – The normality of the distribution cannot be improved.

Std Dev – Standard Deviations
C.V (%) – Coefficient of variation
manu – manufacturing
1 – D-Stat, W-Stat and Prob < W/D are values referring to the raw data

Inspections of the asset turnover distribution characteristics are reported in Table 7. Some of the distributions still exhibit non-normality although the data was transformed and outliers were removed. The distributions were also positively skewed and the kurtosis for the financial services industry is generally higher than in the manufacturing industry.

Table 7
Distribution Characteristics for Asset Turnover

	1990		1991		1992		1993		1994		1995	
	Manu	Financial	Manu	Financial	Manu	Financial	Manu	Financial	Manu	Financial	Manu	Financial
Mean	1.012	0.474	1.150	0.362	1.053	0.373	0.954	0.325	0.997	0.249	0.960	0.252
Skewness	0.553	3.944	2.410	3.597	1.464	2.400	1.606	2.603	1.824	1.502	1.590	1.796
Kurtosis	0.085	17.282	10.550	16.228	2.815	7.617	4.038	8.813	5.210	1.328	3.280	2.926
Std Dev	5.648	0.766	0.708	0.498	0.611	0.443	0.566	0.410	0.582	0.264	0.590	0.285
CV%	5.581	1.616	0.616	1.367	0.580	1.188	0.593	1.262	0.596	1.060	0.615	1.131
Transformation	**	***	ln	none	ln	none	ln	none	ln	none	ln	none
n	77	23	70	34	107	36	114	39	120	39	121	40
D-Stat*	0.093		0.144		0.135		0.147		0.147		0.137	
W-Stat*	.	0.502		0.6		0.718		0.668		0.722		0.657
Prob < W/D*	0.100	< 0.01	0.001	< 0.01	0.000	< 0.01	0.000	< 0.01	0.000	< 0.01	0.000	< 0.01

sqroot – square root
ln – lognormal
ln* – lognormal and removal of outliers
sqroot* – square root and removal of outliers
*** – Removal of outliers only

** – No transformation is needed (the raw data is already normally distributed)
none – The normality of the distribution cannot be improved.

Std Dev – Standard Deviations
CV% – Coefficient of variation
manu – manufacturing
* – D-Stat, W-Stat and Prob < W/D are values referring to the raw data

DISCUSSION

Based on the analysis of the financial ratios for the year 1990-1995 I have shown that the assumption c normality is not true for raw data other than for several ratios from the financial services industry. As fo manufacturing companies, all the financial ratios were not normally distributed.

High values of coefficient of variation supported the result of non-normality. According to Horriga (1965) wide dispersion in financial ratios distribution would make it difficult to obtain a distinctiv average ratio and therefore it is impossible to discriminate between companies on the basis of ratio Among the factors that are expected to increase the dispersion of financial ratios are industr classifications, size of firm, cyclical conditions, seasonal conditions, geographical location an accounting method. This factor will cause the sample to be non-homogeneous. Lee (1988) claimed th homogeneity of cross-sectional data is an important property in testing the normality of a distributio

The sample statistics also revealed the non-normality of the financial ratios distribution. The stud showed that all the financial ratios for manufacturing companies were skewed to the right (positiv skewness). The result is commensurate with the findings by Horrigan (1965). He mentioned that th positive skewness seems reasonable since most of these ratios have an effective lower limit of zero an indefinite upper limit.

It was noticed, however, that natural log and square root transformation give a better approximation t normality. Overall, transformed data exhibited lower skewness compared with raw data. However, som ratios after removal of outliers, show an increase in normality. Although most of the ratios exhibit distribution close to normal after being transformed and undergoing the techniques of removing th outliers, there are some ratios especially in financial services companies, which do not see a improvement in normality. This implies that the existence of extreme values is not the only factor o non-normality. So (1987) claimed that the non-homogeneous characteristics and the non-proportion behaviour make it difficult, if not impossible, to identify outliers. As a result, it explains why normali is not obtained using outlier's eliminating technique.

CONCLUSION

In conclusion, since most of the financial ratios analysed showed significant non-normality, financi analysis using ratios, such as industry average ratios as a 'benchmark' for performance evaluati must take into consideration the skewness and non-normality. Otherwise, conclusions may b misleading. This is due to the fact that the average value, which is usually an arithmetic mean, is no suitable measure of central tendency since it is influenced by extreme values. According to Levin and Rubin (1994), weighted average is the preferable measure to replace arithmetic mean when non-normality exists. They also mentioned that inability to reject the null hyphotesis indicate that parametric statistical test is not an advisable tool to analyse financial ratios. Non-parametric statistical test is a better approach since the test does not require the normality assumption. Among the suitable non-parametric test are Mann Whitney-U, Kruskall-Wallis, and Spearman Rank Correlation. However, the parametric test can be used if the distribution exhibits normality after the data is transformed and outliers are removed or both.

Although variation or differences occur between the industrial average and financial ratios of a particular company (if industrial average is the right measure to be a benchmark) this does not imply that the company is not financially stable. Variation may exist due to the difference in corporate objectives.

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