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The Normal Distribution of Financial Accounting Ratios as Indicators of Business Status

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ABSTRACT

The manner in which financial ratios are distributed overtime in business organizations is often regarded as very useful indicators of the growth, performance, and financial status of the business. However, this paper attempts to reinforce this claim by using the normal distribution statistical model to analyse the structure of financial ratios. It adopts the case study approach to provide an in-depth analysis of the normality of the financial ratios of Vitafoam Plc. The secondary data generated from the company's annual report and accounts were tested for normality using method of moment. It was found that financial ratios were normally distributed. On the basis of our study findings, we conclude, that financial ratios are reliable business status indicators. We therefore recommend the application of financial ratios in the evaluation of business performance, growth and financial status.

KEY WORDS: Financial Ratios, Normal Distribution, Business Status Indicators

INTRODUCTION

It does appear that financial ratios are widely acceptable indicators of business healthiness, the world over. Such ratios are considered as the most credible indices because they clearly show the relationship between activities and outcome with regard to finance, the latter being the blood that runs through the veins of the business. However, not much empirical explanation is available to support this view. This dearth of empirical facts may have possibly created doubts in the application and even in the explanation of business growth and performance trends using these ratios.

However, this paper provides a statistical normal distribution analysis of financial ratios structure as a way of providing verifiable facts on the subject matter. The focus of this paper on financial ratios is largely predicated on its usefulness as a trend and comparative analysis element. This is fundamentally so because of the widely held assumption that financial ratios are normally distributed. Therefore, our discussion embodies a review of the relevant financial ratios in relation to normal distribution and skewness, including related statistics.

LITERATURE REVIEW

Discussions on financial ratios are anchored on the following structural compartments: Profitability, liquidity, debt and activity. Considering the validity of these indices, there appears to be a logical agreement, Turk (2006); Agundu(2005); Anthony and Govindarajain(1995); Pandey(2000); and O'Connor(1973) that financial ratios are very useful indicators for understanding a business' wellbeing. Profitability ratios are derived from margin on sales and turnover of capital employed (Pandey, 2005; Agundu, 2005; Kumbirai and Webb, 2010). Therefore, profitability ratios consist of return on capital employed. (ROCE)-measure of output to resources used; margin on sales (MOS)- measures volume of sales and amount of costs incurred; turnover on capital employed (TCE) – measures the effective management of the use of resources; and return on equity (ROE) – measures the profit of shareholders from their investment (Whithington, 1999; Olaseni, 1998; and Agundu 2005). Where as Ryan (1996) discussed financial ratios as a measure of risk in the determination of the Bid Ask Spread.

ACTIVITY RATIOS

Activity ratios measure cash and debtors returns on stock. Therefore its components are: turnover of stock and debtors' turnover. The turnover of stock is technically the coefficient of stock value at the end of a year and the cost of sales for the year. Therefore, it measures the number of times stocks are turned over in each year. The implication of the ratio is that high coefficient value represents efficient stock management, while lower coefficient indicates inefficient stock management.

However, the debt turnover component of activity ratio tends to measure the volume of fund held in debt and time taken to recover such. In the calculation of its coefficient, the average sales per calendar day are

divided by the debtors at the end of the period. The implication of this measure is the determination of the value of sales held in debt (Wright, 1995; Pandey, 2000; and Awookeni (2003).

LIQUIDITY RATIOS

Liquidity ratios are the most frequently used ratios as it shows the ability of the business to meet its financial obligation or its commitments to its third parties. Liquidity ratios are measured in current ratio, and quick or acid test ratios. The current ratio indicates how current assets can settle current liabilities. Considering the implication of this currency, Wright (1995) argues that, "there must be sufficient long-term funds to cover long-term assets with enough left over to cover the necessary margin between current assets and current liabilities to provide the required ratio". However, the quick or acid test ratio is concerned with the ease at which assets can be converted to cash to settle liabilities. As such its difference from the current ratio is the exclusion of stock and prepaid expenses (Pandey, 2000; Van Horne, 2007).

FINANCING RATIOS

Financing ratios consist of gearing or debt equity ratio, and proprietary ratio. The former seek the coefficient of fixed interests, loans, and redeemable preference share; and book value of equity. The implication of the gearing ratio rests on the business dependency on fixed interest loans in its operation, on the basis of which lower coefficients are preferable. The proprietary ratio, measures the degree of protection of unprotected creditors in the event of business failure. Therefore, it is the coefficient of shareholders fund and total tangible assets (Awokeni, 2003, and Pandey 2000).

INVESTORS' RATIOS

The investors' ratio relates to Earnings Per Share (EPS) measurements Price/earning ratio (P/E); time cover; and dividend yield. The EPS is the coefficient of investors' earnings against the number of ordinary shares issued. E/P is the coefficient of current market price of the company and its EPS. Times cover expresses the number of times the available earnings cover the cost of the dividend. By implication, it is the coefficient of profit after tax and ordinary share dividends. Similarly, the dividend yield expresses the expected gross return of an investor at current market share price.

THE DISTRIBUTION OF FINANCIAL RATIOS

It is skeptical to assume that a set of financial ratios computed from a company record form a normal distribution. Perhaps, what gives credence to this assumption is that accounting reporting requirements are guided by generally accepted accounting principles, professional and statutory postulation and pronouncements. If all companies prepare their accounting records to conform with the principles, procedures and pronouncements, it is then reasonable to assume that the data of the resulting ratio are normally distributed. But how valid is that assumption? It is possible that the term may not have been used in a statistical normality but in a technical sense to mean that all accounting records are kept to conform with laid down principles and procedures. Thus, if we have a common behavioural Patten, then, the output would follow a common pattern. It is on this premise we assume that financial ratios are normally distributed.

However, scholars seem to deviate from this meaning. For example, Horrigan (1965) analysed seventeen (17) ratios for fifty (50) companies over the period 1948-57 and concluded that the financial ratios tended to be approximately normally distributed but were often positively skewed. His explanation for the positive skewness was that most of the ratios have an effective lower limit of zero, but an indefinite upper limit.

A similar study was conducted by O'Cibbir (1973) in the U.S.A. In an analysis of ten (10) ratios for 127 companies over the period 1950 to 1966, he discovered that all the ratios exhibited positive skewness but concluded that when the distribution of ratios were skewed, the central area of the distribution was approximately symmetrical.

Bird and Mc Hugh (1976), in a study of five (5) ratios for 118 Australian firms over the period 1967-1971, found that the distribution of ratios within an industry can be approximated by a normal distribution in most cases, although the quick asset and asset structure ratios were often substantially non-normal. Again, the ratios were found to exhibit skewness in both directions of upper or lower limits.

In the most comprehensive analysis of the pattern of distribution of financial ratios in the U.S.A for the period 1955 – 1973, Deakin (1976), found that ratios were positively skewed, thus leading to non-normal distribution. He concluded:

> … As a result of this analysis, it would appear that assumptions of normality for financial accounting ratios would not be tenable except in the case of the total debt/total assets ratios. Even for this ratio, the assumption would not hold on the most recent data observation (Deakin, 1976).

In a recent study of seven (7) ratios for 700 firms from forty-five (45) industries in the U.K for the year 1975, Drury and Bougen (1980) concluded:

> … the overall impression therefore is that the U.K empirical evidence for the distribution of financial ratios seems to indicate non-normality caused by varying degrees of skewness and the existence of extreme outliners. (Drury and Bougen, 1980).

Olaseni (1998) conducted a test on forty (40) firms from eight industrial groups. He discovered that all the ratios were distributed in a manner that was significantly different from normal distribution and were positively skewed throughout the period. However, current ratio tended to be symmetrically and asymmetrically normal during the period.

NORMAL DISTRIBUTION AND SKEWNESS

In the previous section, we discussed the components of financial ratios and their implications. However, in this section, we shall examine the normal distribution as a statistical means of understanding the behaviour of the ratios discussed above. Normal distribution technically represents the frequency curve of an occurrence, which in this case are the financial ratios of Vita foam Plc. The shape of the normal distributions curve is the skewness (Avwokeni, 2003; Mac'Odo,1996). Considering all continuous probability distributions, the normal distribution is perhaps, the most important (Mac'Odo,1996). In addition to theoretical reasons, we find that the probability distributions of many variables encountered in real life situations are of proximately normal. This implies that the normal distribution of financial ratios over a period of time may produce naturally reliable facts on their behaviours. Thus, the normal distribution appears very useful in the approximation of many discrete probability distributions.

However, there appears to be an agreement between Mac'Odo (1996), Zikmund (1996), and Smith(2000) that the normal distribution possesses three distinct characteristics: the distribution is symmetrical about the mean, because of its perfect symmetry, the mean, median and mode coincide at the centre of he distribution, and on specific normal distribution is uniquely determined by its mean and standard deviation. One serious implication of this distribution is that, the theoretical functions is such that the two parts of the curve representing it are infinitely asymptotic to the horizontal axis, approaching it, but never touching it.(see the model in the methodology)

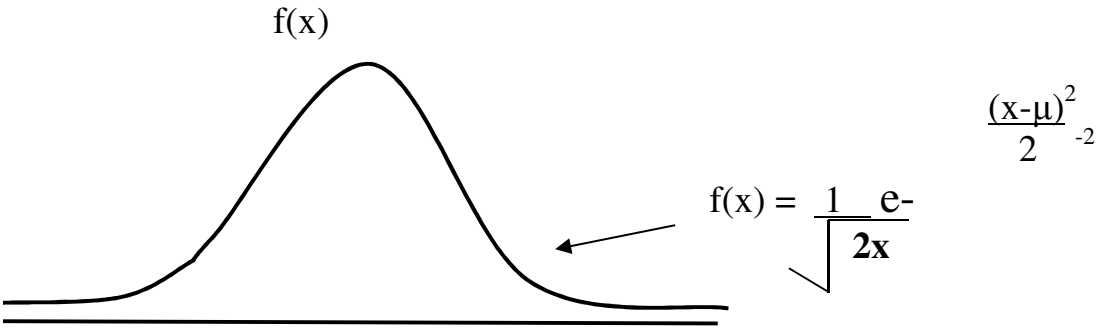
METHODOLOGY

The paper adopts a nomothetic method to analyse secondary data on financial ratios generated from the annual report and accounts of vitafoam plc. The normal distribution statistical model was used to establish the distribution structure of the financial ratios calculated. The coefficient of the normal distribution method applied were used as the basis of acceptability or otherwise of the research propositions.

The normal distribution is given as:

$$f(x) = \frac{1}{\sqrt{2x}} e^{-\frac{(x-\mu)^2}{2^{-2}}}$$

Where: μ is mean of the distribution
is standard deviation of the distribution.



μ (mean)

Me (median)

Mo (mode)

The known methods of calculating the normal distribution curve (skewness) are:

(a) Pearson: $SKp = \frac{3(\text{mean-median})}{\text{Standard deviation}}$

(b Fractile: $SKp = \frac{Q_1 t Q_3 - 2Q_2}{Q_3 - Q_1}$

(c) Moments: Second moment $= \frac{\sum(x-m)^2}{n}$

Third moment $= \frac{\sum(x-m)^3}{n}$

Fourth moment $= \frac{\sum(x-m)^4}{n}$

Research Propositions (RP):
RP1: Financial ratios of business organizations are not normally distributed.

ANALYSIS FOR NORMALITY

TABLE 1: FINANCIAL RATIO DATA (2003-2012)

YEAR	2003	2004	2005	2006	2007
Margin on sale	0.1102	0.1071	0.1151	0.1097	0.0965
ROCE	0.3855	0.4642	0.4828	0.4149	0.4306
Current ratio	1.4908	1.3963	1.5957	1.6310	1.4380
Acid test	1.0586	0.7158	1.0570	1.1375	0.7260
Debt-Equity	-	-	0.0768	0.0797	0.0770
Proprietary ratio	1.0000	1.0000	0.9232	0.9203	0.9230
Stock turnover	6.5027	3.9419	6.5555	6.2655	3.8155
Asset turnover	3.4970	4.3360	4.1951	3.7835	4.4626

YEAR	2008	2009	2010	2011	2012
Margin on sale	0.0298	0.0703	0.0661	0.0707	0.0656
ROCE	0.1464	0.3078	0.2597	02775	0.2633
Current ration	1.4982	1.8197	1.4836	1.3114	1.2593
Acid test	0.6231	0.8856	0.7880	0.6870	0.6809
Debt equity	0.1073	0.1044	0.1903	0.2215	0.2700
Proprietary ratio	0.8927	0.8956	0.8097	0.7785	0.7300
Stock turnover	4.0426	5.5492	5.4498	5.7177	5.3659
Asset turnover	4.9067	4.3776	3.9300	3.9253	4.0167

Source: computed research data 2011

TABLE 2: CHARACTERISTICS OF THE RATIO DISTRIBUTION

RATIOS	CHARACTERISTICS	
MARGIN ON SALES	Mean	8.41
	S.D	2.64
	Moment coefficient of skewness	-05385
	Moment coefficient of kurtosis	2.29
	Standard error	0.6145
	Mt	0.876
Comments: skewed to the left, platykurtic, but significantly normal		
ROCE	Mean	34.33
	S.D	10.31
	Moment coefficient of skewness	-0.3167
	Moment coefficient of kurtosis	2.03
	Standard error	0.6145
	Mt	0.5154
Comments: skewed to the left, platykurtic, but significantly normal		
Current ratio	Mean	149.24
	S.D	15.38
	Moment coefficient of skewness	0.5273
	Moment coefficient of kurtosis	2.287
	Standard error	0.6145
	Mt	0.858
Comments: skewed to the right, platykurtic, but significantly normal		
Acid-test ratio	Mean	83.6
	S.D	17.67
	Moment coefficient of skewness	0.6363
	Moment coefficient of kurtosis	1.78
	Standard error	0.6145
	Mt	1.035

Comments: skewed to the right, platykurtic, but significantly normal		
Debt-equity ratio	Mean	11.27
	S.D	8.47
	Moment coefficient of skewness	0.437
	Moment coefficient of kurtosis	2.17
	Standard error	0.6145
	Mt	0.71
Comments: skewed to the right, platykurtic, but significantly normal		
Proprietary ratio	Mean	88.73
	S.D	8,47
	Moment coefficient of skewness	-0.44
	Moment coefficient of kurtosis	0.79
	Standard error	0.6145
	Mt	0.72
Comments: skewed to the left, platykurtic, but significantly normal		
Stock turnover	Mean	532.06
	S.D	99.21
	Moment coefficient of skewness	-0.375
	Moment coefficient of kurtosis	1.7
	Standard error	0.6145
	Mt	0.61
Comments: skewed to the left, platykurtic, but significantly normal		
Asset	Mean	414.31
	S.D	37.89
	Moment coefficient of skewness	0.2938
	Moment coefficient of kurtosis	2.67
	Standard error	0.6145
	Mt	0.478
Comments: skewed to the right, platykurtic, but significantly normal		

It is argued that if the data are not normally distributed, a failure predictor model will not predict well. Most researchers use parametric statistical techniques to analyze financial ratio data. Again, it is a common assumption that financial ratios satisfy the normality assumption. In order to ascertain whether normality is present, the mean, standard deviations, moment coefficient of skewness (A_s), moment coefficient of kurtosis (B_2), and the moment test ratio (M_t) are computed from the data on Table 1, for each ratio investigated.
The decision rules are:

i. If M_t is less than 3, the distribution is normal, but if greater than 3, the distribution is non-normal.
ii. If $A_s = 0$, the distribution is symmetrical, if A_s is positive, the distribution is positively skewed but if negative, the distribution is negatively skewed.
iii. If $B_2 = 3$, the distribution is mesokurtic (Normal distribution): if B_2 is greater than 3, the distribution is leptokurtic, but if B_2 is less than 3, the distribution is platykurtic.

Therefore, the data presented in Table 2 indicate that each of the financial ratio investigated are normally distributed. The HO_1 is therefore rejected.

DISCUSSION OF FINDINGS AND CONCLUSIONS

The assumption that normality underlies financial ratios is valid. All the ratios investigated are platykurtic, with a normal distribution. Although most of the ratios are slightly either skewed to the left or right, they are however, significantly normal. This result agrees with that of Horrigan (1965) "Financial ratios tended to be approximately normally distributed but were often positively skewed". This finding also is in conformity with that of O'Connor (1973) and Bird and McHugh (1976).

Therefore, the overall impression is that the empirical evidence for the distribution of financial ratios seems to indicate normality with platykurtic top-shape.

Olaseni (1998) found the debt-equity ratio to be non-normally distributed. The study also reveals that collinearity is always present in financial ratios. This confirms the view that accounting statements tend to move in the same direction as others, either more or less proportionately. It is therefore valid that collinearity implies normality. This tends to flow also with the findings of Beaver (1967).

It was discovered that ratios in the same category produce fairly high correlation coefficient whereas ratios in different categories produce fairly low correlation coefficients.

The findings elicited the following far reaching implications: (1) It is valid to compare a financial ratio with a norm, or determine the relative position of a company within an industry because of the presence of the normality assumptions. Failure predictor model can utilize financial ratios as input because they are normally distributed; (2) It is valid to make mathematical computations to estimate unknowns using financial ratios because of the presence of collinearity; (3) Finally, financial ratios should be grouped into classes to produce similar information. The presence of fairly high correlation coefficients within categories indicate that it is valid to manipulate one ratio components to improve the components in different groups as revealed by fairly low correlation coefficients.

RECOMMENDATIONS

The study findings generated implications for users of financial ratios. On that premise we recommend as follows: that, (1) Financial analysts can validly compare a financial ratio with a norm, or determine the relative position of a company within an industry; (2) Financial ratios should be used as data-inputs for failure predicators model; (3) A financial ratio may be used as a basis for estimating unknowns. Thus, financial ratios are useful inputs in regression and multiple discriminant analysis.

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