

Analysing the Effect of Different Financial Ratios on the Performance of the Indian Pharmaceutical Industry



Management

KEYWORDS : econometric model, financial ratios, Pharmaceutical companies, regression analysis, Return on Equity

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ABSTRACT

This paper presents an overview of the Indian pharmaceutical industry, including statistical figures of the major players in the Large Cap, Mid Cap and Small Cap domains. Using the financial ratios of these companies, this paper suggests an econometric model that infuses the effects of these ratios in order to ascertain the financial performance of the company. It assumes ROE to be the main indicator of the performance of a firm/sector and identifies the relationship between ROE and the different factors and from there on suggests conclusions for the decision makers.

1. Introduction

The scrutinizing of the financial well-being of a firm and the collectively, the performance of a sector as a whole has been a subject matter of much discussion for the economists, the managers, investors, lenders and the shareholders for the better part of this decade. It continues to capture attention and encompasses a very vast gamut of intellectual disciplines.

Ratio analysis is an indispensable part of financial analysis, primarily because it acts as a tool to compare related information and hence make that information more meaningful and relevant. This paper has extensively used the liquidity ratios and the profitability ratios of 30 listed pharmaceutical companies in India to gauge their impact on the Rate of Return on Equity, another financial ratio that has been used as the single indicator of the performance of a company.

This paper provides the scenario of the Indian pharmaceutical sector. The findings from McKinsey and Co.'s report (2010) as well as the Confederation of Indian Industry's report (2010) peg the Indian pharmaceutical industry to grow to a gigantic \$50 billion by 2020. The spending on healthcare is also expected to increase from 7% in 2010 to 13% in 2025 (McKinsey and Co., 2010; Nair, 2013). Cygnus prophesizes a growth of 21% for the Indian Pharmaceutical industry. All this spells growth for the industry in the years to come. Financial data of companies across the domains of large cap, mid cap and small cap has been tabulated and scrutinised for a better understanding of the factors that have enabled the Pharmaceutical industry to sustain high growth rates.

The main aim of this paper has been to develop an empirical econometric model that takes into account the effect of liquidity and profitability ratios on the rate of return on equity and predict their degree of impact.

The structure of the paper is as follows: We first present a Literature Review on the topic of concern followed by an overview of the scenario of pharmaceutical industry in India. This is Further; we have presented the research methodology we have followed, the source of our data and the detailed development of an econometric model and the formulation of an empirical relation between the factors of influence and the performance of the company, assuming the factors to be independent variables. This has been followed by the regression analysis and presentation of results. In closing, we account for the irregularities in the proposed method, further scope and closing assertions and comments.

2. Literature Review

Ejljelly (2004) analysed joint stock companies of Saudi Arabia to find the correlation between liquidity and the profitability of a

firm. The method used was correlation and regression analysis to find strong inverse dependence of profitability and liquidity, determined by the current ratio and cash conversion cycle. This characterized strongly the trade-off between profitability and liquidity that a firm faces.

The correlation of book value and net income with the financial health of a company was studied by Barth et al. (1998) for a data set of 396 bankrupt firms. The financial health of a company was found to decrease as the book value increases and net income decreases.

Režňáková et al. (2014) have used non-parametric models to predict ill financial health of firms based on data collected a year before the bankruptcy of a firm. This 'Boosted Trees' method was different from the general linear parameterised model used in most financial research papers. This method accommodates the presence of outliers and is immune to the lack of normality, which may be significant in number in case of financial data (Barnes, 1982, 87).

Iotti et al. (2014) analysed the relationship between Return on Equity and Cash Flow generation for 50 pharmaceutical companies. The research aims to show importance of lack of credits for SMEs and its effect on profitability of these firms. It has also been shown by regression analysis that the financial ratios calculated by economic and financial margins differ significantly.

Boldeanu et al. (2014) have studied the impact of growth dynamic factors such as EBIT Margin, EBITDA Margin (Earnings after Interest Taxes, Depreciation and Amortisation Margin), as well as liquidity factors such as current Ratio and Quick Ratio on profitability of a company characterised by ROE (Return on Equity). The sample set taken was of 23 ThiaPharmaceutical Companies of the Romanian market.

Base on the literature review presented above it has been concluded that there is a significant relationship between the chosen independent variables and the proposed measure of the performance (dependent variable).

Further the development of econometric model gives the review of literature studying the pattern of dependence of these factors thus resulting into the Model 1 of Regression given further.

2.1 Relevant Financial ratios

Relevant Profitability Ratios

The profitability ratios are of chief concern to the investors and owners. An investor invests his money in the firm on the hope of earning a profit on it. These ratios provide a basis to relate the relevant figures that concern the owners. The following have been used as independent variables for the purpose of this pro-

ject to project dynamic growth of Return on Equity:

1. Return on Equity or Return on Net Worth: This measures the rate of return on shareholder's equity and is the most important ratio vis-a-vis the investors.

$$ROE = \frac{EAT - Preference Dividend}{Average Equity Funds} \quad (1)$$

2. Operating Profit Margin: Operating profit margin, also known as EBIT margin, is calculated as the ratio of the earnings before interests and taxes and total sales.

$$Operating Profit Margin = \frac{Operating Profit(EBIT)}{Net Sales} \times 100 \quad (2)$$

3. Net Profit Margin: This ratio indicated two important aspects of the firms economic condition: the actual profit made on each sale and the efficiency of the management of the firm.

$$Net Profit Margin = \frac{Net Profit(EAT)}{Net Sales} \times 100 \quad (3)$$

4. Earnings per Share: EPS is a widely used tool to measure a firm's economic performance. It measures the earnings available on per share basis to equity shareholders.

$$EPS = \frac{EAT - Preference Dividend}{Number of equity shares outstanding} \quad (4)$$

5. Book Value: This shows asset backing per equity share. In other words, it shows effective equity funds per share.

$$Book Value = \frac{Equity share capital + Reserves and Surplus - Accumulated Losses}{Number of equity shares outstanding} \quad (5)$$

Relevant Liquidity Ratios

1. Current Ratio: It is a measure of the short term financial liquidity of the firm.

$$CR = \frac{Current Assets(CA)}{Current Liabilities(CL)} \quad (6)$$

2. Quick Ratio: This takes into account the difference between the homogeneity of different current assets.

$$QR = \frac{CA - Inventory - Prepaid Expenses}{CL} \quad (7)$$

Relevant Solvency Ratios

1. Total Debt to Total Assets Ratio: Measures the way in which the company's total assets are financed by debt.

$$\frac{TD}{TA} Ratio = \frac{Total Debt}{Total Assets} \quad (8)$$

2.2 Multiple Regression

Regression analysis is a statically tool to find the relationship between a dependent variable with a single or multiple independent variables. Typically, the regression analysis is aimed at studying the amount by which the dependent variable varies when there is unit variation in any independent variable. This relation is given by the coefficients given by regression analysis.

$$Y = a + b_1 * X_1 + b_2 * X_2 + \dots + b_p * X_p \quad (9)$$

The model of regression used in this paper is multiple linear regressions in which there is simple linear dependence among variables and while the dependent variable is one, the independent variables are multiple.

The method uses least squares technique and specific care is taken to satisfy the assumptions. According to the principle of multi- colinearity the independent variables should not be corre-

lated with each other because it is difficult to understand which dependent variable causes the variation in other dependent variables. Further, regression analysis assumes that there are no significant outliers in the data because the presence of such outliers can result in a large change in the dependence on the single value as compared to several general values. The confidence interval determines the variation inherent from the regression plot. In this research the regression uses 95% confidence level.

The R- squared value given by regression indicates the number of values fitting the model perfectly within the confidence interval. It shows the percentage of value of the dependent variable that can be determined using the given independent variable. However, adjusted R squared value should be used for the analysis of any model having more than one independent variable as it takes into account the degrees of freedom. The value of significance F should be as low as possible. 0.05 is considered to be good. A value of 0.1 significance F indicates 10% chances of correlation between the dependent variable and the independent variable to be accidental and no strong variation dependence between the variables.

3. Data and Research Methodology

In the present context, we presume that the ulterior purpose of a firm is to generate money for the people who have invested money in it. This includes the shareholder's equity and the retained earnings. Thus, in order to quantify a company's performance by the usage of a single indicator only, we have chosen the Return on Equity (ROE), also known as Return on Net Worth, to be the aforementioned indicator, as has also been done in Bertonecheet et al. (2001). Further, the accessibility of data on ROE, coupled with investors' interest in this ratio makes it apt for the formulation of an econometric model. As reported by The Motley Fool (2015) ROE encompasses profitability, asset management, and financial leverage and the investor can ascertain the success with which these parameters have been balanced by the company and he can sense whether he is like to get a healthy return on his investments.

Through the course of this paper, we have tried to develop a rigorous econometric model that successfully relates the ROE with different parameters, obtain the extent of influence they have on ROE and try to ascertain whether other factors can be incorporated in order to further improve the model.

In this case we have used a total of 30 pharmaceutical companies listed on the BSE, out of which:

- 10 companies have Market Capitalization between Rs. 200-3500 billion (Large Cap)
- 10 companies have Market Capitalization between Rs. 50-200 billion (Mid Cap)
- 10 companies have Market Capitalization lower than Rs 50 Billion (Small Cap)

Multiple regression tool has been used to quantify the data and subsequently generate the model. Multiple Regressions has been done in Microsoft Excel using Data Analysis Toolpak. The confidence level was kept at accepted value of 95%.

The data has been tabulated and compiled from: moneycontrol.com, capitaline.com and BSE. The relevant ratios have been calculated using the data taken from respective companies.

4. Developing the Econometric model

As mentioned in Campbell et al., (2001), the development of empirical relations between factors and performance of a firm is an aim to increase efficiency of the management through interventions in an adaptive learning cycle. The obtainment and analysis of information, both secondary and primary and their

incorporation to evolve tools that can serve as real indicators of the extent to which the relevant factors(ratios in this case) can and do affect the performance. The subsequent developments of economic models that involve mathematical equations generally assume a linear relation between the performance and factors.

However, as suggested in Boldeanu et al. (2014), all factors need not necessarily have linear linkages with the performance. In accordance with the findings of Mramor et al. (1997), the progression of liquidity from zero to a certain value should mean an accompanying increase the value of ROE. Firms with mediocre levels of liquidity ratios are likely to face complications in fulfilling their short term agreements. This has an adverse effect on the ROE. Further, the relation between ROE and liquidity changes after ROE reaches a certain value, beyond which the liquidity costs incurred are greater than the advantages they have to offer and beyond this point, ROE begins to decrease. Following these guidelines the ROE can be assumed to be loosely based on the following function:

$$ROE = \alpha + \beta \ln x + \gamma (\ln x)^2 \tag{10}$$

This fits in appropriately with the pattern that ROE follows with the evolution of liquidity.

Following the same line of thought, we can assume ROE to vary with the CR, QR and TD/TA in the following manner:

$$\begin{aligned} CR: & \ln(CR), (\ln(CR))^2 \\ QR: & \ln(QR), (\ln(QR))^2 \\ TD/TA: & \ln(TD/TA), (\ln(TD/TA))^2 \end{aligned}$$

According to Mramor et al. (1997) the relation between ROE and ROA is approximately linear and ROE increases with an increase in ROE. This is attributed to financial leverage. Extending the same argument to EBIT Margin, the relation between EBIT Margin and ROE is linear as well.

5. Time Analysis

5.1 Projecting the trend in the past decade

In the analysis that follows, we have included the curves of the relevant financial ratios along with their detailed analysis for the 3 major companies over a period of 10 years (FY2005-FY2014). These companies, namely Dr.Reddys, Cipla and Lupin collectively have net sales of about 30% of the total sales. This has been done in order to grasp the manner in which the ratios relevant to this project have varied for the major pharmaceutical companies in the past decade.

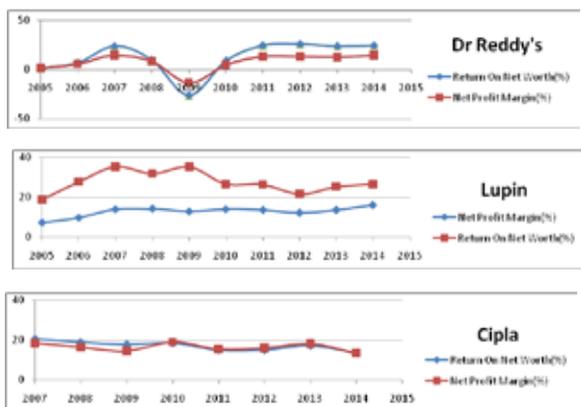


Figure1: The above curves portray the variation of Net Profit Margin and Return on Net Worth (ROE) for the companies under consideration for the past decade.

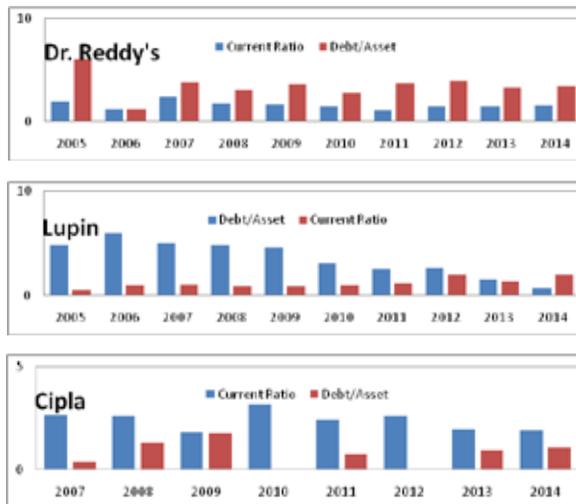


Figure2: The curves above depict the same for CR and Debt to Asset Ratio.

5.2 Establishing the relationship with ROE

Here, the relationship of the relevant ratios (CR, Debt/Assets, Net Profit Margin) with the Return on Equity has been closely analysed and is the main subject matter of this section. Further, this serves as justification for the assumptions that have been made in the Research Methodology section about the functional relationship between ROE and the different financial ratios. The ratios are in accordance with the industry standard.

1. ROE vs Net Profit Margin:

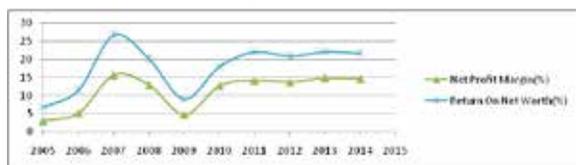


Figure3: the ROE and Net profit margin for past 15 years of the pharmaceutical industry.

The ROE varies with net profit margin in almost a parallel manner. The dip in 2007-09 is due to the economic slowdown during this period. In fact, this checks out with the two point DuPont Identity Definition (ROE =Net Profit Margin x Asset Turnover)

ROE vs Current Ratio

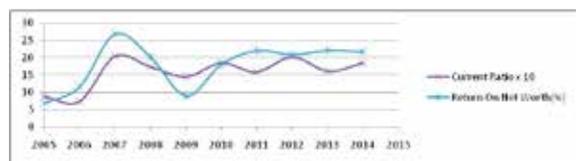


Figure4: CR and Return on Net Worth of pharmaceutical industry for past 15 years

2. Variation of ROE with also checks out with the assumption made in the previous section. A lower liquidity ratio means that the company is unable to meet its short term obligations. This leads to a downfall in the rate of return on net worth. Correspondingly, a healthy liquidity ratio means a higher ROE. However, for high values of ROE and in the absence of any major economic upheavals, the increase in ROE is offset by the additional liquidity costs incurred.

3. ROE vs Debt-Asset Ratio

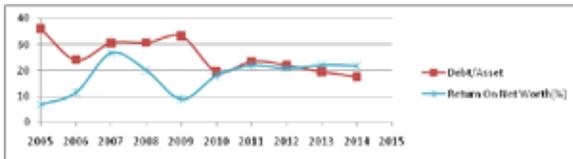


Figure5: D/A and ROE of the pharmaceutical industry for past 15 years

While determining the effect of Debt-Asset ratio on ROE, it is important to factor in the prevalent economic conditions. Debt is the cheapest source of finance and more debt means an increase in the leverage factor. According to Duff (2015) this factor, during the times of a boom, translates to huge profits. At the same time, during a recession, it means huge losses.

6. Regression Analysis

Two different regression models have formulated in this paper in order to analyse the best dependence of y versus x, y being the dependent variable(ROE) while x (x₁, x₂ etc.) represents the different functions of financial ratios (Net Profit Margin, ATR, CR, etc.) taken as independent variables

6.1 Model 1

The assumed hypothesis for this model comes from the findings of Mramor et al. (1997) as described above. The dependence equation assumed is as follows.

$$ROE = C + m_1 \ln(\text{Book Value}) + m_2 \ln^2(\text{Debt Asset Ratio}) + m_3 \ln(\text{Current Ratio}) + m_4 \ln^2(\text{Current Ratio}) + m_5 \text{Earnings per share} + m_6 \text{EBIT Margin} + m_7 \text{Net Profit Margin}$$

$$OR$$

$$ROE = C + m_1 \ln(BV) + m_2 \ln^2(D/A) + m_3 \ln(CR) + m_4 \ln^2(CR) + m_5 \text{EPS} + m_6 \text{EBITM} + m_7 \text{NPM}$$

It is to be noted here that the dependence of ROE on Quick Ratio has not been taken into account (linear or logarithmic). The reason for this has been explained in the text that follows. The data set produced a linear dependence of the two factors having only 1 outlier for both mid cap and small cap companies while for the large companies the number of outliers are more than 50%. This might be due to be fact that the consolidated data for the large cap companies has been analysed. The large cap companies have tendencies to have subsidiaries involved that may be involved in industries different from the pharmaceutical and hence the quick ratio and current ratio are not the absolutely correct measures of liquidity for these companies. Thus it is essential to incorporate only one of the liquidity ratios in analysis or else it might lead to problem in correlation of errors and the principle of multicollinearity.(Refer to Figure6 on next page)

The Regression Statistics

a) Large Cap Companies

The adjusted R-square value is 0.701 indicating that the model fits 70% value of ROE of the large cap companies analysed. The value of Significance F is high at the value of 0.79 which might be due to the restricted size of data set analysed. It is to be noted that the same factor has influenced high P-values. In general, it is safe to state that all factors are about 50% correlated in contributing towards ROE and collectively, they are 70% accurate. It is interesting to note that the coefficients of logarithms of Book Value and Current Ratio are negative which means that these factors contribute negatively to the ROE. Thus, as Book Value of Share increases the return on Equity is expected to decrease exponentially. The coefficient of Net Profit Margin is Positive which satisfies the finding of Boldeanu et al. (2014) that the ROE increases and decreases almost in a parallel manner with the Net Profit margin.

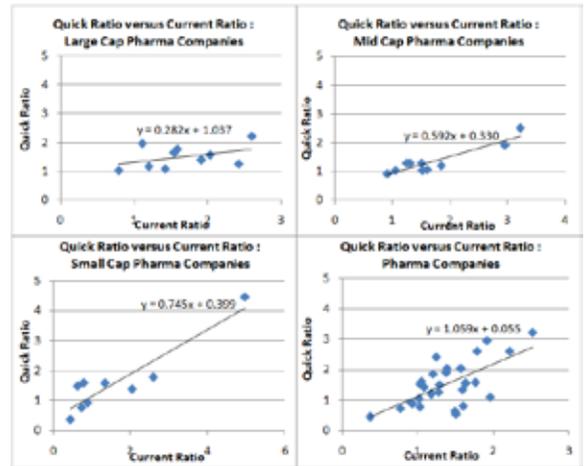


Figure6: The above graphs depict the correlation of Quick Ratio and Current Ratio for 10 Large Cap, 10 Mid Cap, 10 Small Cap companies and then collectively for all the total 30 Pharmaceutical Companies (clockwise from Top Left) according to their ratios calculated for FY14.

SUMMARY OUTPUT										
Regression Statistics										
Multiple R	0.900533037									
R Square	0.810959751									
Adjusted R Square	0.701362244									
Standard Error	8.468422993									
Observations	10									
ANOVA										
	df	SS	MS	F	Significance F					
Regression	8	307.645172	38.45565	0.536235	0.79077374					
Residual	1	71.71418798	71.71419							
Total	9	379.35936								
	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%		
Intercept	821.1754487	849.6314612	0.966508	0.510841	-9974.415847	11616.767	-9974.4158	11616.7667		
ln(BV)	-100.9029508	95.1052146	-1.06096	0.481175	-1309.329279	1107.5234	-1309.3293	1107.52338		
ln(D/A)	182.6475989	224.3525983	0.81411	0.565007	-2668.022448	3033.3176	-2668.0224	3033.31765		
ln ² (D/A)	-2.607049111	4.003374898	-0.65121	0.632526	-53.47475021	48.260652	-53.47475	48.260652		
ln(CR)	-1201.861722	1508.899726	-0.79652	0.571802	-20374.25057	17970.527	-20374.251	17970.5271		
ln ² (CR)	2154.066532	2701.881475	0.797247	0.571517	-32176.50266	36484.726	-32176.593	36484.7257		
EPS	1.804213971	1.782576014	1.012139	0.49616	-20.84556182	24.45399	-20.845562	24.4539898		
EBIT Margin	-23.25217576	27.30847431	-0.85146	0.550995	-370.2392413	323.73489	-370.23924	323.73489		
Net Profit Margin	32.34846779	37.44898233	0.863801	0.546439	-443.4859688	508.1829	-443.48597	508.18294		

Regression 1(a): Regression model analysis results of 10 Large Cap pharmaceutical companies. Applying model 1 of dependence of ROE on select Financial Ratios using Microsoft Excel 2010 Analysis Toolpak Add-in.

b) Mid- Cap Companies

SUMMARY OUTPUT										
Regression Statistics										
Multiple R	0.989899313									
R Square	0.997999628									
Adjusted R Square	0.981996651									
Standard Error	1.778505041									
Observations	10									
ANOVA										
	df	SS	MS	F	Significance F					
Regression	8	1578.08277	197.2603	62.36337	0.0976416					
Residual	1	3.163080182	3.16308							
Total	9	1581.24585								
	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%		
Intercept	61.09244304	28.70814661	2.128052	0.279661	-303.679145	425.864	-303.679	425.864		
ln(BV)	-18.17427105	5.372986189	-3.38253	0.182996	-86.4445336	50.09599	-86.4445	50.09599		
ln(D/A)	-15.09833657	11.6857737	-1.29203	0.419323	-163.58017	133.3835	-163.58	133.3835		
ln ² (D/A)	-4.151352086	4.934844778	-0.84123	0.55476	-66.8545002	58.5518	-66.8545	58.5518		
ln(CR)	10.45226298	12.46763104	0.838352	0.555835	-147.96401	168.8685	-147.964	168.8685		
ln ² (CR)	6.142133717	7.079191936	0.876632	0.545045	-83.8075284	96.09118	-83.8075	96.09118		
EPS	0.503571424	0.155214445	3.244359	0.190341	-1.46861509	2.475758	-1.46862	2.475758		
EBIT Margin	2.284807262	0.465231625	4.911118	0.12788	-3.62652101	8.196136	-3.62652	8.196136		
Net Profit Margin	-2.433097035	0.404014936	-6.02229	0.104755	-7.56659353	2.700399	-7.56659	2.700399		

Regression 1(b): Regression model analysis results of 10 Mid Cap pharmaceutical companies Applying model 1 of dependence of ROE on select Financial Ratios using Microsoft Excel 2010 Analysis Toolpak Add-in

The adjusted R square of Mid Cap Companies is 0.98 and hence proves the utility of the model for these companies as 98% of the

value of ROE fit the model. Also the significance P-values are low as compared to those for large cap companies. EPS, EBIT Margin, Net Profit Margin and logarithm of Book Value correlate 90% with the ROE whereas logarithms of and the squares of logarithms of Debt-Asset Ratio and Current Ratio correlate only 50%.

The overall value of significance F of the model 1 for mid cap companies is also low at 0.09 and hence shows that the model overall correlates with the values of ROE as high as 90%.

The coefficients of Book Value, Debt-Asset Ratio and the Net Profit Margin all assume similar values as they did for the Large Cap companies with coefficients of Book Value and Debt- Asset Ratio being negative while that for net profit margin being positive.

c) Small Cap Companies

SUMMARY OUTPUT								
Regression Statistics								
Multiple R	0.99632807							
R Square	0.99266963							
Adjusted R Square	0.93402663							
Standard Error	33.3844646							
Observations	10							
ANOVA								
	df	SS	MS	F	Significance F			
Regression	8	150927.1525	18865.89	16.92733	0.185921651			
Residual	1	1114.522476	1114.522					
Total	9	152041.675						
	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%
Intercept	427.429621	212.5678973	2.010791	0.293799	-2273.5016	3128.3608	-2273.5016	3128.360845
ln(BV)	-119.05776	53.32919742	-2.23251	0.268099	-796.669461	558.55394	-796.669461	558.553941
ln(D/A)	-239.83186	134.0872038	-1.78863	0.324545	-1943.57132	1463.9076	-1943.57132	1463.907608
ln ² (D/A)	-75.228451	36.03056602	-2.10178	0.282716	-533.5402	382.0833	-533.5402	382.0832971
ln(CR)	40.7800146	34.45330361	1.183631	0.446589	-396.990715	478.55074	-396.990715	478.550741
ln ² (CR)	-22.632555	39.75282984	-0.56936	0.670496	-527.74115	482.47404	-527.74115	482.4740398
EPS	1.84377216	1.860289043	0.991121	0.502839	-21.7934413	25.480986	-21.7934413	25.48098561
EBIT Margin	-7.045604	3.465732234	-2.03293	0.291029	-51.0819073	36.990699	-51.0819073	36.99069934
Net Profit Margin	19.0465439	5.265293346	3.617376	0.171701	-47.8553513	85.948439	-47.8553513	85.94843917

Regression 1(c): Regression model analysis results of 10 Small Cap pharmaceutical companies Applying model 1 of dependence of ROE on select Financial Ratios using Microsoft Excel 2010 Analysis Toolpak Add-in

The adjusted R square of Small Cap Companies is 0.93 and hence proves the utility of the model for these companies as 93% values fit the model. Also the significance P-values are low as compared to those for large cap companies and similar to mid cap companies. EBIT Margin, Net Profit Margin, logarithm of Debt-Asset Ratio and logarithm of Book Value correlate more than 70% with the ROE whereas EPS and logarithm of and the square of logarithm of Current Ratio correlate only 50%.

The overall significance F of the model 1 for mid cap companies is also low at 0.18 and hence shows that the model overall correlates with the values of ROE as high as 90%.

The signs of coefficients tally with the previous cases. It is interesting to note here that the relation with logarithm of Debt Asset Ratio is strongly negative for Small Cap Companies as compared to Mid Cap and Large Cap companies which show that the small cap companies the profits are consumed due to their credit transactions with financial institutions and the return on Equity decreases. This does not happen in case of Large cap companies since banks offer loans to these companies at low interest rates as compared to small cap companies due to assurance of return, owing primarily to their size. For these companies debt is the cheapest source of finance.

d) Collectively for the whole Sector

SUMMARY OUTPUT								
Regression Statistics								
Multiple R	0.894560754							
R Square	0.800238942							
Adjusted R Square	0.724139491							
Standard Error	40.1198568							
Observations	30							
ANOVA								
	df	SS	MS	F	Significance F			
Regression	8	135408.802	16926.1	10.5157	0.000080004			
Residual	21	33801.66111	1609.603					
Total	29	169210.4631						
	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%
Intercept	-194.995182	60.62687036	-3.21632	0.004144	-321.0756604	-68.9147033	-321.07566	-68.91470328
ln(BV)	42.88041388	11.54879136	3.712976	0.001288	18.86338748	66.89740227	18.8633875	66.89740227
ln(D/A)	5.275645968	21.8468442	0.241483	0.811523	-40.1572537	50.70864564	-40.1572537	50.70864564
ln ² (D/A)	-0.72828925	3.42951394	-0.21236	0.833875	-7.860356945	6.403778443	-7.8603569	6.403778443
ln(CR)	-29.6094922	23.11205943	-1.28113	0.214116	-77.67365094	18.45466661	-77.673651	18.45466661
ln ² (CR)	-7.81795684	24.27603112	-0.32204	0.750603	-58.30272726	42.66681358	-58.302727	42.66681358
EPS	-0.8574259	0.395888263	-2.16582	0.041982	-1.680722691	-0.03412911	-1.6807227	-0.034129107
EBIT Margin	-3.58282397	1.538529315	-2.32873	0.029941	-6.782370835	-0.38327711	-6.7823708	-0.383277109
Net Profit Margin	10.37382267	1.947329625	5.327204	2.78E-05	6.324129019	14.42351631	6.32412902	14.42351631

Regression 1(d): Regression model analysis results of 30 pharmaceutical companies(10 each from Large, Mid and Small Cap) Applying model 1 of dependence of ROE on select Financial Ratios using Microsoft Excel 2010 Analysis Toolpak Add-in

Key Features of the model include the large number of variables used in order to determine the most significant contributor to the value. The value of R squared is as follows.

- Large cap : 0.810959751
- Mid Cap : 0.997999628
- Small Cap: 0.99267
- All combined : 0.800238942

The values of R squared are satisfactory and show that more than 80% values fit the model in all cases. It is good to note that 99% values fit the model in case of Mid Cap and Small Cap Companies. The observations show that when combined together these factors can predict the Return on Equity for small and Mid-Cap with a probability as high as 99%. However, it is important to note that the R squared value for all companies combined is 80% and hence predictability for the sector is low. The values of 'P-value' for the variables are in the range of 0 to 0.5 which should actually be lesser than 0.05. Typically, the contribution to the Y variable (ROE) of the X variables having high P-values is less. However, we would remove these variables from our regression model since the R squared value given by the model itself is satisfactory and the contribution of these variables if removed will go towards increasing the error and hence predictability will decrease. This has been shown in second model of dependence of ROE.

6.2 MODEL 2:

$$ROE = C + m_1 * \ln(\text{Quick Ratio}) + m_2 * \ln^2(\text{Quick Ratio}) + m_3 * \ln(\text{Book Value}) + m_4 * \ln(\text{Debt Asset Ratio}) + m_5 * \ln(\text{Current Ratio}) + m_6 * \text{Earnings Per Share} + m_7 * \text{EBIT Margin} + m_8 * \text{Net Profit Margin}$$

OR

$$ROE = C + m_1 * \ln(QR) + m_2 * \ln^2(QR) + m_3 * \ln(BV) + m_4 * \ln(D/A) + m_5 * \ln(CR) + m_6 * EPS + m_7 * EBITM + m_8 * NPM$$

The major Objective of this model is to prove the significance of the model 1 and prove the hypothesis made earlier that removing the variables with high P-values does not increase the R square of the model and rather decreases the predictability. For this purpose the ln²(CR) and ln²(D/A) were removed. In addition to this, Quick Ratio was included in this model along with ln(CR) to show that the quick ratio is already incorporated in current ratio and does not contribute in any way to the model.

SUMMARY OUTPUT							
Regression Statistics							
Multiple R	0.854531						
R Square	0.730223						
Adjusted R Square	0.622312						
Standard Error	6.674219						
Observations	29						
ANOVA							
	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>		
Regression	8	2411.467	301.4333	6.76691	0.000251759		
Residual	20	890.9039	44.5452				
Total	28	3302.371					
	<i>Coefficient</i>	<i>Standard Err</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>	<i>Lower 95.0%</i> <i>Upper 95.0%</i>
Intercept	51.1005	14.2648	3.582278	0.001863	21.34463414	80.8563576	21.3446341 80.8563576
ln(QR)	-7.46024	5.398407	-1.38193	0.182234	-18.72111797	3.80063957	-18.721118 3.80063957
ln^2(QR)	10.22909	5.787811	1.76735	0.092426	-1.844075828	22.3022494	-1.84407583 22.3022494
ln(BV)	-8.53132	2.827741	-3.01701	0.00681	-14.42988257	-2.6327549	-14.4298826 -2.63275487
ln(D/A)	0.555699	1.244737	0.446439	0.660076	-2.040777194	3.15217542	-2.04077719 3.15217542
ln(CR)	4.234533	4.666767	0.90738	0.375009	-5.500172776	13.9692382	-5.50017278 13.9692382
EPS	0.18485	0.084133	2.197116	0.039963	0.009351616	0.36034869	0.00935162 0.36034869
EBIT Margin	0.101481	0.229039	0.443074	0.662467	-0.37628548	0.57924804	-0.37628548 0.57924804
Net Profit Margin	0.265904	0.437841	0.607308	0.55048	-0.647416864	1.17922585	-0.64741686 1.17922585

Regression 2: Regression model analysis results of 30 pharmaceutical companies (10 each from Large, Mid and Small Cap) Applying model 1 of dependence of ROE on select Financial Ratios using Microsoft Excel 2010 Analysis Toolpak Add-in

The R squared achieved drops down by 14% and comes down to 0.622. The Significance F-Values for factors comes down overall as can be seen in data below. It is interesting to note that the significance P values for major contributors such as EBIT Margin and Net Profit Margin has gone up from 0.03 and 0.00 to 0.66 and 0.55, respectively. This also indicates a major rule in regression analysis according to which if a variable x_i is excluded from the analysis parameters then its dependence gets included in the error contributed by other parameters.

7. Conclusions and Closing Remarks

The analysis of financial ratios, their comparison with the industry standard, the comparisons between relevant factors, their interdependencies, their influence on the company's performance require the usage of sophisticated tools and the formulation of rigorous techniques. A detailed analysis of these components serves as a faithful characteristic for the decision makers.

The assertions made in this paper and the developed econometric model can serve as an indicator of the performance of any firm/sector it is applied to after incorporating minor changes.

The model yielded by the regression analysis establishes an empirical relation between ROE and the major profitability ratios as well as between ROE and the relevant financial and solvency parameters.

Our findings are mostly consistent with the research published upon this subject. The value of coefficients obtained justify the assertions made in Eljelly(2004) [there is a trade-off between the liquidity ratios and the profitability ratios], Barth et al.(1998) [Financial health goes hand in hand with the net income] and Mramor et al. (1997) [Increase in liquidity should mean a rapid increase in ROE till a certain value of ROE is reached].

However, some irregularities such as the negative correlation of ROE with EPS, in contrast to what is suggested by Boldeanu et al. (2014) and positive correlation with the Book Value (for the collective set of all 30 companies) in contrast to what is suggested by Barth et al. (1998) have also been observed.

A possible reason for this may be the relatively small size of our sample. Further, we have not checked for multi colinearity among the independent variables by the SPSS technique.

A new direction for this paper study is the application of a more indicative model, based fundamentally on the approach taken in this model, in the pharmaceutical industry concentrated primarily on the supply chain.

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