Impact of R&D Intensity on Market Capitalization

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Abstract

The present study is an attempt to assess the impact of Research & Development (R&D) intensity, profit margin and firm size on market valuation of firm proxied by Tobin's q with special reference to pharmaceutical sector. The pharmaceutical industry has been chosen due to intensive research and development expenditures. There are many pharmaceutical companies listed on the BSE and NSE but 25 companies have been chosen at random and analyzed for a period of 10 years from 2005 to 2014 through regression technique. Theoretically, it sounds true that when a company invests in R&D, it increases the probability of innovation and thereby improved growth prospects which reflects in the market capitalization. An attempt has been made to test this hypothesis and much to our surprise, this assumption does not hold true in case of pharmaceutical sector.

***Keywords:** R&D intensity, Tobin's q, Market capitalization*

Introduction

TJoseph Schumpeter has mentioned in his famous book, Capitalism, Socialism and Democracy, that "the fundamental impulse that sets and keeps the capitalistic engine in motion comes from the new consumers' goods, the new methods of production or transportation, the new markets, the new forms of industrial organization that capitalist enterprise creates." (Schumpeter, 1942, p. 83). As per Schumpeter, a firm can grow in a capitalistic economy only if it is innovative and competitive. Innovation in an organization is said to take place when it is able to supply better quality goods and services at lower prices than their competitors. Thus, with innovation comes efficient utilization of nation's resources which further leads to accelerated growth of the firm and economy. Thus, innovation is not only fruitful for the firms but for the consumers as well.

There are broadly two kinds of innovations which takes place in a firm, i.e., product innovation and process innovation. Research & Development activity helps a firm in doing Product innovation, i.e., enhancing its ability to learn new technologies which helps in creating new products and solutions designed to satisfy customer needs that cannot be not easily imitated by competitors and hence gain competitive advantages. Thus, R&D activity gives an added advantage over its competitors by bringing innovative products to the market. Another form of innovation is Process Innovation which leads to innovation in the way that they produce goods. R&D helps in developing effective ways of producing goods, thereby minimizing the production costs which leads to larger market share and higher profitability (Xu and Zhang, 2004). The focus of this paper will be on product innovation within the pharmaceutical industry.

Investment in R&D generates uncertain rewards and takes long time. Moreover, sometimes the investment in R&D may not even lead to fruitful conclusion and all financial resources may be a complete wastage. R&D results belong to future which leads to higher volatility in firm value. The companies which undertake R&D are indeed patient and risk takers. Pioneering firms invest more in R&D practices to establish its competitive position.

Theoretically it is said that as a firm spends more on R&D, it increases the probability of new drug discovery, which will lead to growth of the firm. Growth in the firm takes place when there

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is higher sales, higher profits and thereby increased shareholder value. This study attempts to analyze empirically whether high R&D Intensity leads to higher Share Price.

Many research studies have already been conducted in the past to study the impact of innovation on growth of the firm. A very common way to assess this relationship is by examining performance of those industries that specialize in innovation. If it is true that innovation does lead to growth, then those firms who invest in R&D and innovate should grow at a faster speed than those who do not innovate. In the present study, an attempt has been made to study whether innovative firms in the pharmaceutical sector are able to increase their shareholders wealth, i.e., increase the market capitalization.

The pharmaceutical industry has been chosen due to intensive R&D expenditures. Moreover, drug discovery not only requires a very high rate of innovation, but also the cost of innovating new medicine is extremely high. Thus, it will be fascinating to see if R&D intensity increases the market capitalization and shareholder's wealth in case of pharmaceutical industry.

When firms in pharmaceutical industry innovate, they receive patents for their innovation, which entitles them with a temporary monopoly over the market, leading to excess profits. These excess profits raise the market value of the firm. A positive relationship between R&D intensity and market capitalization in our analysis will support Schumpeter's view that innovation is a driving force of a capitalistic economy.

There is a large and increasing demand for innovation in the pharmaceutical industry because of new varieties of diseases that are being faced by the world today. The estimated costs of discovering, developing, and launching a new drug now exceeds 2.5 billion dollars in 2014 (Mullin, R. (2014)). With this high amount of spending and such a dire need for product innovation, the pharmaceutical industry appeared to be a viable selection for the present study.

As mentioned earlier, the present study will assess the impact of R&D intensity, firm size and profit margin on market capitalization as proxied by Tobin's q, with special reference to pharmaceutical sector. An attempt has been made to empirically analyze 25 companies in the pharmaceutical sector listed on both Bombay Stock Exchange and National Stock Exchange listed. The data has been collected for a number of variables on yearly basis, for the period 2005 to 2014, and processed using the regression technique.

Literature Review

R&D necessitates heavy investment outlay, and therefore the firms often wonder, whether the massive R&D expenditures

lead to positive results, in terms of increased market capitalisation. Many researches have been conducted in this area. Several studies show that there is positive and significant relationship between R&D intensity and market capitalisation. On the other hand some studies show that the investment in R&D is not helpful in increasing the market capitalization because of huge time gap between investment and its impact on market capitalization. The increase in market capitalization can be due to multitude of reasons.

Ben-Zion (1978) was the first one who studied the relationship between market value, R&D and advertising capital. He developed a model in which market value was influenced by advertising capital and lagged values of R&D. He showed a positive and significant relationship between market value, profitability and R&D. Many researchers have studied the relationship between market capitalization and R&D by applying Tobin's q models. Hall (1993), Hirschey and Weygandt (1985) and Cockburn and Griliches (1988) applied Tobin's q models and found positive influence of R&D on market value. Hirschey (1982) and Chauvin and Hirschey (1993) used market valuation approaches with similar results. Finally, Bublitz and Ettredge (1989) followed a different approach and used a model that surveyed market reaction. They identified that on an average, the market assesses advertising as short-lived whereas R&D is long-lived. Ballardini et al. (2005) calculated an average coefficient of 0.96 for R&D capital in their meta-study. The results showed that R&D has a robust and positive influence on market valuation. The ideal coefficient is close to 1, i.e., investment in R&D generates as much enterprise value as it costs in the first place. Chung et al. (2003) examined the association between R&D expenditure and the market value of firms for US for the period of 1991– 1995. The results showed a positive relationship between R&D expenditure and market value measured by Tobin's q. Munari and Oriani (2002) examined the same relationship using a hedonic model over the period 1982 to 1997 for six different Eastern European countries. They used OLS regression and showed a positive and significant impact of R&D investment on Tobin's q, but for privatized firms, the coefficient is statistically insignificant.

A major portion of the literature validates that the investment in R&D contributes positively to the enterprise value. But, there are substantial variations between the findings on the extent of the influence. The results have shown the variation at regional and industry level also. Hall and Oriani (2006) examined 2,156 companies of U.S and Europe for the period 1989 to 1998. They concluded positively but with low coefficient of 0.3 for R&D capital in France and Germany and 0.8 in the UK. These figures suggest overinvestment in R&D.

Anne Cazavan-Jeny and Thomas Jeanjean(2006) tested the 197 French firms between 1993 and 2002 to value relevance of R&D reporting. They found that capitalized R&D is negatively

associated with returns and stock prices. This negative coefficient on capitalized R&D implies that investors are concerned with and react negatively to capitalization of R&D.

Duqi and Torlucci (2010) took a sample of 416 European firms over the years 2001 to 2007 and found in their study that R&D had a negative effect in Italy and excessively large influence on market value in the UK, Germany, France and Sweden. Jaruzelski et al. (2005) shared a more cynical view on the relationship. They found no statistical relationship between R&D intensity and a series of corporate performance indicators such as sales growth, profits, market capitalisation or yield.

Variable Specification

Market capitalization is the aggregate valuation of the company based on its current share price and the total number of outstanding stocks. It is calculated by multiplying the current market price of the company's share with the total outstanding shares of the company. Market capitalization represents the public consensus on the value of a company's equity. Tobin's q has been calculated using market capitalization divided by total assets.

Innovative firms maintain their competitive position by minimizing their production costs through the active R&D practices. R&D activity escorts the firm towards new products, product design and production process. It gives the ample opportunity to firm to enter in new market or minimize production costs. The R&D investment of a firm generate some intangible assets which facilitate to speed up future cash flows. Increasing cash flows assist and therefore rise the market value of firm. R&D may be perceived as an asset in the financial markets in that it can generate future profits; however, it is expensed in the current period. The theoretical argument of the previous literatures indicates that R&D investments of a firm contributes to future profits by generating intangible capitals that is evaluated by the stock market. R& D Intensity means R&D Expenditure as a percentage of Net Sales.

Profit Margin is Profit after tax (PAT) as a percentage of Net Sales. PAT is the profitability of the firm which is distributable in nature . PAT has an impact on market capitalization, as, the greater the firm's profitability, the greater the distributable earnings available for shareholders which in turn, increases the firm's value. (Haugen and Baker (1996)

Data Collection

The data has been collected for a period of 10 years from 2005 to 2014 for randomly selected 25 pharmaceutical companies listed on the BSE and NSE using Capitaline software. The data has been collected for the mentioned variables: Market Capitalization, R&D Expenditure, Net Sales, Total Assets and Profitability.

Data Analysis

For determining the impact of firm size, R&D intensity and profit margin on the market capitalization, the technique of multiple regression has been used. The dependent variable is Tobin's q as a proxy for market capitalization and the deterministic variables are firm size, R&D intensity and profit margin. The descriptive statistics for the mentioned four variables are shown in Table 1.

	Mean	Std. Deviation	N
Tobin's q	2.767771	2.0678454	250
Profit Margin	20.852129	99.9832387	250
Size	6.936960	1.0213842	250
R& D Intensity	5.462498	5.1934851	250

Table 1: Descriptive Statistics

The Standard Deviation of size indicates that the companies are more or less of the same size. Moreover, they are spending similar amounts on R&D as a percentage of their respective sales revenue as reflected by the standard deviation which is equivalent to the mean. The standard deviation of profit margin is very high as it is evident from the Table 1. This implies that though the firms are of similar size and spend similar amount of money on R&D activities, the variation in profit margin is very high. It means that the profitability of companies in pharmaceutical industry depend on various other factors and not just R&D intensity. This is because there is a long time gap between the R&D investment and its positive output.

The following table shows the correlation among the variables under consideration.

		Tobin's q	Profit Margin	Size	R&D Intensity
Pearson Correlation	Tobin's q	1	-0.01	0.276	0.148
	Profit Margin	-0.01	1	0.005	-0.029
	Size	0.276	0.005	1	-0.05
	R&D Intensity	0.148	-0.029	-0.05	1
Sig. (1-tailed)	Tobin's q	-	.437	0	0.01
	Profit Margin	.437	-	.467	.322
	Size	0	.467	-	.214
	R&D Intensity	.01	.322	.214	-

Table 2: Correlations

As it is evident from the Table 2, the correlation between the mentioned variables is very low and insignificant.

In order to see the impact of firm's size (measured by Log Sales)on market capitalization as proxied by Tobin's q, the following regression equation was used.

Tobin's q = α + β. Log Sales + eit   (1)

The R^2 was 7.2% and significant as F statistic was 0 . For every 1 unit change in Log sales, there is 0.55 unit change in Tobin's q.

In order to see the impact of R&D Intensity on market capitalization as proxied by Tobin's q, the following regression equation was used.

Tobin's q = α + β. R&D Intensity + eit   (2)

The R2 was 1.8% and significant at 5% as F statistic was 0.019 . For every 1 unit change in R&D Intensity, there is 0.058 unit change in Tobin's q.

In order to see the impact of both firm's size(measured by Log Sales) and R&D Intensity on market capitalization as proxied by Tobin's q, the following regression equation was used.

Tobin's q = α + β1 Log Sales + β2 R&D Intensity + eit   (3)

The R2 was 9.5% and significant as F statistic was 0. For every 1 unit change in Log Sales, there is 0.574 unit change in Tobin's q. For every 1 unit change in R&D Intensity, there is 0.064 unit change in Tobin's q.

To see the impact of profit margin, size and R&D intensity on market capitalization, we run multiple regression by taking Tobin's q as a dependent variable. The following regression has been used:
Tobin's q = α + β1 Profit Margin + β2 Log Sales + β3 R&D Intensity + eit.   (4)

R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
.320	.102	.091	1.9710362	.576

Table 3: Regression Results

The results obtained after running the regression on SPSS are summarized in Table 3. In order to test auto correlation, DW test has been used. The DW statistic is 0.576 which indicates positive auto correlation which may be due to the fact that the data is time series. The coefficient of determination, R2, is 10.2% this indicate that profit margin, size and R&D intensity influence the Tobin's q to the extent of 10%. The F test results show that the model is fit as the F test result is significant as per Table 4.

Model	Sum of Squares	d.f.	Mean Square	F	Sig.
Regression	109.014	3	36.338	9.353	.000
Residual	955.706	246	3.885		
Total	1064.720	249			

Table 4: Anova

Model	Unstandardized Coefficients		Standardized Coefficients	T	Sig.	Collinearity Statistics	
	B	Std. Error	Beta			Tolerance	VIF
(Constant)	-1.569	.875		-1.793	.074		
Profit Margin	.000	.001	-.007	-.113	.910	.999	1.001
Size	.575	.122	.284	4.694	.000	.997	1.003
R&D Intensity	.065	.024	.162	2.682	.008	.997	1.003

Table 5: Coefficients

As per Table 5, the coefficient of profit margin is 0 which shows that the one unit change in profit margin will have no impact on Tobin's q. But the results are insignificant indicating that such relationship is dubious. The Variance Inflation Factor (VIF) test has been used to test the multi-collinearity between the variables. The VIF factor for profit margin is 1.001, which indicates that multi-collinearity is absent.

The coefficient of firm's size is 0.575 which indicates that for 1% change in firm size, there will be 0.575% change in Tobin's q. The VIF factor for firm size is 1.003 which indicates no multi-collinearity with the other two variables.

The coefficient of R&D Intensity is 0.065 which shows that for one unit change in R&D Intensity, there will be 0.065 unit change in Tobin's q. Also, the VIF factor for R&D Intensity is 1.003, indicating no multi-collinearity with the other two.

Conclusion

The present study shows that R2 is 10%. This leads to the conclusion that in pharmaceutical industry, R&D intensity, size and profit margin collectively influence the market capitalization as proxied by Tobin's q, to the extent of 10%. The descriptive results shows that the companies which are included in data are of similar size and they spend almost similar amount on research and development activities but the profitability spread is very high. The impact of R&D intensity, as the only independent variable, on Tobin's q is only to the extent of 1.8%. This means that expenditure in R&D activity is a necessity for pharmaceutical companies in spite of the fact that it has almost no impact on the market capitalisation. It may be possible that R&D intensity will have more impact on market capitalisation in case of manufacturing or FMCG industries. The impact of firm's size, as the only independent variable, on Tobin's q is to the extent of 7.2%. Collectively the impact of firm's size and profitability on Tobin's q is 9.5%.

When the impact of all the independent variables in the present study was analysed on Tobin's q using the technique of multiple regression, it was found that the impact is 9.14%. The multi-collinearity among the variables is tested by using VIF. The result shows that there is no multi-co linearity between the variables. DW test showed positive autocorrelation which may be due to presence of time series data. Thus, it can be concluded that the R&D intensity has positive but little impact on market capitalization as proxied by Tobin's q in the Pharmaceutical Industry .

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Appendix

S No.	Name of the Company
1	Aarti Drugs
2	Ajanta Pharma
3	Aurobindo Pharma
4	Cadila
5	Cipla
6	Divis
7	Dr Reddy Labs
8	FDC
9	Glenmark
10	GSK Pharma
11	Hikal Ltd
12	Indoco
13	IPCA
14	J B Chemicals
15	Jubilant
16	Lupin
17	Natco Pharma
18	Novartis
19	Piramal Enterprises
20	Sanofi India
21	Shasun Pharma
22	Sun Pharma
23	Suven Life Sciences
24	Unichem
25	Torrent