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DOES THE STOCK MARKET ACKNOWLEDGE THE R & D EFFORT BY FIRMS?: EVIDENCE FROM INDIAN STOCK MARKET

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Abstract: *This paper aims at examining the impact of research and development expenditure on stock market returns of the Indian corporate firms. The study is based on the sample of Indian NSE listed firms during 2002 to 2014. The panel data method of analysis is used to examine the relation between R & D expenditure and stock market return. The study also examines the effect of R & D expenditure on, Return on Assets and Volatility of Market Value of the firm. The empirical studies examining the effects of R & D expenditure on firm value are not found in the context of Indian listed companies. The present study contributes to the extant literature by examining the relation between R & D expenditure and the firm value of the listed Indian corporate firms. The findings of the study suggest that stock market returns do not show positive effect of the research and development expenditure. These findings have important implication for the policy makers. In view of the recent policy initiatives in form of Make in India and emphasis on indigenous production, it is pertinent to examine the status of research and development expenditure by firms in India and its impact on firm performance in terms of market value and volatility. If the relation between the market value of the firm and its R & D expenditure is established, the firms would have an incentive to increase their R & D effort.*

1. INTRODUCTION

This paper aims at examining the impact of research and development expenditure on stock market returns of the Indian corporate firms. The research and development activity or innovation is the primary factor generating short term profits according to Schumpeter. Schumpeter identified innovation as the critical dimension of economic change (Pol & Carroll, 2006). The research and development expenditure (R& D) by firms is one of the most significant yet largely neglected factor having important implications for firm valuation at microeconomic level. Since the market value of a firm is determined by the value of its assets and research and development expenditure forms a part of intangible assets, the rise in research and development expenditure is

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expected to be reflected in the rise in its market value, other things remaining the same. Thus, the R & D expenditure does affect firm valuation through asset value. The valuation models do not recogni the contribution of higher R & D expenditure directly in increasing the market value of the firm.

At macroeconomic level, according to modern growth theory, innovation is one of the major factors contributing to economic growth. The value of the firm is determined by the value of its total assets and return on assets. The assets include tangible as well as intangible assets.

In spite of this microeconomic and macroeconomic importance of research and development activity, the literature on market value of firm does not explicitly recognize the influence of research and development expenditure by the firms.

The empirical studies examining the effects of R & D expenditure on firm value are not found in the context of Indian listed companies. The present study contributes to the extant literature by examining the relation between R & D expenditure and the firm value of the listed Indian corporate firms. This paper aims at examining the impact of research and development expenditure on stock market returns of the Indian corporate firms. The study is based on the sample of Indian NSE listed firms during 2002 to 2014. The panel data method of analysis is used to examine the relation between R & D expenditure and stock market return. The study also examines the effect of R & D expenditure on, Return on Assets and Volatility of Market Value of the firm. As the empirical studies examining the effects of R & D expenditure on firm value are not found in the context of Indian listed companies, the present study contributes to the extant literature. The findings of the study suggest that stock market returns do not show positive effect of the research and development expenditure .These findings have important implication for the policy makers. In view of the recent policy initiatives in form of 'Make in India' and emphasis on indigenous production, it is pertinent to examine the status of research and development expenditure by firms in India and its impact on firm performance in terms of market value and volatility. If the relation between the market value of the firm and its R & D expenditure is established then the firms would have an incentive to increase their R & D effort.

The study is divided into five sections. The first introductory section provides an overview of the accounting framework of the R & D expenditure and the trends and composition of the R & D expenditure by the Indian corporate firm , the second section provides a literature survey. The data and methodology is explained in the third section and the empirical findings are presented in the fourth section. The fifth section provides conclusions of the study.

1.1. Status of R& D Expenditures in the Accounting Framework and its implications

With reference to the definitions given by the Indian Accounting Standards, (IAS: Section 8), "Research is defined as original and planned investigation undertaken with

the prospect of gaining new scientific or technical knowledge and understanding." IAS defines development activity by a firm a, "Development is the application of research findings or other Knowledge to a plan or design for the production of new or substantially improved materials, devices, products, processes, systems or services prior to the commencement of commercial production or use (IAS: Section 26)."

It is difficult to capture the effect of research and development expenditure by firm on its market value. Many conceptual and reporting issues arise in estimating this effect. The conceptual issue is estimation of the extent to which the stock prices in India reflect the R & D expenditure. In an efficient market, the stock price impounds the value of a firm's R&D capital along with other intangible assets, so there is no association between R&D intensity and future stock returns (Chan, 2001).

The empirical issue arises because, the R& D expenditure is a capital expenditure a large amount is spent initially for a few years on R & D activity the results of which are uncertain. This is reported under the "Asset - capital work in progress" head of the balance sheet. If the R& D activity is successful then it will be reflected in the income statements and has impact on costs and profits. If, however, it is not fruitful then it will not be reported under the income statements. Due to this malleable nature the effect of R & D on usual valuation ratios remains hazy.

Another measurement issue is of time lag between the R & D spending by the firm and its fructification. The successful R & D expenditure gets reflected in the value of the firm through increased profitability and return on assets; but only after the gestation period. So to measure its effects on the stock market return one has to take into account the time lag.

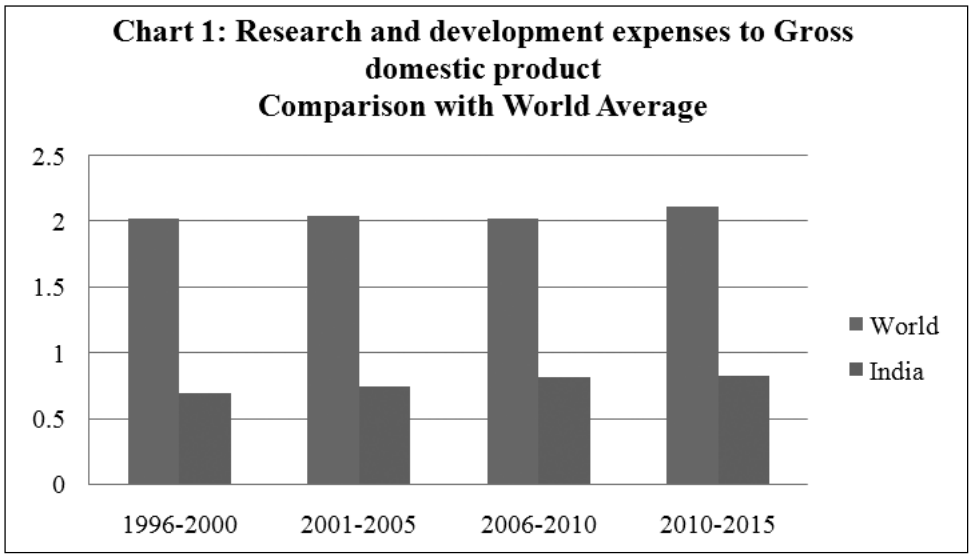
In spite of all these problems, examining the effect of R & D on market valuation is worthwhile because it is not only important for firm value in the Schumpeterian sense but also extremely important for economic growth of a nation. If the R & D expenditure proves to have a positive impact on the market value of a firm, it will be an incentive to the firms to increase their R & D effort. It is an evidence of the commercial market recognition of firm's entrepreneurship, dynamism and contribution to the constant human endeavor for betterment of its race.

1.2. Segment wise Status of R& D Expenditure in India

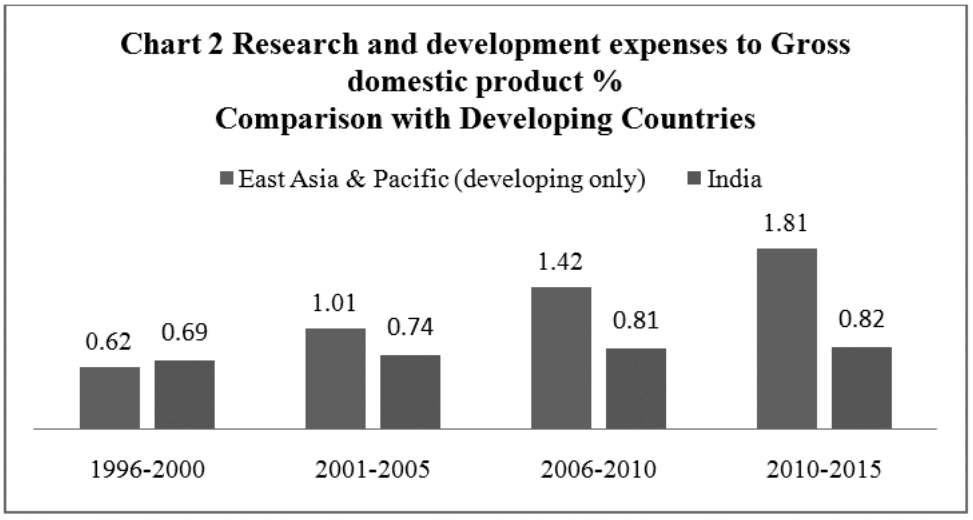
Research and development activity comprises basic research, applied research and experimental research as well. R & D to GDP ratio reflects the intensity of Research and development in manufacturing and service industry.

It is observed that R & D to GDP ratio for India is nearly 0.8% of their GDP on research and development expenses.It is less than 50% of the world average expenditure on R & D.

The above chart 2 shows that the ratio of research and development expenditure to GDP of India is less than that of the developing countries in East Asia and Pacific region.



(*Source*: World Bank Database on R & D Expenditure, World Bank)



(*Source*: World Bank Database on R & D Expenditure, World Bank)

To examine the sector wise status of R & D expenditure we have classified the listed Indian corporate firms in various sectors according to the CMIE Prowess database.

The following table 1 shows sector wise composition of R & D expenditure as percentage of total sales revenue.

It is observed that R & D expenses to sales ratio is less than 1% for all sectors except for "Chemical Sector".

Table 1
Sector Wise Share of R & D expenditure to Total Sales Revenue in India(%)

Year	*Auto*	*Chemical*	*Consumer products*	*Food*	*Industrial Product*	*IT*	*Steel*	*Tobacco*
2002	0.009	0.019	0.004	0.001	0.001	0.001	0.002	0.001
2003	0.007	0.022	0.003	0.003	0.001	0.002	0.002	0.001
2004	0.007	0.030	0.003	0.003	0.001	0.009	0.002	0.002
2005	0.006	0.041	0.003	0.003	0.000	0.005	0.002	0.002
2006	0.005	0.047	0.004	0.002	0.000	0.002	0.001	0.002
2007	0.005	0.045	0.003	0.001	0.000	0.002	0.001	0.002
2008	0.004	0.043	0.003	0.001	0.003	0.002	0.004	0.002
2009	0.003	0.041	0.003	0.001	0.003	0.007	0.005	0.003
2010	0.003	0.038	0.003	0.001	0.003	0.009	0.005	0.003
2011	0.004	0.044	0.004	0.001	0.003	0.010	0.004	0.003
2012	0.007	0.047	0.005	0.001	0.003	0.010	0.003	0.002
2013	0.009	0.050	0.003	0.001	0.003	0.010	0.003	0.002
2014	0.008	0.056	0.002	0.001	0.003	0.008	0.002	0.002

(*Source*: Derived from CMIE Prowess Database)

2. LITERATURE SURVEY

The literature on research and development expenditure in finance is conspicuous by its scarcity. The empirical studies are found on the factors determining R & D expenditure. Most of these studies are either country specific or sector specific. For example, Cumming & Macintosh (2000) examines the relative importance of a multitude of factors for the allocation of expenses towards R & D. It finds multiple factors like firm size, debt equity ratio, competition and demand pull factors as determinants of R& D expenditure by firms.

Some studies on the impact of R& D expenditure on firm performance focus on the sales revenue and profits as the measure of firm performance (Sherer, 1965; Nolan et al,1980; Hall 1987; Geroski and Toker, 1996; Choi and Williams ,2013).

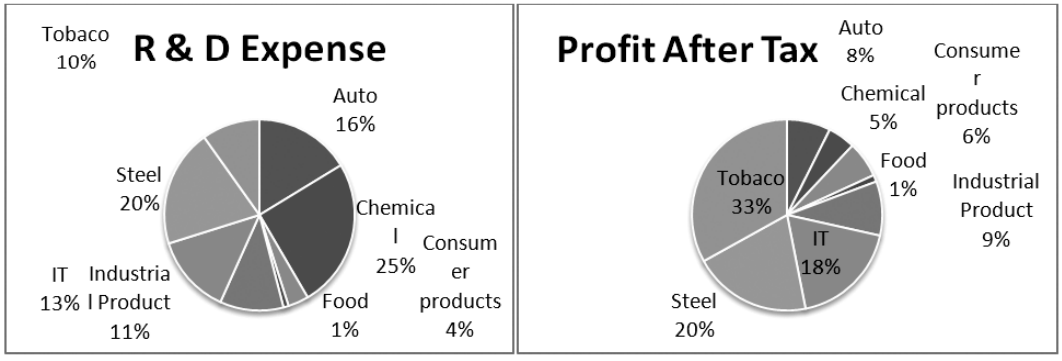


Chart 2: Sector Wise Average R & D Expenses and Profit after tax composition

(*Source*: Derived from CMIE Prowess Database)

Among the very few studies on impact of R& D expenditure on stock market return are country specific and sector specific. Ozturk&Zeren,(2015) analyze the effects of research and development (R&D) activities on firm performance are manufacturing firms data in Turkey and finds that R&D expenditures have a positive effect on sales growth in the manufacturing industry. Duqi & Torluccio, (2010) show the strong positive and significant influence of R&D expenditure on firm market value. Mojtahedzadeh & Abedi(2010), study the *R*&D expenditure of pharmaceutical companies and find no impact on market value of the pharmaceutical companies.

Gollotto & Kim (2003), examined the effects of the R&D expenditure of Dot Com companies on the market value. They find that the increased R & D expenditure is expected to indicate higher future growth of the firm and thus is reflected in an increase in stock price.

(Chan, Lakonishok, & Sougiannis, 2001) , finds that US stock returns value the research and development expenditures. The firms with high R & D expenditures get higher returns. However, R & D expenditure has positive relation with market volatility.

Kim et al., (2011), investigates the value relevance of R&D investment and the reactions of investors in Korean stock markets over the period of 2001-2008. This paper examines whether R&D investment is associated with equity value and whether the information of R&D investment is truly reflected on the Korean stock markets. Consistent with the hypothesis and prior researches, the empirical results of this paper documents that R&D investment is significantly related to the market value of equity and Korean investors quickly recognize the implication of R&D investment information.

Eberhart, Maxwell, & Siddique, (2004) examine a sample of 8,313 cases, between 1951 and 2001, where firms unexpectedly increase their research and development (R&D) expenditures by a significant amount. Their sample firms experience significantly positive long-term abnormal operating performance following their R&D increases. Their findings suggest that R&D increases are beneficial investments, and that the market is slow to recognize the extent of this benefit consistent with investor under reaction.

However the evidence from UK shows a relationship between stock price of a firm and its current as well as previous R&D expenditure (Stark and Thomas, 1998;Akbar and Stark, 2003; Shah *et al*., 2007; Hughes, 2008)

Anagnostopoulou (2008) studied the relationship between R&D activities and market reactions from 1978 to 2007. Results indicated a very strong positive relationship between R&D and market reactions. He observed that R&D intensity appears to be associated with the improvement in the persistence in operating growth but only among firms that engage in R&D as a result of the industry they belong to.

Xu (2005) studies pharmaceutical industry in USA from 1998 to 2001. He finds that R&D strategy has a significant impact on lowering stock price instability

(Franzen and Radhakrishnan, 2009), show that the valuation multiplier on R&D expenditures is likely to be negative for profit firms. This occurs because the linear information dynamics assumption of the residual-income model is more appropriate for profit making firms than loss making firms. Earnings of profit firms are likely to contain information on the future benefits of R&D activity,however, earnings of loss firms do not contain such information. The empirical evidence confirms our predictions for profit and loss firms. An important implication of our findings is that understanding the role of the R&D expense line item in valuation across firms and within firms, across time depends on whether the linear information dynamics assumption of the residual-income model is applicable for the sample of firms under investigation.

The study on effects of R & D expenditure of firms on stock market returns with reference to Indian corporate sector is not found in the literature.

Thus the literature shows that the studies on R & D expenditure and market performance of the firms are fragmented .Many studies limit their analysis to one specific industry and very few studies focus on the entire industrial sector. The study on R& D expenditure in India and its effects on the firm's stock price and stock volatility are not found in the literature. The present study aims at filling this void.

3. DATA AND METHODOLOGY

The study is based on the data of corporate firms listed at National Stock Exchange of India (NSE).The period of study is from 2002 to 2014. The data is transformed into a strongly balanced panel after removing the gaps. The panel data model is applied to the forty four firms listed in Nifty index. The data represents eight important industrial sectors including Automobiles, Chemical, Food, Industrial Product, Consumer products, Tobacco and Steel from the manufacturing sector and Information technology from the service sector.The following Table 2 shows the sector wise composition of the sample.

Table 2
List of sectors included in the sample

Sector	*No of firms*
Automobiles	12
Chemical & Pharmaceuticals	11
Consumer products	4
Food&Beverages	4
Industrial Products	2
Information & Technology	6
Steel	4
Tobacco	1
Total	44

4. EMPIRICAL ANALYSIS

4.1. Hypotheses

The study aims at answering three questions:

1. Does the increase in R & D expenditure by a firm increase its stock market return?
2. Does the increase in R& D expenditure by firm increase its profitability
3. Does the increase in R& D expenditure by a firm decrease the volatility of stock market return?

Based on the above questions the study will test three hypotheses with respect to the corporate sector in India:

H1: R & D expenditure by a firm has positive and significant effect on its stock market return.

H2: R & D expenditure by a firm has positive and significant effect on its profits.

H3: R & D expenditure by a firm and its volatility are positively related.

4.2. Model Specification

The hypotheses are formally specified in terms of the following three models.

The first model examines the effect of R& D expenditure on Stock market return. The dependent variable is the natural log return of stock price of the firm .Independent variables are log of R& D effort in terms of ratio of R& D expenditure to Sales, log of ratio of book value of the firm to market value, volatility of the firm in terms of variance of its market value and the ratio of intangible to market value, return on assets is added as a control variable.

Following equations specify the above model:

Model 1

The first model examines the effect of R&D expenditure on stock market return of the firm. The dependent variable is the log return on stock price of the firm .The independent variables are: log of R&D effort in terms of ratio of R&D expenditure to Sales, log of ratio of book value of the firm to market value, volatility of the firm in terms of variance of its market value and the ratio of intangible to market value and return on assets as a control variable to adjust for the differences in the size of the firm.

$$\text{Stock Market Return}_{it} = \text{Ln(RD/Sales)it} + \text{Ln(BK/MV)}_{it} + \text{MKTVOL}_{it} + \text{Ln(MV)} + \text{INT/MV}_{it} + \text{ROAit}$$

Where,

$Ln\ (RD/Sales)_{it}$ = Natural log of the ratio of R& D expenditure to total sales revenue of the firm i during time period t

$Ln\ (BK/MV)_{it}$ = Natural log of the ratio of book value of the firm i to its market value during time period t

LN (MV) = Size of the firm in Market

$MKTVOL_{it}$ = Variance of the market value of the firm i in terms of value of shares outstanding during time period t

INT/MV_{it} = The value of intangible assets of the firm i to its market value during time period t

ROA_{it} = Return on assets firm i during time period t.

Model 2

The second model examines the effect of R& D expenditure on return on assets. The dependent variable is the return on assets to represent the profitability of the firm. The independent variables are log of R& D effort in terms of ratio of R& D expenditure to Sales, log of ratio of book value of the firm to market value, volatility of the firm in terms of variance of its market value and the ratio of intangible to market value.

$$ROA_{it} = Ln\ (RD/Sales)_{it} + Ln(BK/MV)_{it} + MKTVOL_{it} + INT/MV_{it}$$

Where,

ROA_{it} = Return on assets firm i during time period t

$Ln\ (RD/Sales)_{it}$ = Natural log of the ratio of R& D expenditure to total sales revenue of the firm i during time period t

$Ln\ (BK/MV)_{it}$ = Natural log of the ratio of book value of the firm i to its market value during time period t

$MKTVOL_{it}$ = Variance of the market value of the firm i in terms of value of shares outstanding during time period t

INT/MV_{it} = The value of intangible assets of the firm i to its market value during time period t

Model 3

The third model examines the effect of R&D expenditure on market volatility of the firm value. The dependent variable is the variance of market value of the firm to represent the market volatility of the firm .The independent variables are: log of R& D effort in terms of ratio of R& D expenditure to Sales, log of ratio of book value of the firm to market value, volatility of the firm in terms of variance of its market value and the ratio of intangible to market value and return on assets as a control variable.

$$MKTVOL_{it} = Ln\ (RD/Sales)_{it} + Ln(BK/MV)_{it} + + INT/MV_{it} + ROA_{it}$$

Where,

$MKTVOL_{it}$ = Variance of the market value of the firm i in terms of value of shares outstanding during time period t

$Ln\ (RD/Sales)_{it}$ = Natural log of the ratio of R&D expenditure to total sales revenue of the firm i during time period t

$Ln\ (BK/MV)_{it}$ = Natural log of the ratio of book value of the firm i to its market value during time period t

INT/MV_{it} = The value of intangible assets of the firm i to its market value during time period t

ROA_{it} = Return on assets firm i during time period t

The correlation matrix shows that there exists no correlation between the independent variables selected for the model.

Table 3
Correlation matrix

Variables	*lnrdsales*	*lnmv*	*bvmv*	*mvvol*	*int_assetmv*	*roa*	*stockreturn*
lnrdsales	1						
lnmv	-0.6373	1					
bvmv	-0.0603	-0.0235	1				
mvvol	-0.1018	0.1788	-0.0454	1			
int_assetmv	-0.1839	0.0471	0.1033	-0.1401	1		
roa	-0.1916	0.4425	-0.1491	0.1363	-0.2193	1	
stockreturn	-0.102	0.1119	-0.2372	-0.0548	0.1387	0.3612	1

4.3. Model Selection for Panel Data Analysis

For each model, pooled OLS regression is tested on the data. As expected the results were not significant. The data is a strongly balanced panel .The fixed effects Least Squares Dummy Variable (LSDV) model and Random effects generalized least squares model (GLS) is run on the data. To select the panel data model appropriate for the data, the Hausman test is applied .The results are presented in the following table no. 4. For Model 1 and Model 3, fixed effects model is selected based on the Hausman test and F statistic. For model 2 Random effect model is selected based on the Hausman test and Breusch pagan Lagrange Multiplier test.

Table 4
Model Selection:

Model	*Selected Model*
Model 1	Fixed Effect Model***
Model 2	Random Effect Model*
Model 3	Fixed Effect Model***

Note: Test Statistic *** p<0.01, ** p<0.05, * p<0.1

4.4. Results of the Empirical Analysis

The following table 5 presents the summary of the results of the empirical analysis.

Table 5
Summary of Results

	Model 1: Dependent Variable : Stock Market Return		
Independent Variables	*Coefficient*	*Std. Error*	*P-value*
Ln(RD/Sales)	-0.003	0.003	0.280
Ln(MV)	-0.011	0.002	0.000
Ln(BK/MV)	-0.295	0.040	0.000
MKTVOL	-0.027	0.008	0.000
INT/MV	0.101	0.021	0.000
ROA	1.108	0.065	0.000

	Model 2: Dependent Variable : Return on Assets		
Independent Variables	*Coefficient*	*Std. Error*	*P-value*
Ln(RD/Sales)	-0.002	0.002	0.208
Ln(MV)	0.011	0.001	0.000
Ln(BK/MV)	-0.058	0.026	0.029
MKTVOL	0.007	0.005	0.160
INT/MV	-0.053	0.014	0.000

	Model 3: Dependent Variable : Market Volatility		
Independent Variables	*Coefficient*	*Std. Error*	*P-value*
Ln(RD/Sales)	0.028	0.017	0.109
Ln(MV)	0.040	0.013	0.002
Ln(BK/MV)	-0.042	0.228	0.854
INT/MV	-0.530	0.118	0.000
ROA	0.595	0.367	0.105

Note: Test Statistic *** p<0.01, ** p<0.05, * p<0.1

4.5. Findings of the Empirical Analysis

As shown by the results of the empirical analysis:

1. The research and development expenditure of the firms in the sample is not significantly reflected in the stock market returns of the firms. A one percent increase in research and development expenditure decreases the stock market return by 0.03% .This effect is statistically weak. We fail to accept the first hypothesis that, R & D expenditure by a firm has positive and significant effect on its stock market return.
2. A one percent increase in R & D expenditure decreases the profitability by 0.02%. The result is statistically weak. Hence, we fail to accept the second hypothesis H2: that R & D expenditure by a firm has positive and significant effect on its profits.
3. The impact of R& D expenditure on volatility of current market returns is positive with 10% level of significance.Thus we fail to reject the third hypothesis H3: that R & D expenditure by a firm and its volatility are positively related.

4. The market value of the firm (the value of shares outstanding) shows a weak negative statistically significant relation with the stock market return on the firm's stock. The market value shows a weak positive relation with both profits and stock price volatility of the firm .This relation is also statistically significant.
5. The ratio of intangible assets to market value shows that a one percent increase in this ratio increases stock market return by 10%. A one percent increase in intangible assets to market value ratio will decrease the profitability as well as the market volatility by 5%.

5. CONCLUDING REMARKS

The study examines the association between the market value of the firm and the research and development expenditure by the firm. The panel data model on forty four NSE listed Indian firms is used to analyze the data .The empirical results of the panel data analysis of the sample firms during the period 2002 to 2014, indicate that the research and development expenditure of the firms in the sample is not significantly reflected in the stock market returns of the firms. This implies that the market in India does not consider the significance of current R& D expenditure by the firms. The market stock price and thus the firm value is related to the current profit in India. The stock market is not valuing the R & D effort of the firms unless it is fructified and reflected in the higher profits. This implies that the R & D effort in terms of the current R& D expenditure by the firms is not incentivized by the stock market. As a result the firms prefer spending more on the marketing and sales expenses to increase market share rather than spending on R & D. The low level of R & D expenditure as a percentage of GDP reflects this apathy toward R & D. To increase the research and development expenditure in India, can be increased only with the increase in the R & D spending of each firm .The study shows that the impetus for the R & D spending cannot come by way of increased market price, hence, the public intervention is called for. These findings indicate that Government should undertake policy measures to incentivize the firms to motivate them for higher level of spending on research and development should be adopted. The study also highlights the despicable portion of research and development spending by the corporate sector across last ten years. In this light the current policy of various incentives under Make in India scheme are fully justified.

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