Empirical Investigation of Growth Opportunity in Information Technology and Oil and Gas Industries

Ruchi Kulkarni, Balasundram Maniam, and Geetha Subramaniam

***Abstract*—A growth opportunity is an investment or project that has the potential to grow significantly, leading to profits for the investor. New investments are often presented to potential investors as growth opportunities. The objective of this study is to use a multiple regression model to observe the impact of firm size, financial leverage, and R&D investment in generating growth opportunities in Information Technology and Oil and Gas Industries. This study uses yearly data from 1999 to 2012, collected from S&P Research Insight. It is hypothesized that firm size, firm's debt level and investments in research and development play a crucial role in the growth opportunities of these two industries. The results provide some clues about which of these variables are important in the growth opportunities of these two industries.**

***Index Terms*—Growth opportunity, information technology industry, oil and gas industry.**

I. Introduction

It is an undisputable fact that information technology leads the way in the development of any nation. It can be considered as an infrastructure on which the nation stands. On the other hand, oil and gas may not be an industry that runs every nation, but the nation cannot survive without the contributions provided by the oil and gas industry. Growth and development of these two industries is a requisite for people to survive in the long run.

Firm size decides the availability of substitute funding resources while financial leverage is important because innovation cannot be financed by returns from a firm's regular operating cycle and research and development (R&D investments create assets of intangible nature. Investors' belief and expectations determine the extent to which R&D investments affect stock performance. Some other factors are R&D expenditure to market value of equity ratio, debt ratio, planned R&D increases, and growth opportunities [1].

This study differs from existing literature in several ways. First, the effects of firm characteristics such as firm size, financial leverage, and R&D investment on the growth opportunities of a firm is examined. Second, comparisons are made on the information technology of oil and gas industries, which is not common in past available literature.

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II. Literature Review

Reference [2] discussed in detail how product innovation is affected by R&D expenditure and firm size. Firms which have a bigger product array, due to investments in R&D, have a higher proclivity to introduce new products to the market. They also show that the firm's age has a positive effect on its ability to innovate. By looking over a long period, the study found that the firm's organisational features and circumstantial aspects affect introduction of new components in the market.

Another study by [3] looked at the effects of firm size, financial leverage, and R&D expenditure on firm's earnings which differ considerably across earning quantiles. The paper analyses the relationship between the three factors and firm earnings by looking at different statistical tools such as ordinary least squares (OLS), least absolute deviation (LAD) and others.

In an earlier study, [4] explained how market value of R&D affects firms of all sizes in United Kingdom. The study showed that market in not obsessed with short-term profitability of firms; it realizes the long-term benefits that are accumulated from the investments in R&D for firms of all sizes. It also proves that there is no advantage of large firms over small firms and finally, it looks at the valuation influences of R&D investments.

Another study on firms' R&D intensity and the risk of its common stock by [1] examined a sample of firms, and found that firms which have high market capitalisation power, are more lucrative, and are more R&D intensive than other American firms are. It proves how R&D intensity is positively related to systematic risk in stock market and also that R&D intensive firms differ in operating leverage but they all carry less financial leverage.

In discussing the determinants of firm leverage, [5] studied a sample of manufacturing firms from China between 2003 and 2006. They proved that the private firm financing the amount of leverage is negatively related to profits, liquidity, and age and positively related to firm size and average leverage ratio.

Another study which looked at empirical determinants of equity risk discussed the analysis of the firm's underlying characteristics, specifically, the firm's size, its financial leverage, and its dividend record [6]. They discussed how empirical investigations on analysing the theory of advancement in capital theory and its application to corporate finance, investment policy, and portfolio analysis are taking place.

Reference [7] discussed how by automating existing operations many organisations are improving their efficiency.

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They compared firm size, leverage, and profitability to see the impact of using accounting information systems. By using regression analysis, they proved that the use of accounting information systems has substantial influence on the profitability of the firm.

Reference [8] studied how each business faces investment opportunities and by continuing the business, it is making a choice about reinvesting the capital. A company has to invest heavily in a new project to start, but to reap its full benefits it has to wait until the project reaches its mature stage. The advances in technological resources and globalisation are creating enormous growth opportunities but the miscalculation of risk is also high.

Reference [9] discussed the empirical analysis to identify the relationship between scale and scope of the firm and information technology (IT) investments. The results of the study indicate that there is a positive relation between levels of IT investment and the degree of firm diversification. It implicitly suggests that there is a greater need for coordination of assets.

III. Data and Research Methodology

Developing plans to encourage growth opportunities is a vital objective for any industry. In this paper, we have identified three independent variables as the factors affecting growth opportunity. They are firm size, financial leverage, and investments in R&D. Empirical analysis are performed on data provided by Standard and Poor's Compustat Database for the years 1999-2012 (14 years). For the IT industry, 551 observations were available, whereas for the oil and gas industry, information of 578 companies were gathered. Due to missing information for many companies, we narrowed the sample size of 50 companies was used for both, the IT and oil and gas industries. The multiple regression analysis was used to identify if the model was a good fit for analysis.

Previous studies have employed similar dependent variable as well these three independent variables. Firm size is measured by the natural logarithm of a firm's net sales. For financial leverage, natural log of debt ratio is used. Investments in R&D are defined by taking a natural log of R&D expenses. Proxy for growth opportunity was computed by taking natural log of market value of total equity divided by multiplication of book value per share and common shares outstanding [1]. The Table I below provides the proxies of these variables as explained above and these variables definitions are derive from Standard and Poor's Research Insight database.

TABLE I: Definitions of Variables Used in the Study

Variable	**Proxies**
Growth Opportunity	LN(MKVAL/BKVAL*CSTK)
Firm Size	LN(SALE)
Financial Leverage	LN(DAT)
R&D Investments	LN(XRD)

where MKVAL stands for the market value of equity, BKVAL stands for the book value per share, CSTK stands for the common stock outstanding, SALE stands for net sale, DAT stands for the debt ratio, XED stands for research and development expenses, and LN stands for natural logarithm.

Preview of the results:

Firm Size should have a positive effect on growth opportunity of a company. The bigger the size of the firm in terms of paper, the higher will be the net sales giving a boost to the growth opportunity of the firm.

Financial leverage should have a negative effect on the growth opportunity. The smaller debt ratio indicates that the company has more assets than debt. The higher this ratio, the more leveraged the company and the greater its financial risk.

Investments in R&D should have a positive effect on the growth opportunity of a company. The more a company invests in R&D, the higher are its chances of making a new or improved product which in turn may positively affect the growth opportunity of the company.

The results of this study will provide more insight on how the growth opportunity (dependent variable) of a firm is influenced by firm size, financial leverage, and investments in R&D (independent variables). In the long run, more awareness is important in promoting growth opportunity for any industry to survive.

IV. Empirical Results

IT-Data of 50 IT Companies Using All Three Independent Variables. First, we performed the regression analysis using all three independent variables on growth opportunities of IT companies. The results are shown on Table II-Table IV.

TABLE II: Model Summary of IT Companies with All Three Independent Variables*

Model	R	R Square	Adjusted R Square	Std. Error of Estimate	Durbin Watson
	0.163	0.027	0.018	2.8812420	1.979

*Predictors: Constant, R&D investments, financial leverage, firm size.

Table II shows that the Durbin-Watson value is 1.979, indicating that there is no autocorrelation in the sample data. This means the error terms of the different time periods are linearly unrelated.

TABLE III: ANOVA For IT Companies with All Three Independent Variables*

Model	Sum of Squares	DF	Mean Square	F	Sig.
Regression	79.206	3	26.402	3.18	0.024
Residual	2897.243	349	8.302		
Total	2976.449	352			

*Predictors: Constant, firm size, financial leverage, R&D investments.

Table III shows that the model's F-statistic is 3.18 and it is significant at 5%, which suggests that there is enough evidence to support the validity of the model. The R-square value is an indicator of how well the model fits the data. However, the R-square is very small. Only 2.7% of the variation in growth opportunity (y) is explained by the changes in firm size, financial leverage, and R&D investments and this regression model is further used to predict y reduces the error by only 2.7%. In other words, 2.7% of the original variability is explained, and there is 97.3% residual variability left. This would also mean that we may have to look at other variables to further explain these variations. More will be discussed in the limitation of the study section later.

TABLE IV: MODEL COEFFICIENTS OF IT COMPANIES WITH ALL THREE INDEPENDENT VARIABLES*

Model	Standardized Coefficients		Standardized Coefficients	T	Sig.
	B	Std. Error	Beta		
Constant	6.377	.498		12.798	.000
Firm Size	-.019	.067	-.015	-.276	.783
Financial Leverage	.153	.082	.099	1.861	.064
R&D Investment	.393	.153	.136	2.567	.011

*Predictors: Constant, firm size, financial leverage, R&D investments.

The results in Table IV shows that R&D investment is significant at the five percent level whereas the financial leverage is significant at the ten percent level, but the that the firm size is not significant. Hence, we decided to further test the regression model using only the two significant independent variables (financial leverage and R&D investments) and these results are shown in the Tables V through VII below.

IT-Data of 50 IT Companies Using Two Independent Variables (Financial Leverage, R&D Investments)

TABLE V: MODEL SUMMARY OF IT COMPANIES WITH FINANCIAL LEVERAGE AND R&D INVESTMENTS*

Model	R	R Square	Adjusted R Square	Std. Error of Estimate	Durbin Watson
	0.166	0.028	0.023	2.8297019	1.989

*Predictors: Constant, financial leverage, R&D investments.

Durbin-Watson value is 1.989 as shown in Table V, which means that there is no autocorrelation in the sample data. Adjusted R-square went up from 0.018 to 0.023 indicating that firm size in not beneficial for this analysis. Hence, removing firm size from further analysis seem to make sense. Similarly, the ANOVA for this model is shown in the following table.

TABLE VI: ANOVA FOR IT COMPANIES WITH FINANCIAL LEVERAGE AND R&D INVESTMENTS*

Model	Sum of Squares	DF	Mean Square	F	Sig.
Regression	86.972	2	43.486	5.431	0.005
Residual	3058.755	382	8.007		
Total	3145.727	384			

*Predictors: Constant, financial leverage, R&D investments

As shown in Table VI, the model's F-statistic is 5.43 and it is significant at 1%, which suggests that there is enough evidence to support the validity of the model. The R-square value is an indicator of how well the model fits the data. R-square is very small whereby only 2.8% of the variation in growth opportunity (*y*) is explained by the changes in firm size, financial leverage, and R&D investments and this regression model is further used to predict y reduces the error by only 2.8%. In other words, 2.8% of the original variability is explained, and 97.2% residual variability is left.

The significance of these two independent variables for model are shown in Table VII.

The results in this Table VII clearly shows that R&D investment is significant at the five percent level whereas the financial leverage is significant at the ten percent level. Therefore in the case of the IT companies, only financial leverage and R&D investment seem to play a role in growth opportunities of these type of firms.

TABLE VII: MODEL COEFFICIENTS OF IT FIRMS WITH FINANCIAL LEVERAGE AND R&D INVESTMENTS*

Model	Standardized Coefficients		Standardized Coefficients	T	Sig.
	B	Std. Error	Beta		
Constant	6.32	.387		16.316	.000
Financial Leverage	.148	.079	.095	1.878	.061
R&D Investment	.405	.144	.142	2.816	.005

*Predictors: Constant, financial leverage, R&D investments.

Next, we proceed with the analysis of the oil and gas companies in the same manner. The result are discussed in the following section.

Oil and Gas-Data of 50 Oil and Gas Companies Using All Three Independent Variables.

We start the regression analysis using all three independent variables on growth opportunities of the oil and gas companies. These results are shown on Table VIII-Table X below.

TABLE VIII: MODEL SUMMARY OF OIL AND GAS COMPANIES WITH ALL THREE VARIABLES*

Model	R	R Square	Adjusted R Square	Std. Error of Estimate	Durbin Watson
	0.524	0.275	0.270	2.4781395	1.889

*Predictors: Constant, firm size, financial leverage, R&D investments.

Table VIII shows that the Durbin-Watson value is 1.889, again indicating that there is no autocorrelation in the sample data. Similarly, the ANOVA for the oil and gas companies are shown in Table IX below.

TABLE IX: ANOVA FOR OIL AND GAS COMPANIES WITH ALL THREE INDEPENDENT VARIABLES*

Model	Sum of Squares	DF	Mean Square	F	Sig.
Regression	968.970	3	322.990	52.594	0.000
Residual	2554.729	416	6.141		
Total	3523.699	419			

*Predictors: Constant, firm size, financial leverage, R&D investments.

TABLE X: MODEL COEFFICIENTS FOR OIL AND GAS COMPANIES WITH ALL THREE INDEPENDENT VARIABLES*

Model	Standardized Coefficients		Standardized Coefficients	T	Sig.
	B	Std. Error	Beta		
Constant	7.53	.500		15.055	.000
Firm Size	-.336	.056	-.345	-5.980	.000
Financial Leverage	-.096	.109	-.037	-.833	.378
R&D Investment	.447	.117	.220	3.818	.000

*Predictors: Constant, firm size, financial leverage, R&D investments.

As this Table IX shows the model's F-statistic is 52.594 and it is significant at 1%, which suggests that there is enough evidence to support the validity of the model. The R-square value is an indicator of how well the model fits the data. R-square is very small whereby only 27.5% of the variation in

growth opportunity (*y*) is explained by the changes in firm size, financial leverage, and R&D investments and this regression model is further used to predict y reduces the error by only 27.5%. In other words, 27.5% of the original variability is explained, and 72.5% residual variability is left. Finally, the significance of the independent variables are shown in Table X below.

Significance of firm size and R&D investments is less that 5% but the significance of financial leverage is way more that 5%, indicating that financial leverage has no significant impact on the growth opportunity of an oil and gas firm. This is an interesting result because in the case of the IT companies, we realized that the firm size were not significant, but in the case of oil and gas companies, the financial leverage is not significant. Therefore as before, we removed the financial leverage and tested the model with firm size and R&D investments as independent variables. These results are shown in the Table XI-Table XIII.

Oil and Gas-Data of 50 Oil and Gas Companies Using Two Independent Variables (Firm Size and R&D Investments)

TABLE XI: MODEL SUMMARY OF OIL AND GAS COMPANIES WITH FIRM SIZE AND R&D INVESTMENTS*

Model	R	R Square	Adjusted R Square	Std. Error of Estimate	Durbin Watson
	0.487	0.238	0.234	2.6192413	1.875

*Predictors: constant, firm size, R&D investments.

Table XI shows that the Durbin-Watson value is 1.875, indicating that there is no autocorrelation in the sample data. Adjusted R-square went down from 0.27 to 0.234 suggesting that even though financial leverage is less significant as compared to firm size and R&D investments, it is still a beneficial variable for this analysis.

TABLE XII: ANOVA FOR OIL AND GAS COMPANIES WITH FIRM SIZE AND R&D INVESTMENTS*

Model	Sum of Squares	DF	Mean Square	F	Sig.
Regression	961.686	2	480.843	70.089	0.000
Residual	3087.191	450	6.860		
Total	4048.878	452			

*Predictors: Constant, firm size, R&D investments.

Table XII shows the model's F-statistic is 70.09 and it is significant at 1%, which suggests that there is enough evidence to support the validity of the model. R-square is very small whereby only 23.8% of the variation in growth opportunity (*y*) is explained by the changes in firm size, financial leverage, and R&D investments and this regression model is further used to predict y reduces the error by only 23.8%. In other words, 3.8% of the original variability is explained, while 76.2% residual variability is left. Therefore it is imperative that further study using additional variables are tested.

The results in the following table (Table XIII) clearly shows that both firm size and R&D investment are significant at the one percent level for the oil and gas companies in the two independent variables model. Hence, it is very clear that they play a significant role in growth opportunities of these type of firms.

TABLE XIII: MODEL COEFFICIENTS OIL AND GAS COMPANIES WITH FIRM SIZE AND R&D INVESTMENTS)*

Model	Standardized Coefficients		Standardized Coefficients	T	Sig.
	B	Std. Error	Beta		
Constant	6.97	.412		16.908	.000
Firm Size	-.27	.053	-.283	-5.074	.000
R&D Investment	.511	.114	.249	4.471	.000

* Predictors: Constant, firm size, R&D investments.

V. LIMITATIONS

In this study, only three factors that influence the growth opportunity of an industry is examined. Given at least one variable was not significant for both type of firms and the additional testing using only two variables provided somewhat a better result. But it is imperative that more factors and their relevant interdependence should be taken into consideration in future research. The multiple regression is used to analyse the results in this paper but there are many other statistical tools should also be tested to see if it gives a more robust results. It may also be interesting to look at the results by splitting the time period into several periods see if the significance of the variables are different.

VI. SUMMARY AND CONCLUSION

This study uses annual data for fourteen years (1999-2012) to observe the impact of firm size, financial leverage, and investments in R&D on growth opportunities for information technology and oil and gas industries. The results indicate that, when it comes to information technology industries' growth opportunity, firm size does not play an important role, as past history reveals that there are a number of companies that have started in garages, and later have grown to become global giants. When it comes to oil and gas industries' growth opportunity, financial leverage does not play an important role, as being financially stable is a prerequisite for being in the oil and gas industry.

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