OVERINVESTMENT, GROWTH OPPORTUNITIES AND FIRM PERFORMANCE: EVIDENCE FROM SINGAPORE STOCK MARKET

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Abstract

This paper aims to study the extent of overinvestment, underinvestment problem and measure its impact on corporate performance. Our sample consists of 7 years data (2005 to 2011) of 360 non-financial companies listed in the Singapore Stock Market. After panel data models appropriation tests (LM test, Hausman test, No Fixed effect test) we employed fixed effect regression methodology in our analysis. Our results show that 52% firms in our sample are engaged in proper investment projects, 29% firms are overinvesting, while 19% firms are underinvesting. Maximum overinvestment is taking place in Basic Material sector while maximum underinvestment happening in Healthcare sector. Further tests show that both overinvestment and underinvestment shows severe negative impact on firm performance. However, proper investment has positive impact on firm performance in Singapore Stock Market. The results highlight the extent of agency problem in Singapore Stock Market. Moreover, it depicts the importance of investment activities of Singaporean companies for the international investors and portfolio managers.

Keywords: Overinvestment, Underinvestment, Corporate Performance, Agency Problem, Singapore

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1 Introduction

Overinvestment happens when firms invest in negative NPV projects while, underinvestment happens when firms let go positive NPV projects (Brealey, Myers and Allen, 2008). Both overinvestment and underinvestment are value destroying and have negative impact on firm performance (Liu and Bredin, 2010); (Titman, Wei and Xie, 2004); (Yang, 2005); (Fu, 2010). Overinvestment may happen due to expropriation of shareholders right by insider investment behaviour of empire building. Underinvestment may happen due to risk averse investment behaviour of managers or if the managers are too lazy enough to explore new investment projects (Brealey et al, 2008). Thus, both of these investment behaviour cause agency problem as it both overinvestment and underinvestment indicates the conflict of interest between firm insiders and firm shareholders.

Based on Jensen (1986) agency cost of free cash flow, Pawlina and Renneboog (2005) tested overinvestment and underinvestment by checking the direction of relationship between investment and firm cash flows. Positive relation between investment and cash flows when firms have low growth opportunity is indicative to be overinvestment and negative relation between investment and cash flows when firms have high growth opportunity shows underinvestment (Pawlina and Renneboog, 2005). Lyandres and Zhdanov (2005) hypothesis of overinvestment of debt says that a positive relation between investment and leverage indicates overinvestment and a negative relation between investment and leverage indicates underinvestment. Therefore, we can assert that firms with low growth opportunity and positive relation between investment and leverage indicate overinvestment, while firms with high growth opportunity and negative relation between investment and leverage indicate underinvestment.

Insider ownership aligns managers and shareholders' interests, therefore, overinvestment and underinvestment problem is less likely to happen in firms with high insider ownership, but at the same time high insider ownership may cause the problem of empire building behaviour of managers (Brealey et al, 2008). Institutional ownership also acts as powerful surveillance body to prevent problems like bad investments. Most of the previous empirical studies concerning have the consensus that institutional ownership does act as to prevent overinvestment and underinvestment, because they serve a powerful monitoring role on managers (Tempel, 2011); (Liu and Bredin, 2010); (Stepnov, 2012). Previous empirical findings found a negative impact of overinvestment and underinvestment on firm

performance (Liu and Bredin, 2010); (Titman et al, 2004); (Yang, 2005); (Fu, 2010).

Singapore itself is an interesting market. All the market dynamics and laws in Singapore are identical to Anglo-Saxon countries, but ownership structure is typical of Asian countries, which means very high insider and governmental ownership and very low individual ownership (Shliefer, La Porta and Lopez-De-Silanes, 1999).

Motivation of this study is to investigate the extent of overinvestment and underinvestment problem and measuring the impact of overinvestment and underinvestment on firm performance. Using our own model, we decided to test extent of overinvestment and underinvestment and its impact on firm performance in in non-financial companies of Singapore stock market, during the 7 year time period from 2005 to 2011. Our findings will reveal the extent of this problem in Singapore listed companies and it will further help us to investigate that to what extent this problem is influencing the firm performance in Singapore listed companies. We used Richardson (2006) model to extract investment residuals and then used our own technique to identify proper investment, overinvestment and underinvestment. Finally, we employed Liu and Bredin (2010) model to check its influence on firm performance.

2 Literature review

2.1 Agency theory

Proper investment at proper time helps firms achieve its financial objectives. The objective of every firm is maximisation of shareholders wealth. Shareholders are actual owners of the firms while managers take key decisions on behalf of shareholders. So, this makes a relationship between both parties which is called agency relationship. Agency relationship is that when owner (shareholders) authorize an agent (managers) to carry out the key decisions regarding a firm (Jensen and Mecklings 1976). Finance literature discusses this shareholder-manager relationship and the literature further suggests that although manager and shareholders share the same goal of shareholders wealth maximisation, but interests of both parties might be different. This conflict creates agency problem. Therefore both overinvestment and underinvestment creates agency problem.

2.1.2. Agency problem due to overinvestment

The concept of overinvestment is precisely explained in the studies of Jensen (1986); Brealey et al. (2008) and Stulz (1990). Overinvestment is managerial investment behaviour of investing in negative NPV projects. Literature reveals that this problem is predominant in mature firms, with limited growth opportunities and high cash flows.

Brealey et al. (2008) explained the managerial overinvestment behaviour as empire building. Managers love power and keen to have more resources under their discretion, therefore it leads to empire building which is possible through reckless investment in negative NPV projects (Brealey et al. 2008). Shleifer and Vishny (1989) discussed the entrenching investment approach of managers leading to overinvestment. Managers tend to feel attracted to invest in those projects, which require manager's own specialised skills. In several cases managers will even ignore +NPV projects, which don't require managers specialised skills, while accept those –NPV projects which require manager's own specialised skills (Shleifer et al, 1989). This may also lead to overinvestment. As the size of the firms increases the CEO salary also increases (Conyon and Murphy 2000) therefore this shows that managers are willing to do overinvestment to increase the company size.

Jensen (1986) pointed out the managerial temptation to overinvest greatly increases with abundant supply of free cash flows. Free cash flows are the excessive cash flows available, then required for financing +NPV projects (Stulz, 1990). Overinvestment problem gets more severe when the firm has both the combination of low growth opportunities i.e. unavailability of +NPV projects and high cash flows (Jensen, 1986). Managers always have an incentive to grow firms beyond its optimal size because firstly its puts lot of assets under manager's control and secondly managerial compensation is directly linked with the growth in sales (Murphy 1985).

Lyandres and Zhdanov (2005) provided completely new hypothesis of overinvestment which is totally different to what Jensen (1986) mentioned in his famous hypothesis of free cash flows. Lyandres and Zhdanov (2005) named it as "overinvestment of debt" in which they predicted that overinvestment happens when there is positive relation between debt and investment. Dynamics behind overinvestment due to debt works on the principle of tradeoff between the cash flows received through an investment and loss incurred on the option to wait. When debt level increases it makes option to make less valuable therefore managers decide to exercise option by making an investment decision which leads to overinvestment (Lyandres and Zhdanov, 2005).

Listed corporations often face overinvestment problem, because firms are not obliged to pay dividends. Dividends payment substantially decreases the free cash flows which restricts managers to invest in wasteful projects. Based on these arguments we can say that overinvestment is clearly an indication of agency problem because it is totally against the managers interests of empire building and shareholders' interests of investment in +NPV projects. Debt has an overall benefit of reducing this agency problem arising due to overinvestment (Jensen, 1986); (Stulz, 1990).

Issuance of debt can prevent firms from overinvestment for so many reasons. Firstly firms are committed to pay interest and principal amount after fixed time period. Firms are bound to pay back debt regardless of its financial capacity as contrary to dividends payment where firms are not bound to pay dividends. Trade off theory of capital structure suggests that, an inherent risk of bankruptcy is associated with introduction of debt in capital structure. Bankruptcy risk tends to make managers more vigilant of their investment decisions. Debt issuance also put firms under monitoring by lenders and this monitoring becomes stricter if lenders happen to be institutions or banks.

Therefore debt reduces agency problem arising due to overinvestment (Jensen, 1986). Overinvestment problem is much worse than underinvestment problem because there are higher chances for the overinvesting firms to fail in the future then underinvesting companies (Degryse and De Jong, 2006). Due to protective mechanism of debt we can assert that there is a negative relation between debt and investment.

2.1.3 Agency problem due to underinvestment

Underinvestment happens when managers pass on +NPV projects, which if taken could prove highly profitable investment projects. Brealey et al, (2008) have indicated that managerial behaviour of reduced efforts and risk avoidance are the main reasons of underinvestment. Some managers are not motivated enough to find, evaluate and fund several valuable investment opportunities. They do not want to put a lot of efforts in finding and implementing these investments leading to underinvestment (Brealey et al, 2008). These managers are characterized as Passive managers.

Myers (1977) explained precisely the theory of underinvestment. He argued that agency conflict arises between bondholders and shareholders when leverage is included in the capital structure. Managers of the firms will start ignoring to invest in several +NPV projects because, lenders (bondholders) have the first right to get the money back from the added benefit received from investing in +NPV project (Myers 1977). Hence a +NPV project can be considered as a –NPV project if it is to be analysed from the perspective of shareholders and hence ignored leading to underinvestment (Lyandres and Zhdanov 2005).

Information Asymmetry is the unequal level of information between two parties. Managers know more about the firm internal situation and investment opportunities while shareholders and bondholders don't know a lot. Information asymmetry also leads to underinvestment problem and under this problem managers will ignore lot of +NPV investment projects which were needed to be financed through issuing equity (Myers and Majluf 1984).

Passive managers do not work hard to differentiate between valuable and invaluable investment opportunities, which, is opposite of active investment managers. This strategy helps them to avoid uncertainty or avoid decision errors (Voicu, 2013). When managerial interests are not aligned with shareholders interest through insider ownership, then managers would give up investing in several valuable risky projects due to their risk avoidance behaviour (Brealey et al, 2008). Risky projects may have a huge potential but due to fear of losing jobs, if the project doesn't turn out successful. This prevents managers to invest in several of these +NPV projects. Underinvestment mainly occurs in firms which have high growth opportunities (McConnel and Servaes, 1995).

Several factors combine together that may justify risk avoidance behaviour of managers. Widely acknowledged Pecking order theory of Myers and Majluf (1984), suggests that when investment opportunities comes up then, order of financing should always be utlising internal funds, issuing debt and finally issuing equity respectively. Literature suggests that issuance of debt gives two signals to the market.

Firstly, debt issuance is a signal that company is in bad financial state, therefore empirical findings suggest that debt issuance mostly leads to decrease in share prices. Stock price performance after debt issuance declined significantly (Long, Malitz and Sefcik, 1992). Between year 1975-1989 the post debt issue underperformance was observed in the firms issuing straight debt and convertible debts and this problem was primarily noticeable in the younger firms (Spiess and Affleck-Graves, 1999). Debt taken from the bank usually gives positive signal and improves share price performance because it shows that firm is being monitored by strong outsider and this was found to be true in US where there is more disclosure of information (Huang, Schwienbacher and Zhao 2012). In countries like China where there are tight ownership structure and less transparency leads to negative share price behaviour after debt issuance (Huang et al, 2012). These signals reveal that due to asymmetry of information shareholders react negatively to managers decisions of taking debt. So risk averse managers avoid investing in several +NPV projects through debt and thus, discard these valuable investment options.

The second signal that issuance of debt gives to the market is low free cash flows which alerts the lenders. Due to asymmetric information, lender may not consider the true potential of firm's growth opportunities; rather they rate company as risky company. It pushes up the risk premium required by lenders. Hence overall financial cost increases that further increase bankruptcy risk for firms. Firms financing if being done through costly and risky debt will force firms to pass up several +NPV projects, which otherwise could prove highly profitable

investment projects (Myers, 1977). Those highly levered facing very high financial distress cost are predominantly affected by underinvestment problem (Brealey et al, 2008).

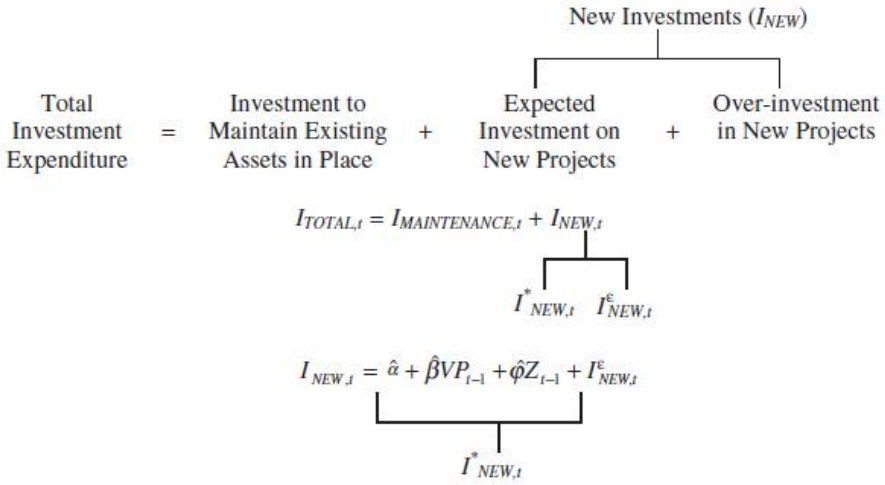
2.2 Overinvestment and underinvestment and its impact on firm performance

Richardson (2006) was the first one to separate the overinvestment and underinvestment while Liu and Bredin (2010) extended these findings and investigated that what is the impact of overinvestment/underinvestment on firm performance. Several other studies by Titman, Wei and Xie (2004); Yang (2005); Liu and Bredin (2010); Fu (2010) also checked the impact of abnormal investment on firm performance and stock performance.

It has already been mention in detail that firm investment decisions are very important for its future profitability and enhancement of its value. The important studies used in my analysis will be discussed in detail that how overinvestment is quantified and how it is used to check corporate performance.

Richardson (2006) defined overinvestment as "investment expenditures beyond that required to maintain assets in place and to finance expected new investments in +NPV projects". Vice versa is the case for underinvestment. Richardson (2006) identified overinvestment/underinvestment through Figure (1) shown below:

Figure 1. Overinvestment and underinvestment (Richardson, 2006)



New investment (INEW) is divided in two parts. One is "Over-investment in New Projects" while other is "Expected Investment on New Projects". Expected investment on new projects is the normal expected investment of the firm and it depends on factors such as growth opportunity, financing constraints (Richardson, 2006). The other part of New Investment is the Overinvestment. Using this concept a regression equation was formulated which is specifically used to estimate "Expected Investments".

Richardson (2006) argued that after running regression the estimated fitted line shows the "Expected Investment" of the firm while residuals are called "Overinvestment". This unexplained component of regression could be positive or negative; hence negative values are considered underinvestment while positive values are considered overinvestment (Richardson, 2006). Analysis on the US firms with 58053 firm year observations revealed that overinvestment is the common problem and on average firms are overinvesting 20% of its cash flows (Richardson, 2006).

Liu and Bredin (2010) studied overinvestment in Chinese firms and furthermore checked the impact of institutional shareholdings on extent of overinvestment and finally analysed the impact of overinvestment on firm corporate performance. It is interesting to check the impact of institutional shareholdings on overinvestment because the widely acknowledged theories of corporate finance argue that institutional shareholdings provide a powerful monitoring mechanism on managerial investment decisions. Hence, it may act as to decrease firms overinvestment level and improve performance.

Results of this study showed that overinvestment is not so high and its mean value is equivalent to 0,0002. So overinvestment problem is not so serious. In addition to that, 36,9% of Chinese firms were found to be suffering with overinvestment and 63,1% with underinvestment (Liu and Bredin, 2010). In contrast to theoretical evidence, it was found that institutional shareholdings could not reduce overinvestment problem (Liu and Bredin, 2010). Corporate performance proxies considered were Tobin's Q and ROA. Tobin's Q is the ratio of market value of the firm to its book value, while ROA is the return a firm is getting per unit of assets. Liu and

Bredin (2010) found the significant negative impact of overinvestment on firm performance.

Some studies showed positive relation between unexpected investment and performance. Mcconnell and Muscarella (1985) showed that on announcement of huge investment decisions, the market value of the firm shows positive upward trend. But from this we can assert that this improvement in performance might be the short term price reaction to investments announcements. Another study by Yang (2005) disapproved of this positive performance phenomenon. Yang (2005) applied 2-stage approach in his research and identified overinvestment and underinvestment through company's estimated residual. If residual is located away from industry median investment of the year then it is considered abnormal investment. It was found that both overinvestment and underinvestment has disastrous effects on firm performance and a bad investment decision taken today will have persistent negative affect on firm performance for the next five years (Yang, 2005).

Fu (2010) provided a new explanation of overinvestment in which he said that right after the seasoned equity offerings, firms usually undergo overinvestment. Investment analysis and comparison between SEO offering firms and non-issuing firms revealed that firms which did SEO had done more abnormal investments (Fu, 2010). Soon after the firm undergoes SEO, the firms investments were recorded and its simple investment is regressed with firm performance proxies. Results again revealed that these post SEO investments have negative impact on firm performance.

Stock returns show that how much profits is gained on investment in a stock, between two points of time. So it is also a performance, since it represents the wealth of firms shareholders. Titman, Wei and Xie (2004) documented the impact of overinvestment and stock returns and found that there is negative impact of overinvestment on stock returns of the firm and this negative relation between stock returns and overinvestment gets stronger when firms have high cash flows and low leverage (Titman et al, 2004). Further analysis revealed that those firms continued to earn low returns for subsequent 5 years which increased its investment level the most (Titman et al, 2004). Another study by the same authors revealed that firms which do underinvestment does not have any impact on firm stock returns (Titman, Wei and Xie, 2009). These findings approve the idea that investors react negatively to the empire building decisions of the managers therefore, stock returns negatively on the news of overinvestment, while underinvestment does not have any impact on investors.

3 Model and methodology

3.1 Model

Richardson (2006) developed a methodology to separate overinvestment and underinvestment. New investment (INEW) for a given year is the total capital expenditures and acquisitions subtracted with sale of property, plant and equipment. New investment (INEW) is the scaled with total assets at the beginning to the year. We used Richardson (2006) panel data regression model as follows:

$$\begin{aligned}&\text{New Investment } (INEW)\ \text{i,t}\\&= \alpha\,\text{i} + \beta_1\,\text{Tobin's Q i,t} - 1 + \beta_2\,\text{Leverage i,t}\\&- 1 + \beta_3\,\text{Cash flow i,t} - 1 + \beta_4\,\text{Size i,t} - 1\\&+ \beta_5\,\text{Stock Returns i,t} - 1\\&+ \beta_6\,\text{New Investment } (INEW)\ \text{i,t} - 1\\&+ \Sigma\,\text{industry effects} + \Sigma\,\text{year} + \varepsilon\,\text{i,t}\end{aligned} \quad (1)$$

Regression gives us fitted value which we call estimate of New Investment (estimate) and residuals which is estimate of overinvestment if its positive and estimate of underinvestment if its negative (Richardson, 2006). Yang (2005) argued that it is highly unlikely for the firms to meet expected investment level which is estimated by regression models. We say that Regression model does not explain 100% variability of investment so we can say that, it is not true that all the investments deviating from the expected investment is value destroying. Firms always undergo some extent of overinvestment and underinvestment. Therefore, investment residual in regression models does not necessarily represent overinvestment and underinvestment due to agency problem.

Firm decide its amount of investments based on the growth opportunities. Tobin's Q is the proxy used to measure growth opportunities for the firms. It is defined as the investment opportunities which a firm will have in the near future (Aivazian, Ge, Qiu, 2005). Tobin's Q represents the market to book value of the company. If the company has possible +NPV projects in the near future than its numerator which is the "market value" will definitely be higher, hence that firm will have high Tobin's Q. All the similar studies related to our study have used Tobin's Q as measure for growth opportunity. (Aivazian et al, 2005); (Richardson, 2006).

Pawlina and Renneboog (2005) studied overinvestment of cash flows. They stated that when firms have low growth opportunities in the beginning of the year and positive relation between investment and cash flows then overinvestment of cash flows is taking place. While in context of high growth opportunity and negative relation between investment and cash flows represent underinvestment.

We conceptualize the above findings of Pawlina and Renneboog (2005) and took Richardson (2006) findings one step further. We say that a firm with

positive investment residuals at time (t) and low growth opportunities at time (t-1) actually has severe overinvestment problem. This shows that even though a firm does not have investment opportunities but still it is investing indicates overinvestment. In the same way a negative investment residual at time (t) with high growth opportunity at time (t-1) indicates severe underinvestment. This point out that firm is letting go its investment opportunities which shows underinvestment. This concept can be understood by the Table (1) below:

Table 1. Identifying overinvestment and underinvestment

Investment Residuals (t)	Growth Opportunity (t-1)	Indication
+ve Investment Residuals	Low Growth Opportunity (Less than 1 Tobin's Q)	Overinvestment
-ve Investment Residuals	High Growth Opportunity (Greater than 1 Tobin's Q)	Underinvestment
+ve Investment Residuals	High Growth Opportunity (Greater than 1 Tobin's Q)	Normal Investment
-ve Investment Residuals	Low Growth Opportunity (Less than 1 Tobin's Q)	Normal Investment

Finally, to evaluate the effect of overinvestment and underinvestment on firm performance, we based our model from Liu and Bredin (2010). Based on our criteria of overinvestment and underinvestment, mentioned in Table (1), we created the interaction terms of overinvesting firms and underinvesting firms in our model to separately check the influence of overinvestment, underinvestment and normal investment on firm performance. Contrary to Liu and Bredin (2010) model, we did not take the difference between investment residuals, because they are not dealt with on the whole by the model, but dealt with differently by creating interaction terms of overinvestment and underinvestment, using the criteria mentioned in Table (1) of our model. We used Tobin's Q, ROA and ROE as firm performance proxies.

$$\begin{aligned}\text{Tobin's Q}_{i,t} &= \alpha_i + \beta_1 \text{Normal Investment}_{i,t-1} + \beta_2 \text{Size}_{i,t-1} \\ &+ \beta_3 \text{Leverage}_{i,t-1} + \beta_4 \text{Overinvestment}_{i,t-1} \\ &+ \beta_5 \text{Underinvestment}_{i,t-1} + \Sigma \text{industry effects} \\ &+ \varepsilon_{i,t}\end{aligned} \quad (2)$$

$$\begin{aligned}\text{ROA}_{i,t} &= \alpha_i + \beta_1 \text{Normal Investment}_{i,t-1} + \beta_2 \text{Size}_{i,t-1} \\ &+ \beta_3 \text{Leverage}_{i,t-1} + \beta_4 \text{Overinvestment}_{i,t-1} \\ &+ \beta_5 \text{Underinvestment}_{i,t-1} + \Sigma \text{industry effects} \\ &+ \varepsilon_{i,t}\end{aligned} \quad (3)$$

$$\begin{aligned}\text{ROE}_{i,t} &= \alpha_i + \beta_1 \text{Normal Investment}_{i,t-1} + \beta_2 \text{Size}_{i,t-1} \\ &+ \beta_3 \text{Leverage}_{i,t-1} + \beta_4 \text{Overinvestment}_{i,t-1} \\ &+ \beta_5 \text{Underinvestment}_{i,t-1} + \Sigma \text{industry effects} \\ &+ \varepsilon_{i,t}\end{aligned} \quad (4)$$

3.2 Methodology

We use panel data regression for our tests. Panel data regression is a combination of time series and cross sectional analysis. Hence, thorough combination of these two, the relationship between variables is considered by multiple periods of times and multiple variables. There are three types of Panel data model, which are Pooled model, Fixed effect model or Random effect model.

We begin with comparing the appropriation method between Random effect and Pooled method. A widely acceptable test carried out for this comparison is Bruesch Pagan Lagrange multiplier (LM) test of the random effect model. This is carried out in order to test that whether u i =0 for all the individuals if there are no individual differences across the observations (Hill, Griffiths, Lim, 2012). If we find evidence of no individual effects then we do not reject the null hypothesis and state that Pooled method is the most appropriate method. But in case if p value of Breusch Pagal LM test is significant and less than 0.05 then we reject null hypothesis in favour of Random effect model.

Before proceeding with random effect model we further have to test random effect vs fixed effect in our data. Hausman specification test is carried out for this analysis. Hausman specification test, checks that whether "independent effects are uncorrelated with independent variables and the fixed effect estimator and random effect estimator should not be statistically different" (Aivazian et al, 2005). If p value of Hausman test is significant then we reject null hypothesis in favour of Fixed Effect Regression. Finally F-test for no Fixed effect test is also conducted to test fixed effect in our data.

We have reported p-value of all these three tests in our regression tables. In most of the cases Fixed Effect model is considered most appropriate for our analysis.

4 Data

Thomsonone Banker is used to gather 7 years data from 2005 to 2011. All the firms with GICS code 40

were excluded from our analysis, as it includes banks, financials and insurance companies

Screening process was carefully carried out on 560 non-financial firms listed in Singapore Stock Exchange. Data of all the companies was carefully analyzed and all those companies were deleted from the sample which did not have complete 7 years data available. In the same way all the companies with missing values were also screened out. Outliers were also removed from the data.

After the screening process 360 companies were considered ready for our further analysis. A complete representation of all the companies divided in to its particular industry category is summarised in the following Table (2):

Table 2. List of companies by industry

Industry	No. of companies	% Representation	Total firm year Obs.
Industrial	183	50,6%	1281
Consumer Goods	55	15,3%	385
Consumer Services	41	11,4%	287
Telecommunication	5	1,4%	35
Healthcare	9	2,2%	63
Basic Material	22	6,1%	154
Oil and Gas	5	1,4%	35
Technology	42	11,7%	294
Total	***360***	***100%***	***2520***

Most of the listed firms in Singapore belong to Industrial and Consumer Goods category. Technology firms also play a vital role in the economy of Singapore. Least number of firms are represented in Telecommunication, Health Care and Oil & Gas sector.

4.1 Variables

The proxies and the definition of proxies used on our analysis are as follows:

Table 3. Definition of variables

Variable	Calculation
New Investment (*INEW*) i, t	*New Investment* (*INEW*) = *{ (Investment in Fixed Assets + Investment in Intangibles + Acquisitions + Investment in Financial Assets) – Sale of Investment }* t / *Total Assets* t-1
Leverage i, t-1	*Long term Debt= (Long term debt / Total Assets)* t-1
Cash Flow i, t-1	*Cash Flow = CF after Operating Activities* t-1 / *Total Assets* t-1
Tobin's Q i, t-1	*Tobin's Q = (Market Value / BV Total Assets)* t-1
Stock Returns i, t-1	*Stock Returns = (Stock Return* t-1 – *Stock Return* t-2 *) / Stock Return* t-1
Size i, t-1	*Log of Total Assets t-1*
Return on Assets i, t	*ROA = Net Income* t / *Total Assets* t
Return on Equity i, t	*ROE = Net Income* t / *Avg Total Equity* t

4.2 Variables descriptive statistics

Table (4) below shows the descriptive statistics of all the variables used in our study. Descriptive stats show that overall Singaporean companies are investing 5,6% of their total assets. The huge differences between minimum and maximum values indicate that there is huge variance between investments in various companies. On average, Singapore companies are relying on long term debt which accounts for 11% on average. While this number varies from 0% to 126% of their assets. This shows that some companies have huge long term debt which even exceeds their total assets.

On average Cash flow accounts for 5,8% of total assets and this figure touches the maximum number of 85% of total assets. This shows that some companies have abundant availability of cash flows. Both mean and median value of Tobin's Q reflect that companies in Singapore have high growth opportunities. They mean value is 1,22 while median value is 1,013 which both are greater than 1, indicating that Singapore companies have lot of +NPV projects and have lot of future growth opportunities. This also indicates that market values of the companies are higher than their book values. Figures show that Singapore companies are earning 18% average stock returns annually. This indicates the continuously increasing market value of Singapore companies.

Table 4. Descriptive statistics

Variable	Mean	Std Dev	Minimum	Maximum	Median
New Investment	0,056	0,13	-1,28	1,54	0,032
Leverage	0,11	0,13	0	1,26	0,077
Cash Flow	0,058	0,13	-1,33	0,85	0,058
Tobin's Q	1,22	0,71	0,17	6,86	1,013
Stock Returns	0,18	0,789	-1,00	6,57	0
Size	4,98	1,47	1,68	10,52	1,78
ROA	0,049	0,077	-0,40	0,39	0,054
ROE	0,068	0,15	-1,21	0,47	0,084

4.3 Industry wise descriptive statistics

It is interesting and important for us to know that how all of the aforesaid variables vary across different industries of Singapore. This will help us to know that how homogenous the different industries in Singapore are? Table (5) below shows that how our independent and dependent variables vary in across different industries of Singapore.

The mean values of New Investment shows that Oil & Gas sector is investing at the maximum rate of 15% of their assets. While it also have the maximum leverage in their capital structure, which accounts for 9,4% of its total assets. Minimum investment is taking place in Industrial sector at the rate of 5% of their assets but they have the second highest leverage in which long term debt consists of 7,4% of its assets. Healthcare sector has the second highest Net investment but also the highest cash flow which accounts for 11% of its assets.

All Singapore industries have fairly high growth opportunities. All of them have higher than 1 figure of Tobin's Q. Despite Oil & Gas sector has the maximum leverage and net investments but it also has the maximum Tobin's Q of 1,85. Healthcare sector has the second highest net investment but also has the second highest Tobin's Q score of 1,67. On average, Basic Material has the minimum Tobin's Q of 1,04 which is still higher than 1.

Comparison of performance proxies show that Oil & Gas sector has maximum ROA and ROE of 10% and 12% respectively, but it also has the highest standard deviation in ROA and Cash Flow which is 0,10 and 0,17 respectively and second highest standard deviation in ROE which is 0,16. This shows that it is also one of the riskiest businesses. Despite of its highest risk it is also generating the highest returns. Standard deviation values of other industrial sectors are quite identical which shows that most of the industries in Singapore are quite homogenous.

4.4 Correlation analysis

Table (6) includes correlation analysis of all the variables of our model. Correlation analysis is the first step before starting before starting a regression analysis. This gives us an idea that how strong is the linear relationship between the two variables. Correlation is also important to investigate the problem of multicollinearity. Multicollinearity is considered to be high when there is very high correlation within the independent variables.

Analysis of correlation tables reveals that no multicollinearity exists between our independent variables. All the correlation coefficients are below the value of 0.8. Firm size and leverage has the highest value of correlation which means big firms are more likely to be highly levered. A high correlation of Tobin's Q and Stock returns is also natural which means firms with high growth opportunities also have high stock returns. Firms with high cash flows and high growth opportunities are also doing more new investments. This is depicted by the positive significant correlation between investment, Tobin's Q and cash flows. Firms with high Tobin's Q also have high growth opportunities.

5 Results

Results are reported for complete sample as well as industry wise, in order to study this problem with profound detail.

Analysis started with running a regression on Richardson (2006) model. Our basic objective is to separate Investment residuals from the results. Table (7) below shows the result of complete sample regression. As already mentioned, our analysis started with Breusch Pagan LM test. p-value less of than 0.05 shows that we reject null hypotheses of that Pooled regression is more appropriate model and conclude that data has random effects. To check that, whether we have random effect or fixed effect in our data, we carried out Hausman test and p-value less than 0.05 indicates that we reject the null hypothesis that Random Effect regression model is more appropriate model. The third test which is F-test for No Fixed Effect also indicates the p-value less than 0.05, which shows that we reject null hypothesis that there are no fixed effects in the data, therefore Fixed effect regression is the better methodology.

Table 5. Industry wise descriptive statistics

Variable	Industrial	Consumer Goods & Services	Technology & Telecommunication	Healthcare	Basic Material	Oil & Gas
Mean						
New Investment	0.05	0.055	0.053	0.093	0.074	0.15
Leverage	0.074	0.074	0.059	0.058	0.039	0.094
Cash Flow	0.05	0.066	0.05	0.11	0.063	0.09
Tobin's Q	1.20	1.20	1.26	1.67	1.04	1.85
Size	5.14	5.57	5.13	4.34	4.99	5.75
ROA	0.05	0.06	0.03	0.05	0.039	0.10
ROE	0.07	0.09	0.02	0.07	0.037	0.12
Std Dev.						
New Investment	0.13	0.122	0.13	0.17	0.16	0.29
Leverage	0.11	0.097	0.09	0.07	0.058	0.11
Cash Flow	0.14	0.11	0.13	0.11	0.12	0.17
Tobin's Q	0.67	0.61	0.89	0.92	0.78	1.14
Size	1.39	1.78	1.36	1.03	0.86	1.14
ROA	0.076	0.07	0.09	0.07	0.077	0.10
ROE	0.15	0.13	0.20	0.11	0.14	0.16
Minimum						
New Investment	-0.78	-1.28	-0.55	-0.13	-0.27	-0.46
Leverage	0	0	0	0	0	0
Cash Flow	-1.34	-0.57	-0.47	-0.16	-0.36	-0.35
Tobin's Q	0.28	0.17	0.27	0.37	0.25	0.61
Size	1.67	2.44	2.61	2.39	3.22	4.09
ROA	-0.33	-0.25	-0.29	-0.17	-0.40	-0.08
ROE	-0.99	-0.70	-1.21	-0.22	-0.67	-0.27
Maximum						
New Investment	1.55	1.12	1.21	0.89	1.09	0.98
Leverage	1.06	0.53	0.52	0.22	0.25	0.32
Cash Flow	0.85	0.51	0.47	0.41	0.71	0.53
Tobin's Q	6.86	5.92	6.55	5.47	6.00	6.14
Size	10.10	10.18	10.56	6.06	6.60	7.48
ROA	0.27	0.30	0.39	0.17	0.18	0.32
ROE	0.47	0.42	0.45	0.25	0.28	0.38
Median						
New Investment	0.03	0.036	0.02	0.05	0.026	0.10
Leverage	0.028	0.030	0.009	0.026	0.0034	0.05
Cash Flow	0.055	0.06	0.05	0.10	0.059	0.07
Tobin's Q	1.02	1.03	0.97	1.44	0.86	1.55
Size	4.91	5.37	4.99	4.54	4.91	5.76
ROA	0.05	0.06	0.03	0.06	0.047	0.06
ROE	0.09	0.095	0.05	0.08	0.062	0.12

Table 6. Correlation analysis

Pearson Correlation Coefficients							
	New Investment	**Leverage**	**Cash Flow**	**Tobin's Q**	**Stock Returns**	**New Investment t-1**	**Size**
New Investment	**1.000**	0.016	0.125***	0.185***	0.067***	0.268***	0.013
Long term Debt	0.016	**1.000**	-0.037*	0.063***	0.059***	0.124***	0.373***
Cash Flow	0.125***	-0.037*	**1.000**	0.058***	0.069***	0.128***	0.094***
Tobin's Q	0.185***	0.063***	0.058***	**1.000**	0.325***	0.188***	-0.013
Stock Returns	0.067***	0.059***	0.069***	0.325***	**1.000**	0.061***	0.055***
New Investment t-1	0.269***	0.124***	0.128***	0.188***	0.061***	**1.000**	0.058***
Size	0.013	0.373***	0.094***	-0.013	0.055***	0.058***	**1.000**

*** Significant at 99% , ** Significant at 95%, * Significant at 90%

Table (7) shows the results. it is clear that firm cash flow is significant predictor of investment and positive significant relation between both variables show that investment is positively related to presence of internal cash available. Higher the cash flows higher will be the firm investments. Table (7) also shows that there is a positive relation between Tobin's Q and investment, which shows that Singaporean firms have propensity to expand, therefore, and they are expanding. Hence there is a positive relation between Tobin's Q and investment. Negative relation between investment and leverage indicates that leverage work as to restrict the firm's investments because of the financial distress and bankruptcy risks.

These findings are perfectly in accordance to the findings of previous similar research findings of (Aivazian et al, 2005); (Richardson, 2005); (Odit and Chittoo, 2008); (Lang, Ofek, Stulz, 1996). R-square value of the model shows that 32.48% variability of investment is dependent on its independent variable.

Table 7. Regression analysis on richardson (2006) model

	New Investment i, t		
	Beta Coefficient	**SE**	**t-value**
Intercept	0.243***	0.053	4.56
Leverage i, t-1	-0.122***	0.042	-2.89
Cash flow i, t-1	0.048***	0.025	1.91
Tobin's Q i, t-1	0.018***	0.006	3.14
Size i, t-1	-0.053***	0.006	-8.25
Stock Returns i, t-1	-0.001	0.003	-0.36
Net Investment i, t-1	-0.012	0.021	-0.59
R^2	0.3248		
LM Test	p<0.0001		
Hausman Test	p<0.0001		
No Fixed Effect Test	p<0.0001		
Observations	2520		

*** Significant at 99% , ** Significant at 95%, * Significant at 90%

5.1 Extent of overinvestment & underinvestment

We carefully separated the Investment Residuals, from above regression analysis, which according to Richardson (2006) are values of overinvestment if positive and underinvestment if negative. Without going in to more details we separated the Investment Residuals from above regression analysis using our own model discussed in Table (1). It says that a firm with positive investment residuals and low growth opportunities actually has severe overinvestment problem. In the same way a negative investment residual with high growth opportunity indicates severe underinvestment. Table (8) below shows the results.

Our analysis shows that 52% firm in Singapore are doing normal investment, which means that they have positive investment residuals when growth opportunity is high (Tobin's Q>1) and negative investment residuals when growth opportunity is low (Tobin's Q<1). 48% firms in our sample are doing value destroying over/underinvestment. This includes 29% firms doing overinvestment which means that they have positive residuals when growth opportunity is low (Tobin's Q<1) and 19% observations doing underinvestment, which includes those firms having negative investment residuals and high growth opportunity (Tobin's Q>1).

Industry wise results from the Table (8) above shows that Oil & Gas sector is doing the most efficient investments having 67% firms from Oil & Gas sector doing normal investments. Maximum overinvestment is taking place in Basic Material & Utilities sector, while is 37% firms. Worst investments are taking place in Industrial sector in which accounts of its 50% firms doing value destroying overinvestments and underinvestment. Most underinvestment is taking place in Health sector which constitute of 33% firms. Due to sensitive nature of this sector it is important for this sector to be provided with adequate resources for investments.

5.2 Impact of overinvestment & underinvestment on firm performance

5.2.1 Overall sample results

Performance proxies used in our study are Tobin's Q, ROA and ROE. We carried out three different regression analyses. They are showed in Table (9), Table (10) and Table (11). Results confirm our idea that both overinvestment and underinvestment is value destroying for the firms while normal investment has positive impact on firm performance.

When performance proxy is Tobin's Q then both overinvestment and underinvestment has severe negative impact on firm performance. Result shows that severe negative impact of underinvestment is much stronger than overinvestment. Table (9) shows firm performance of firms only doing overinvestment

having beta coefficient of (-1.47) versus (-1.54) Table (10) showing performance of firms doing underinvestment. Part of which can be explained by the fact that all Singapore industries have fairly high growth opportunities. All of them have higher than 1 figure of Tobin's Q. If firms underinvest or let go any +NPV projects then other competitors take those projects resulting in severe loss of firm performance and its competitiveness.

Table 8. Extent of overinvestment & underinvestment

Industries	Normal Investment	Underinvestment+ Overinvestment	Overinvestment	Underinvestment
Total	52%	48%	29%	19%
Basic Material & Utilities	60%	40%	37%	3%
Consumer Goods & Services	52%	49%	24%	25%
Health	21%	42%	8%	33%
Industrial	50%	50%	31%	19%
Oil & Gas	67%	33%	21%	13%
Telecommunication & Technology	53%	47%	33%	14%

Moreover, normal investment has positive impact on firm performance. Table (11) shows beta coefficient of (1.33) of firms doing normal investment. It's significant and positive.

Table 9. Regression analysis on overinvestment and firm performance

	Tobin's Q i, t			ROA i, t			ROE i, t		
	Beta	SE	t-value	Beta	SE	t-value	Beta	SE	t-value
Intercept	2.96***	0.19	15.71	0.345***	0.03	10.09	0.58***	0.07	8.29
Normal Investment i, t-1	0.56***	0.11	4.90	0.07***	0.02	3.22	0.11***	0.04	2.59
Leverage i, t-1	0.67***	0.17	3.81	0.08**	0.03	2.53	0.16**	0.06	2.50
Size i, t-1	-0.43***	0.03	-14.41	-0.06***	0.005	-10.35	-0.10***	0.01	-9.12
Overinvestment i, t-1	-1.47***	0.23	-6.31	-0.03	0.042	-0.74	0.02	0.09	0.22
R^2	0.6880			0.5128			0.4942		
***** Significant at 99% , ** Significant at 95%, * Significant at 90%**									

Table 10. Regression analysis on underinvestment and firm performance

	Tobin's Q i, t			**ROA i, t**			**ROE i, t**		
	Beta	SE	t-value	Beta	SE	t-value	Beta	SE	t-value
Intercept	2.82***	0.19	14.82	0.34***	0.03	9.91	0.57***	0.07	8.11
Normal Investment i, t-1	0.46***	0.10	4.34	0.07***	0.02	3.44	0.14***	0.04	3.54
Leverage i, t-1	0.59***	0.17	3.37	0.08**	0.03	2.47	0.16**	0.06	2.46
Size i, t-1	-0.41***	0.03	-13.39	-0.05***	0.005	-10.10	-0.10***	0.01	-8.83
Underinvestment i, t-1	-1.54***	0.25	-6.05	-0.04	0.05	-0.85	-0.10	0.09	-1.06
R^2	0.6876			0.5128			0.4947		
***** Significant at 99% , ** Significant at 95%, * Significant at 90%**									

Table 11. Regression analysis overinvestment, underinvestment, normal investment and firm performance

	Tobin's Q i, t			**ROA i, t**			**ROE i, t**		
	Beta	SE	t-value	Beta	SE	t-value	Beta	SE	t-value
Intercept	2.74***	0.18	14.80	0.34***	0.03	9.85	0.57***	0.07	8.09
Normal Investment i, t-1	1.33***	0.14	9.43	0.08***	0.03	3.25	0.14***	0.05	2.68
Leverage i, t-1	0.61***	0.17	3.58	0.08**	0.03	2.48	0.16**	0.06	2.46
Size i, t-1	-0.38***	0.03	-12.95	-0.05***	0.005	-9.98	-0.10***	0.01	-8.79
Overinvestment i, t-1	-2.19***	0.24	-9.08	-0.05	0.04	-1.07	-0.01	0.09	-0.12
Underinvestment i, t-1	-2.35***	0.26	-8.92	-0.06	0.05	-1.16	-0.10	0.10	-1.04
R^2	0.7040			0.5131			0.4947		
***** Significant at 99% , ** Significant at 95%, * Significant at 90%**									

5.2.2 Industry wise results

All the industries are not homogenous. They have different operating and competitive environment. Our analysis above showed that every industry has different magnitude of overinvestment and underinvestment problem. Therefore, overinvestment and underinvestment might have different impact on

every industry. Table (12) below shows the industry wise results.

When Tobin's Q is our performance proxy then it shows that both overinvestment and underinvestment has significant severe negative impact on firm performance in all sectors. Magnitude of this negative impact on firm performance is highest in underinvesting firms of healthcare sector. Likewise, when ROA is our performance proxy, shows that overinvesting firms of technology and telecommunication sector and underinvesting consumer goods & services sector is suffering. In case if ROE is our performance proxy then again underinvesting consumer goods & services sector has negative ROE.

Table 12. Regression analysis of industry wise overinvestment, underinvestment & firm performance

	Tobin's Q i, t			**ROA i, t**			**ROE i, t**		
	Beta	SE	t-value	Beta	SE	t-value	Beta	SE	t-value
Intercept	2.73***	0.19	14.56	0.34***	0.03	9.81	0.58***	0.07	8.12
Normal Investment i, t-1	1.36***	0.14	9.56	0.087***	0.03	3.30	0.14***	0.05	2.67
Leverage i, t-1	0.60***	0.17	3.55	0.077**	0.03	2.41	0.16**	0.06	2.40
Size i, t-1	-0.38***	0.03	-12.63	-0.05***	0.005	-9.94	-0.10***	0.01	-8.83
Basic Material_Utility Overinvestment i, t-1	-2.03***	0.38	-5.39	-0.03	0.07	-0.46	0.05	0.14	0.33
Consumer Goods_Services Overinvestment i, t-1	-2.03***	0.44	-4.60	0.02	0.08	0.21	0.07	0.17	0.42
Healthcare Overinvestment i, t-1	-19.15	17.37	-1.10	-3.49	3.23	-1.08	-5.72	6.6	-0.87
Industrial Overinvestment i, t-1	-2.47***	0.32	-7.67	-0.06	0.06	-1.05	-0.05	0.12	-0.38
Oil_Gas Overinvestment i, t-1	-2.69**	1.15	-2.34	0.12	0.21	0.56	0.43	0.44	0.99
Tech_Telecom Overinvestment i, t-1	-2.26***	0.57	-3.96	-0.21**	0.10	-1.99	-0.27	0.21	-1.25
Basic Material_Utility Underinvestment i, t-1	-1.48**	0.73	-2.03	-0.05	0.13	-0.41	-0.17	0.28	-0.61
Consumer Goods_Services Underinvestment i, t-1	-2.75***	0.43	-6.36	-0.17**	0.08	-2.12	-0.35**	0.16	-2.15
Healthcare Underinvestment i, t-1	-4.78***	1.76	-2.72	-0.04	0.32	-0.14	0.34	0.67	0.51
Industrial Underinvestment i, t-1	-2.19***	0.35	-6.17	0.005	0.07	0.08	0.03	0.13	0.23
Oil_Gas Underinvestment i, t-1	-2.30***	0.60	-3.81	-0.11	0.11	-0.94	-0.20	0.23	-0.85
Tech_Telecom Underinvestment i, t-1	-3.01***	0.86	-3.46	0.03	0.16	0.19	0.17	0.33	0.53
R^2	0.7054			0.5158			0.4976		

***** Significant at 99% , ** Significant at 95%, * Significant at 90%**

6 Conclusion

We investigated 360 non-financial companies listed in Singapore Stock Market, with our sample size covering 7 years period, from 2005 to 2011. Our study had two objectives. These include: 1) Measuring extent of overinvestment and underinvestment in firms listed in Singapore Stock Market. 2) Measuring the impact of overinvestment and underinvestment on firm performance. We applied Fixed Effect regression model in our analysis and got following results.

52% of the firms in Singapore are doing proper investment. 29% firms are doing overinvestment while 19% firms are doing underinvestment. Sector wise analysis shows that most efficient investments are taking place in Oil & Gas sector which accounts for 67% firms doing proper investment. Maximum overinvestment is taking place in Basic Material & Utilities sector which is 37% firms. Worst underinvestment is happening in Healthcare sector which comprises of 33% firms.

Our further tests show that both overinvestment and underinvestment has severe negative impact on firm performance, while proper investment has positive impact on firm performance. We further found out that underinvestment has stronger negative impact on firm performance compared to overinvestment. Moreover, sector wise result shows that all the industrial sectors doing overinvestment or underinvestment has severe negative impact on firm performance when Tobin's Q is proxy for firm performance. Magnitude of negative firm performance is most severe in underinvesting firms of Healthcare sector.

Our results indicate that agency problem due to overinvestment and underinvestment exists in the firms listed in Singapore Stock Market. While most, of the firms are doing proper investment but overinvestment and underinvestment is still prevalent. It further indicates that consequences of improper investment result in negative firm performance.

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