The Influence of the Stock Market on Corporate Investment

by

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Abstract

This paper investigates how corporate investment is influenced by the non-fundamental component of stock prices. Previous research conducted has found that investment is sensitive to equity mispricing where both the stock is undervalued and the firm is dependent on equity. Under these conditions the firm would need to issue undervalued equity to fund new investment.

The suggestion is that the investment behaviours of equity dependent firms display a stronger correlation to stock prices than firms that are not dependent on equity. It is of particular interest to investigate the effect of equity-dependence on corporate investment in South Africa as developing economies often do not have access to debt due to under-developed credit markets.

The data used in this study covers a period of 18 years, from 1993 to 2010. The sample studied includes all JSE (Johannesburg Stock Exchange) listed companies who were listed before 1991 and remained listed as at 31 December 2013, in order to draw a conclusion on the effect of mispricing in the JSE on corporate investment in South Africa.

The results show a low correlation and a lack of statistical significance in the regression analyses performed, making it impossible to draw any meaningful conclusion about the effect of equity dependence. The default conclusion is that the null hypothesis cannot be rejected. In other words, the alternate hypothesis, that the investment behaviours of equity dependent firms display a stronger correlation to stock prices than firms that are not dependent on equity, is rejected for firms listed on the Johannesburg Stock Exchange. The weak form efficiency of the JSE and the limited access to credit may be the reasons behind the results, or lack thereof, observed.

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Chapter I: Introduction

A critical research question is whether corporate investment is influenced by the stock market. Previous research has found that investment is sensitive to equity mispricing where both the stock is undervalued and the firm is dependent on equity (Baker, Stein, & Wurgler, 2003). This was found to be true on the New York Stock Exchange (Lee *et al*., 2010; Rosenberg *et al*., 1985). The purpose of this dissertation is to investigate whether equity dependence has an effect on corporate investment in South Africa.

Literature relevant to this study will be reviewed in chapter 2.The review will begin with literature that investigates the effect of the stock market on corporate investment where the stock market is assumed to be efficient. However, given that the JSE (Johannesburg Stock Exchange) has been shown to be inefficient (Van Rensburg & Robertson, 2003; Auret & Sinclaire, 2006; Basiewicz & Auret, 2009) the focus of the review will be literature which does not assume that the market is efficient. The review will then explore how inefficiencies in the market result in a non-fundamental component of stock prices[2] which has an effect on the investment behaviour of firms who are reliant on equity to fund incremental investment.

The findings from the review of literature will form the basis for the hypothesis development in chapter 3, where the null and alternate hypotheses will be

[2] Stock price is the sum of the fundamental and non-fundamental components. The non-fundamental component of stock price arises as a result of mispricing. “The non-fundamental component of stock prices, being the difference between actual prices and their fundamental values, is any component unaccounted for by price fundamentals.” (Anderson et al., 2003). In other words the non-fundamental component of stock price is the under or over-pricing of the stock from its fundamental value.

formulated. The main focus of this study is hypothesis 1, which questions whether the investment behaviour of equity-dependent firms is more sensitive to the non-fundamental component of stock prices than those firms which are not dependent on equity (Baker, Stein, & Wurgler, 2003). A second hypothesis will also be developed and discussed in chapter 3, and will be used to rule out alternative explanations for the findings of hypothesis 1. This study applies the same methodology as Baker *et al.* (2003) to data obtained from the Johannesburg Stock Exchange (JSE) over an 18 year period that covers 1993 through to 2010.

The source of data and method of research will be discussed in chapter 4. In addition, robustness checks performed will be explained.

In chapter 5 the empirical results will be presented and analysed, followed by chapter 6 where relevant literature will be discussed to offer explanations for the findings presented in chapter 5.

Chapter 7 will highlight the conclusions that can be drawn from this study, based on the results of chapter 5 and chapter 6, and will set out any potential areas for future research.

Chapter II: Literature Review

Introduction

The relationship between corporate investment and stock prices is well-researched. Researchers agree that the stock market and corporate investment are positively correlated (Keynes, 1936; Tobin, 1969; Abel, 1980; Roll, 1986; Morck *et al*., 1990; Barro, 1990; Blanchard *et al*., 1993; Stein J., 2001; Polk & Sapienza, 2009; Duchin *et al*., 2010; Bolton *et al*., 2011).However there are differing explanations for this relationship. Previous studies conducted in this area fall into two main categories: researchers who assume the market is efficient, and those who assume the market is inefficient.

Assuming the stock market is efficient

Tobin's Q is a well-known measure used to describe the relationship between corporate investment and the stock market (Polk & Sapienza, 2002; Bolton *et al.,* 2011). The 'Q theory' offers some explanation behind the positive relationship between stock prices and corporate investment. Tobin (1969) defines Q is as the ratio of the market value to replacement cost of a firm's assets. Tobin's Q provides a measure of stock price relative to a firm's assets. In his study 'A General Equilibrium Approach to Monetary Theory' Tobin (1969) suggests that a firm will continue to invest until Q equals 1. The theory hinges on "the values of existing capital goods, or of titles to them, to diverge from their current reproduction cost" (Tobin, 1969, p.19). It would appear that any divergence between the true value of a firm's assets and the market price must be due to mispricing in the market. However Abel (1980) and Hayashi (1982) do not

abandon the idea that stock markets are efficient and argue that Q does not equal 1 due to adjustment costs, such as taxes.

Abel (1980) and Hayashi's (1982) suggest that the rate of investment is a function of marginal Q, where marginal Q is the ratio of the market value of marginal investments to the replacement costs of those investments.

"According to traditional efficient-market theories, one should expect to see a strong association between Tobin's (1969) Q and firm investment, since Q is a summary statistic for the market's information about investment opportunities." (Stein, 2001, p.126).

However, while the 'Q theory' appears to be theoretically sound empirical studies have found the relation between Tobin's Q (or marginal Q) and investment to be weak where the market is assumed to be efficient.

To explain this finding researchers have considered the effect of asymmetric information and agency on investment behaviours without abandoning the efficient market hypothesis. For example, Roll (1986), Heaton (2002) and Malmendier *et al.* (2011) make the assumption that the market is efficient when they argue that managerial overconfidence explains overinvestment. The findings of Roll (1986), Heaton (2002) and Malmendier *et al.* (2011) offer explanation for the weak relationship between Tobin's Q and investment where the EMH holds true.

The efficient market hypothesis

The efficient market hypothesis ('EMH'), developed by Eugene Fama (1965), emerged as the prominent theory behind stock market behavior in the 1960's. "In

the first decade after its conception in the 1960s, the EMH turned into an enormous theoretical and empirical success." (Shleifer, 2000, p.3). In an efficient market stock prices should reflect all publicly available information, where new information arises the stock price should adjust instantaneously to reflect this new information, thus preventing any investors from earning excess returns.

However, the idea of an efficient market should be viewed with skepticism given the growing body of evidence against it.

The EMH requires the population of investors to have rational expectations on average. However empirical studies conducted have consistently criticised the fundamentals behind the EMH.

Consider the proposition that investors cannot make excess returns using past information: De Bondt and Thaler (1985) investigated overreaction in the market and found that extreme 'winners' perform relatively poorly and extreme 'losers' tend to outperform relative to average share performance. De Bondt and Thaler (1985) suggested that market overreaction leads to 'winners' becoming overpriced resulting in future returns being poor, and vice versa for 'losers'. Jegadeesh and Titman (1993) released an influential paper documenting the 'momentum' effect, showing that high performing stocks continue to earn higher returns on average than low performing stocks for a period of up to a year. More recently Jegadeesh and Titman (2001) find that momentum profits continued into the 1990s and proposed that overreactions are the reason behind momentum profits. These results point to inefficiencies in the market. Chui *et al.* (2010)

evaluate stock market data from 23 different countries and conclude that most stock markets show evidence of the momentum effect.

In performing a test of the Efficient Market Hypothesis, Basu (1977) shows a relationship between the return and price-earnings ratios of stocks. Basu (1977) argues that 'exaggerated investor expectations', reflected in the price-earnings ratio of stocks, result in stocks with low price-earnings ratios outperforming stocks with high price-earnings ratios. Rosenberg *et al.* (1985) show evidence of market inefficiency on the New York Stock Exchange (NYSE). "A Book/Price strategy and a 'specific-return reversal' strategy subject to careful tests, lead to the 'inescapable conclusion' that prices on the NYSE are inefficient." (Rosenberg, Lanstein and Reid, 1985, p.9). More recently, Lee *et al.* (2010) (2010) test the efficient market hypothesis using data obtained from 32 developed and 26 developing countries over an 8 year period ending in 2007; Lee *et al.* conclude that stock markets around the world are not efficient.

In a South African context, Van Rensburg and Robertson (2003), using data from the Johannesburg Stock Exchange, find that small firms earn higher returns and have smaller betas in comparison to larger firms. Auret and Sinclaire (2006) (2006) find that the book-to-market ratio of a firm can be used to predict future stock returns. Auret and Basiewicz (2009) find that a price premium exists based on firm size and confirm that the book-to-market ratio of a firm can be used to predict future returns on the JSE, allowing investors to earn excess returns. These findings are in direct contradiction to the EMH which does not allow for investors to earn excess returns.

Abandoning the idea that the stock market is efficient

Abandoning the idea that the stock market is efficient, researchers have explored the possibility that inefficiencies in the market affect corporate investment. The empirical studies conducted have yielded mixed results.

Blanchard *et al*. (1993, p.115) find results that point "strongly but not overwhelmingly, to a larger role of 'fundamentals' than of 'valuation' in investment decisions" in the investigation of whether managers should follow market signals in making investment decisions. In other words, managers largely ignore the market value of their firm's equity when they perceive the fundamental value of their firm's equity to differ from the market valuation. However Blanchard *et al.* do admit there is evidence to suggest that during a 'fad or bubble' managers will follow market valuations in their investment decision making.

Morck et al. (1990) explore whether managerial objectives drive bad investments. Morck *et al.* (1990) suggest that managers will avoid good long-term investments that offer limited gain in the short-term as their job performance is linked to the short-term performance of the firm's stock. Morck *et al.* (1990) conclude that while the stock market does have an impact on corporate investment it may not be central in investment decision making.

In contrast, Keynes (1936), one of the first researchers to investigate the effect of the stock market on corporate investment, suggests that an element of investor irrationality is implicit in stock price which leads to the cost of equity diverging from the cost of other sources of finance. Mispricing due to investor irrationality therefore affects equity issues in the market and thus impacts

corporate investment (Baker, Stein, & Wurgler, 2003). Barro (1990, p.115) shows that “even in the presence of cash flow variables, such as contemporaneous and lagged values of after-tax corporate profits, the stock market variable retains significant predictive power for investment”.

Gilchrist *et al.* (2005) argue that firms exploit inflated stock prices; by issuing equity at an inflated price the cost of capital is reduced and real investment increases. Gilchrist *et al* (2005) find that stock price bubbles result in increased equity issuance and real investment, as predicted. Chen *et al.* (2007, p.619) investigate ”*Price Informativeness and Investment Sensitivity to Stock Price*”” and obtain results which suggest that managers incorporate information obtained from the stock price into their investment decisions.

The effect of investment horizon

Stein (1988) explores a ‘short-horizons’ theory and examines how managers sacrifice long-term interests to boost short-term profits. In short, an inefficient market results in suboptimal investment strategies being undertaken. “If stockholders are imperfectly informed, temporarily low earnings may cause the stock to become undervalued, increasing the likelihood of a takeover at an unfavourable price; hence the managerial concern with current bottom line” (Stein, 1988, p.61). Shleifer and Vishny (1990) go on to develop a model around this ‘short-horizons’ theory showing how market inefficiencies lead to suboptimal corporate investment.

Polk and Sapienza (2009) explore the effect of investment horizon on corporate investment and find that firms with short-term investors, as indicated by a high

share turnover, have corporate investment that is more sensitive to stock mispricing than firms with long-term investors.

Stein (1996) explores how mispricing may affect Investment decisions in his theoretical paper 'Rational Capital Budgeting in an irrational World'. Stein develops a framework around the 'short-horizons' theory which shows that managers who have short horizons or face financial difficulties should use market data to capture market perception to ensure short term stock price performance. He concludes that managers who face financial constraints have investment behaviour which is more sensitive to deviations of their firm's stock from the fundamental value than those managers who do not face financial constraints.

More recently Baker *et al*. (2003) have further investigated the effect of financial constraints on corporate investment; Baker *et al* (2003) explore the effect of equity-dependence on corporate investment, concluding that an equity-dependent firm has corporate investment that is more sensitive to mispricing in the market than firms that are not equity-dependent.

Investment behaviour of equity-dependent firms

It is of particular interest to investigate the effect of equity-dependence on corporate investment in South Africa as developing economies often do not have sufficient financial capital due to under-developed credit markets (Higson, 2011); Rajan and Zingales (1996) show that firms dependent on external finance grow slower in developing markets. Love (2001) finds that firms are more sensitive to the availability of internal funds in less financially developed countries.

Therefore, the key focus of this study is whether stock prices have an impact on corporate investment behaviour, specifically how equity dependence makes a firm's corporate investment more sensitive to stock prices.

Following the work of Stein (1996), Baker *et al*. (2003) use a simplified version of the model developed in Stein's (1996) study, to develop hypotheses on equity dependence and investment that are testable as an empirical study. "Intuitively, a firm with no debt and a stockpile of cash can insulate its investment decisions from irrational gyrations in its stock price. But an 'equity-dependent' firm that needs equity to fund its marginal investments will be less likely to process if it has to issue undervalued shares" (Baker *et al.,* 2003, p.970). Using an index developed by Kaplan and Zingales (1997) as a proxy for equity dependence, Baker *et al.* find that stock prices have a greater impact on the investment behaviour of firms that require external finance to fund marginal investments.

Defining equity dependence

Kaplan and Zingales (1997, p.172) explore what it means for a firm to be financially constrained; "The most precise (but also broadest) definition classifies firms as financially constrained if they face a wedge between the internal and external costs of funds". This definition suggests that all firms are financially constrained given the costs to raise capital externally. This definition is useful in developing a framework to differentiate firms based on the level of financial constraint they face. Based on this idea Kaplan and Zingales (1997) develop an index to measure financial constraint, designed to distinguish the degree of financial constraint faced by firms. "In general, our unconstrained or less

constrained firms are those firms with relatively large amounts of liquid assets and net worth." (Kaplan and Zingales, 1997, p.173).

Lamont *et al*. (2001) adapt the index created by Kaplan and Zingales; Lamont *et al.* construct a linear combination of accounting ratios, the 'KZ index'. There are five variables included in the KZ index; cash flow to total capital (negative), dividends to total capital (negative), cash balances to total capital (negative), the market to book ratio (positive) and leverage (negative). The greater the financial constraint faced by firms the higher the KZ index; the KZ index will be highest for highly leveraged firms with limited internal capital to fund investments. The KZ index therefore serves as a good proxy for equity dependence.

Baker *et al.* (2003) suggest that investment is sensitive to mispricing in the market where both the stock is undervalued and the firm is dependent on equity. Under these conditions the firm would need to issue undervalued equity to fund any investment. When a firm is dependent on equity to finance incremental investments inefficiencies in the market that result in a low stock price act like a finance constraint as managers are will need to issue underpriced equity and are therefore discouraged to make further investments.

Baker *et al.* (2003) conclude that a sensible proxy for equity dependence should include a negative relation to operating cash flow, a positive relation to growth opportunities, a positive relation to leverage and a negative relation to the debt capacity of assets. "A firm is more likely to be dependent on equity when a firm's pre-existing wealth is low (which translates into low profitability, cash balances, or previously untapped debt capacity) … when growth opportunities are good,

and when the incremental debt capacity of new assets is low." (Baker *et al*., 2003, p.982).

Conclusion

The review of literature explored the effect of the stock market on corporate investment. Literature where the stock market is assumed to be efficient suggests a positive correlation between investment and Tobin's Q, but empirical studies in this area find the relationship to be weak.

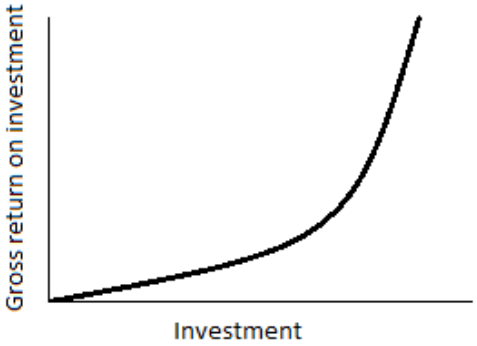
Abandoning the idea that the market is efficient and focusing on the effect of equity-dependence on incremental investment an interesting hypothesis arises; the literature suggests that the investment behavior of equity-dependent firms is more sensitive to the non-fundamental component of stock prices than firms which are not dependent on equity. Given that the JSE (Johannesburg Stock Exchange) is shown to be inefficient (Van Rensburg & Robertson, 2003; Auret & Sinclaire, 2006; Basiewicz & Auret, 2009) the effect of the non-fundamental component of stock prices on corporate investment in South Africa is an interesting area of research.

Chapter III: Hypothesis development

The key idea behind this study is that investment behaviours of equity dependent[3] firms display a stronger correlation with stock prices than firms that are not dependent on equity. Baker *et al*. (2003) developed a theoretical model, based on the work of Stein (1996), to posit several testable hypotheses. The Baker *et al.* (2003) model makes several assumptions.

To begin with, a firm earns a gross return on its investments, where the function for gross return is an increasing, concave function as shown in Figure 1 below (Baker, Stein, & Wurgler, 2003).

Figure I: Gross return on investment



To fund investments a firm can either use pre-existing wealth or raise external finance in the form of debt or equity. The second assumption is that the firm is subject to a leverage constraint[4]. Thirdly, the equity market is not efficient[5];

[3]. "A firm is more likely to be dependent on equity when a firm's pre-existing wealth is low (which translates into low profitability, cash balances, or previously untapped debt capacity) … when growth opportunities are good, and when the incremental debt capacity of new assets is low." (Baker et al., 2003).

[4] This assumption is made to simplify the model however a leverage constraint exists on firms endogenously. Empirically as the debt ratio increases the cost of financial distress increases,

equity may be undervalued or overvalued relative to its fair market value. Fourth, debt is fairly priced[6]. The fifth, and final, assumption is that there is an upper limit on how much equity can be issued and equity cannot be re-purchased[7]. The optimal investment level is known as the 'first-best level' (Baker, Stein, & Wurgler, 2003).

Under these conditions a firm will invest at the 'first-best level' only where it has sufficient pre-existing wealth to fund investment or where equity is overvalued as the firm will issue as much equity as possible. Where equity is undervalued the firm will avoid issuing equity, therefore "an undervalued firm with insufficient wealth underinvests... and both investment and the size of the equity issue are functions of the degree of undervaluation" (Baker *et al.,* 2003, p.974). These different outcomes are displayed in the figures below.

In Figure II the vertical axis represents the level of investment and the horizontal axis represents the degree of mispricing of equity. To the right of the vertical axis, in the region of overvaluation, is the investment behaviour of non equity-dependent firms. Where a firm is not dependent on equity they invest at the

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discouraging further debt issues. Resulting in an endogenous leverage constraint. (Baker et al., 2003)

[5] See discussion in literature review, above, around market inefficiency. Empirical studies conducted have consistently criticised the fundamentals behind the EMH, examples include studies conducted by De Bondt and Thaler (1985), Basu (1977), Rosenberg, Lanstein, & Reid (1985), Van Rensburg and Robertson (2003) and Auret and Sinclaire (2006) (2006).

[6]Baker *et al* (2003) suggest that the equity and debt markets are segmented in that expected return premiums vary independently. This allows for equity mispricing to exist while debt remains fairly valued.

[7]While these assumptions are made to simplify the model the limit on how much equity can be issued and re-purchased may exist endogenously where price pressure effects exist (Baker et al., 2003)

optimal level - the ‘first-best level’. Figure III represents the financing behaviour of firms in the presence of equity mispricing. The vertical axis represents the level of equity issuance and the horizontal axis represents the degree of mispricing. Where a firm is equity-dependent it is clear that equity issues are a function of the degree of undervaluation (Baker, Stein, & Wurgler, 2003). The function in each case is concave up, increasing.

The Baker *et al.* (2003) model defines a firm as equity dependent where the debt capacity and pre-existing wealth is insufficient to achieve the ‘first-best’ level of investment. The model shows that investment is dependent on the non-fundamental component of stock prices when key conditions are present; where a firm’s stock is undervalued and the firm’s debt capacity and availability and pre-existing wealth are so low that “the firm would have to issue undervalued equity to invest at the first-best level” (Baker *et al*., 2003, p.975). Therefore market inefficiency is a financial constraint which discourages investment when a firm’s stock becomes undervalued.

Figure II: Investment behaviour in the presence of equity mispricing

(Baker *et al*., 2003)

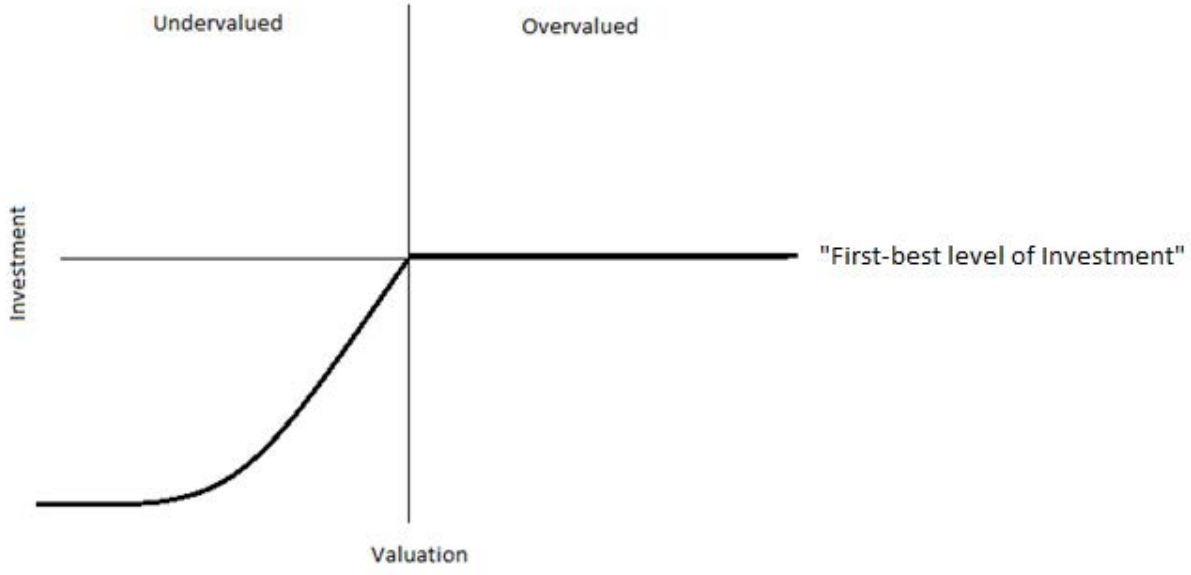
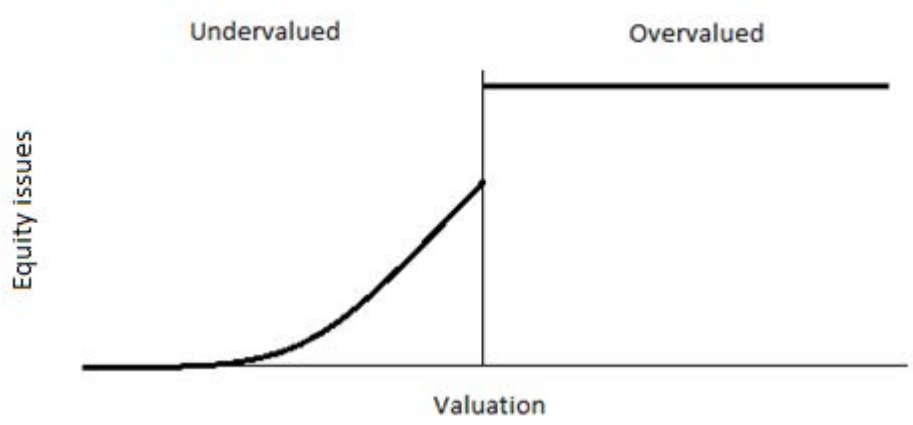


Figure III: Financing behaviour in the presence of equity mispricing

(Baker *et al*., 2003)



An interesting observation that can be taken from this model is that a firm facing restricted access to debt has investment which is more sensitive to mispricing in

the market than a firm facing relatively unrestricted access to debt. This is because the firm with less debt capacity must issue more equity for each marginal unit of investment.

Based on this model Baker *et al.* (2003) make three empirical predictions around investment behavior and financing behavior of firms listed on the New York Stock Exchange. Applying the same methodology as Baker *et al.* the following testable hypotheses are developed in the context of the Johannesburg Stock Exchange;

Hypothesis 1

The literature suggests that the investment behavior of equity-dependent firms is more sensitive to mispricing than firms which are not dependent on equity.

The null hypothesis is therefore that investment sensitivity to mispricing does not differ between equity-dependent firms and non-equity-dependent firms.

If the null hypothesis is rejected the conclusion that can be drawn is that Equity-dependent firms have investment which is more sensitive to mispricing (Q) than non-equity-dependent firms.

Q represents mispricing, the non-fundamental component of stock price, where Q is shown in the equation below;

Equation I: Q

$$Q = \frac{Assets + (Market\ Value\ of\ Equity - Book\ Value\ of\ Equity)}{Assets}$$

The model outlined by Baker *et al*. (2003) , as depicted in Figure II above, shows how investment policy is affected by over or undervaluation where a firm is dependent on equity. Hypothesis 1 is used to test whether equity dependence leads to a higher sensitivity of investment to stock prices. Therefore the hypothesis does not require that it be identified whether a firm is over or undervalued, rather it averages over the regions of overvaluation and undervaluation by using Q as a measure of the non-fundamental component of stock prices. Baker *et al.* (2003) explain that this is an appealing feature of this approach as there is no need to determine whether a firm is overvalued or undervalued to be able to test the model empirically.

Hypothesis 2

While hypothesis 1 utilises Q as a proxy for the non-fundamental component of stock prices an alternate measure of mispricing is future stock returns. The idea is that when a stock is overpriced the expected returns will be low as the mispricing is corrected; in contrast an undervalued stock will have high expected returns (Baker, Stein, & Wurgler, 2003). In other words, the idea is that realized returns act as a rough proxy for expected returns, and therefore a proxy for mispricing.

The null hypothesis is therefore that investment sensitivity to future stock returns [8]does not differ between -dependent firms and non-equity-dependent firms.

[8] Where future stock return is the cumulative return earned on a stock in years t+1 to t+3 as a percentage of the stock price at time t.

If the null hypothesis is rejected the conclusion that can be drawn is that equity-dependent firms have investment behavior which is more sensitive to future stock returns than non-equity-dependent firms.

Future return is a noisy proxy for mispricing (Baker, Stein, & Wurgler, 2003); a high positive realised return at time t+3 indicates that a stock was undervalued at time t, conversely, a stock may have been overvalued at time t where the realised return at time t+3 is low or negative. The prediction is that investment is negatively related to future stock returns, and that the more dependent on equity a firm is the greater the negative relation to stock returns is.

The focus of this study is to develop an understanding of the relationship between Q and investment through tests performed on hypothesis 1, however hypothesis 2 is used to rule out alternative explanations for the findings of hypothesis 1 (Baker, Stein, & Wurgler, 2003).

Investment sensitivity and Q

The model outlined by Baker *et al*. (2003) suggests that investment is sensitive to mispricing. The alternate hypothesis 1 suggests that investment is sensitive to a proxy for mispricing; Q. However, while Q contains information on mispricing it also contains other information which may lead to ambiguities in the results of this empirical study. “Q potentially contains three sources of variation: (i) mispricing (ii) information about the profitability of investment; and (iii) measurement error.” (Baker *et al.,* 2003, p.979) Hypothesis 1 is based on the element of mispricing within Q; therefore the existence of other sources of variation within Q is problematic.

It is possible that even where all the variation in Q is as a result of variation in the profitability of investments equity dependent firms will have investment which is sensitive to Q.Myers and Majluf (1984) develop an issue-invest model which shows a tendency of management to rely on internal funds to finance investments, and when external financing is required they show that management favours debt over equity. Specifically, where a firm is dependent on equity Myers and Majluf (1984) show that management may rather pass up worthwhile investment opportunities than issue new stock. This is an adverse-selection problem.

The Myers and Majluf (1984) model suggests that where the market is efficient, and no mispricing exists, equity-dependent firms may have investment which is more sensitive to Q. Myers and Majluf (1984) propose that a lower value of Q leads to a greater reluctance of management to issue new stock. The Myers and Majluf (1984) model raises a competing explanation for the source of investment sensitivity to Q and suggests that an observed sensitivity of investment to Q may not be as a result of mispricing. Baker *et al.* (2003) suggest that this competing explanation for investment sensitivity to Q can be addressed with the tests performed for hypothesis 2. The alternate hypothesis 2 suggests a relationship between investment and future stock returns. The model suggested by Myers and Majluf (1984) assumes the market is efficient, it does not predict that equity-dependent firms will have a greater sensitivity of investment to future stock returns.

In addition there is the argument that investment may be observed as being sensitive to Q as a result of observational error rather than the influence of

mispricing. Hypothesis 2 is useful to address this competing explanation; “Measurement error in Q is typically thought to arise from an inability to accurately measure the replacement cost of capital…the concern is that nonequity-dependent firms do more intangible investment, which leads to more measurement error and hence a bias in sensitivity toward zero.” (Baker *et al*., 2003, p.980) Using future stock returns rather than Q in hypothesis 2 removes the potential for this observational error to affect the results.

Investment sensitivity to Q of equity-dependent versus non equity-dependent firms

It is important to note that the model compares equity-dependent firms against firms that are not dependent on equity, and shows that investment becomes more sensitive to stock prices when a firm becomes equity-dependent. What the model does not show is whether investment sensitivity to stock prices varies at varying levels of equity dependence. Baker *et al*. (2003, p.977) explain that “a globally monotonic relationship between the degree of equity dependence and the sensitivity of investment to stock prices only obtains if we put certain restrictions on the form of the production function.” Therefore the questions of whether varying levels of equity-dependence result in varying levels of investment sensitivity to stock prices over the whole range is difficult to put into a theoretical model. This question will be explored empirically.

Chapter IV: Method and data

Baker *et al*. (2003) investigate the effect that equity-dependence has on the sensitivity of corporate investment to stock prices on the New York Stock Exchange over a 20 year period, 1980 to 1999. This study applies the same methodology as Baker *et al.* (2003) to data obtained from the Johannesburg Stock Exchange (JSE) over an 18 year period that covers 1993 through to 2010[9].

Data

Data used in this study is obtained from McGregor BFA. The data used includes all JSE (Johannesburg Stock Exchange) listed companies who were listed before 1991 and remained listed as at 31 December 2013[9]. After removing companies from the data set with missing data points 64 companies remained. Data obtained is collected by McGregor BFA directly from the annual financial statements of these companies.

[9] This study investigates the investment behaviour of firms listed on the JSE over the 18 year period 1993 to 2010. However 23 years of data is obtained for this study, ranging from 1991 to 2013;

Two years of lagged data is required; the investment behaviour of a firm at time t may depend on the firm's level of equity dependence, measured by the KZ index, at time t-1. In order to calculate the firm's KZ index at time t-1 the firm's total assets at time t-2 must be obtained.

Three years of leading data is required; Hypothesis 2 uses future stock return which is the cumulative return earned on a stock in years t+1 to t+3 as a percentage of the stock price at time t.

Method

Firms with no excess cash or access to debt must rely on external equity issues to raise capital for marginal investments. These firms will be less likely to make marginal investments where their stock is undervalued (Baker, Stein, & Wurgler, 2003). Therefore it follows that stock prices impact corporate investment of equity-dependent firms. The hypothesis is that investment behaviors of equity dependent firms display a stronger correlation to stock prices than firms that are not dependent on equity. In order to test this hypothesis a proxy for equity dependence is required.

Equity dependence

Kaplan and Zingales (1997) first developed the KZ index as a proxy for financial constraint faced by firms. Lamont *et al*. (2001) adapt the index created by Kaplan and Zingales; the five variable KZ index developed by Lamont *et al.* (2001) is as follows;

Equation II: Kaplan and Zingales index

$$KZ_t(five\ variable) = -1.002\ \frac{CF_t}{A_{t-1}} - 39.368\ \frac{Div_t}{A_{t-1}} - 1.315\ \frac{C_t}{A_{t-1}} + 3.139\ LEV_t + 0.283\ Q_t$$

Where $\frac{\mathrm{CF_t}}{\mathrm{A_{t-1}}}$ is cash flow (McGregor BFA 'cash utilised (cash flow)') over lagged assets; $\frac{\mathrm{Div_t}}{\mathrm{A_{t-1}}}$ is cash dividends (McGregor BFA 'dividends (cash flow)') over lagged assets; $\frac{C_t}{A_{t-1}}$ is cash balances (McGregor BFA 'cash & near cash (balance sheet)') over lagged assets; LEV_t is leverage, which is liabilities (McGregor BFA

'total liabilities (balance sheet)') over assets ; Q_t is the market value of equity (McGregor BFA 'share price company financial year end (sundry)' multiplied by 'number of ordinary shares issued (sundry)') plus assets less the book value of total equity (McGregor BFA 'total shareholders' interest (balance sheet)').

A disadvantage of the Lamont *et al.* five variable KZ index is that a proxy for investment opportunities distinct from mispricing is required to fully represent the concept of equity dependence (Baker, Stein, & Wurgler, 2003). In the five variable KZ index $Div_t$and Q_t act as proxies for investment opportunities, where low dividend payouts and a market value significantly higher than book value of a firm (high Q_t) are both indicative of strong investment prospects. However $Q_t$also contains information on the mispricing of a firm's equity in the market. Baker *et al.* (2003) highlight that the inclusion of Q_t in the five variable KZ index is problematic given its dual role. As a proxy for investment opportunities $Q_t$has a positive effect on equity dependence while as a proxy for mispricing it has a negative effect on equity dependence. Baker *et al* (2003) suggest a modified four-variable KZ index, omitting Q_t to avoid this ambiguity. Baker *et al* (2003) find that the omission of Q_t does not have an effect on the basic results.

Equation III: KZ index

$$KZ_t = -1.002\,\frac{CF_t}{A_{t-1}} - 39.368\,\frac{Div_t}{A_{t-1}} - 1.315\,\frac{C_t}{A_{t-1}} + 3.139\,LEV_t$$

Following the methodology of Baker *et al*. (2003) this study uses the modified four-variable KZ index. Going forward any reference to the 'KZ index' is in relation to this four-variable KZ index.

Notice that on omitting the $Q_t$variable from the KZ index the coefficients of the remaining variables are not adjusted; Baker *et al.* restimate the coefficients for the four-factor KZ index using the original data provided in the appendix of Kaplan and Zingales [1997] and find that "the coefficients on the other four variables are virtually identical whether or not Q is included in the regression" (Baker *et al.*, 2003, p.985). This indicates that there is no need to adjust the coefficients of the remaining four variables once $Q_t$is removed from the KZ index.

Using the data obtained from McGregor BFA the KZ index is calculated for each firm for each year of the 18 year period of study (1993 to 2010). An average KZ index is then computed for each firm and the firms are then ranked from the least financially constrained (low KZ index) to most financially constrained (high KZ index). The 64 companies are then split into four groups or quartiles, 16 companies per quartile, based on their level of equity dependence. Regression analysis is performed on each of these quartiles to assess the relationship between corporate investment and the stock market.

Robustness checks on the KZ index

Baker *et al.* (2003) note that the KZ index is not a precise measure of equity dependence, but is a useful proxy as it contains several variables which "plausibly ought to be indicative of equity dependence" (Baker *et al*., 2003,

p.984). The relative weightings of each variable in the index are suggested by Kaplan and Zingales (1997) in their study 'Do Investment-Cash Flow Sensitivities Provide Useful Measures of Financing Constraints'. However Baker *et al.* show that the precise weightings do not significantly influence the outcome of the study; Baker *et al.* reset the coefficients to 0.25, such that each variable contributes equally to the KZ index, and find that similar results are obtained. The same robustness checks have been performed on the outcome of this study with similar results seen regardless of the weightings of the variables in the index.

This study follows the suggestion of Baker *et al.* (2003) to omit the Q_t variable from the KZ index for conceptual cleanness. In order to check that this does not alter the results of the study robustness checks are performed on the results in this study and find that the exclusion of Q_t from the KZ index does not significantly alter the results. Overall the type of firm that is expected to be dependent on equity will have "a young non-dividend paying firm, with low cash flow balances, and with high leverage relative to the debt capacity of assets." (Baker *et al*., 2003, p.996)

The sample in the Baker *et al.* (2003) study includes all firms on the New York Stock Exchange, only excluding financial firms and firm-years with a book value under $10 million. This study looks at firms listed on the Johannesburg stock exchange (JSE), including all firms listed on or before the year 1991 and still listed in 2010. An interesting characteristic of the JSE is the dominance of resource firms, which make up a large portion of the listed firms on the JSE. "Given the dominance of resource counters on the JSE, the commodity cycle is a

significant determinant of return." (Muller and Ward, 2013, p.8). Moreover the United States of America is a developed economy and the New York Stock Exchange is strong form efficient (Cilliers, 2005), while South Africa is an emerging economy (Jefferis & Smith, 2005) and the JSE is weak form efficient (Okeahalam & Jefferis, 1999). This brings to mind the question of how appropriate the application of the KZ index is in this study of JSE listed firms. This is explored further in chapter VI.

Corporate Investment

The data used in this study is gathered from the annual reports of firms, therefore measures of corporate investment are based on accounting ratios. This study uses three measures; firstly the ratio of capital expenditure (McGregor BFA 'Fixed Assets Acquired (cashflow)') to start-of-year book assets (McGregor BFA 'Total Assets (balance sheet)'). Then the inclusion of research and development expenditure (McGregor BFA 'Research & Development (cashflow)') is considered, and finally, the percentage change in total book assets (McGregor BFA 'Total Assets (balance sheet)') each year is considered.

Financing

Following the methodology of Baker *et al.* (2003) two measures of external finance are considered in this study; equity issuance and total external finance raised. As a measure of equity issuance the ratio of new share issues to start-of-year book assets is used. Similarly, as a measure of total external finance raised the ratio of total new external finance each year to start-of-year book assets is calculated. The change in book equity (McGregor BFA 'Share Capital (balance sheet)' plus 'Share Premium (balance sheet)') less the change in retained

earnings (McGregor BFA 'Retained Earnings (balance sheet)') is used as a measure of new share issues. Total external finance issuance is constructed by adding together new share issues plus debt issues, where change in assets less the change in book equity (McGregor 'Total Shareholders' Interest (balance sheet)') is used as a measure of debt issues.

Summary statistics

The table below summarises the key data for this study. The full sample period is over 18 years, from 1993 to 2010. However during the 18 year period under study two large market disturbances occurred which may influence the results of this study: the 2000 collapse of the 'Dot-com Bubble' and the 2007/2008 financial crisis. Therefore, the data has also been split into three sub-sample populations, with the 1999-2004 sub-sample capturing the collapse of the 'Dot-com Bubble' and the 2005-2010 sub-sample capturing the 2007/2008 financial crisis.

Table I: Summary statistics: Full sample

		Full sample (1993 - 2010)				
		Mean	**SD**	**Median**	**Min**	**Max**
KZ Index		-3.74	9.08	-3.05	-225.45	0.21
CF/A	**%**	13.25	65.58	9.38	-713.17	1,858.85
Div/A	**%**	4.67	20.44	2.48	0.00	522.07
Cash/A	**%**	13.21	15.68	8.88	0.00	241.52
Leverage	**%**	49.57	22.08	48.56	0.03	144.57
Q		3.40	10.95	1.22	0.03	175.57
CF/A	**%**	0.12	0.34	0.10	-7.13	8.31

Table II: Summary statistics: Sub-sample

		Sub-sample means		
		1993 - 1998	**1999 - 2004**	**2005 - 2010**
KZ Index		-4.18	-3.23	-3.88
CF/A	**%**	16.43	4.89	16.02
Div/A	**%**	6.03	2.69	4.74
Cash/A	**%**	10.10	15.11	14.64
Leverage	**%**	49.58	48.91	49.58
Q		3.28	3.50	3.41
CF/A	**%**	0.09	0.11	0.14

Limitations of the study

This study is limited by a number of simplifying assumptions that may not apply in the real world; debt is fairly priced[10] , there is an upper limit on how much equity can be issued and equity cannot be re-purchased[11].

In addition this study is limited by the data available; Data used in this study includes all JSE (Johannesburg Stock Exchange) listed companies who were listed before 1991 and remained listed as at 31 December 2013. After removing companies from the data set with missing data points only 64 companies

[10]Baker *et al* (2003) suggest that the equity and debt markets are segmented in that expected return premiums vary independently. This allows for equity mispricing to exist while debt remains fairly valued.

[11]While these assumptions are made to simplify the model the limit on how much equity can be issued and re-purchased may exist endogenously where price pressure effects exist (Baker et al., 2003)

remained, this is a fraction of the number of firms included in the Baker et al. (2003) study.

Chapter V: Empirical Results

Hypothesis 1

The alternate hypothesis 1 predicts that equity-dependent firms will have investment which is more sensitive to Q than firms which are less dependent on equity. Using the KZ-index as a measure of equity dependence the firms were split into quartiles based on their average KZ-index over the full sample period, 1993 to 2010.As KZ increases the dependence on equity increases, and therefore firms within quartile 4 should be the more dependent on equity than those firms in quartile 1.

The following investment equation is estimated for each quartile;

Equation III: Investment and Q equation

$$\frac{CAPX}{A_{t-1}} = \beta_0 + \beta_1 Q_t + \beta_2 \frac{CF_t}{A_{t-1}}$$

The prediction of the alternate hypothesis 1 is that β_1, the coefficient of Q, should increase as KZ increases. Therefore, the expectation is that β_1 should increase between Quartile 1 and Quartile 4. Quartile 4 is expected to have the greatest sensitivity of investment to Q and therefore the highest β_1.

A separate regression analysis is run for each quartile using the average values of the variables, capital expenditure (CAPX), total assets (A_{t-1}), $Q_t$and cash flow (CF_t), for each firm over the full sample period. The table below displays the results of the regression analysis. For the full output of the regression analysis refer to appendix I.

Table III: Summary of regression output for full sample period

Full sample: 1993 to 2010

	Adjusted R square	Significance of F (P value)
Quartile 1	0.796	0.000
Quartile 2	0.705	0.000
Quartile 3	0.163	0.124
Quartile 4	0.370	0.020

	Q			CF/A		
	t stat	Std error	Coefficient	t stat	Std error	Coefficient
Quartile 1	-0.037	0.001	0.000	7.689	0.106	0.812
Quartile 2	0.715	0.018	0.013	4.933	0.162	0.799
Quartile 3	-1.586	0.002	-0.003	1.660	0.203	0.336
Quartile 4	1.325	0.007	0.009	-3.266	0.583	-1.904

The pattern in the coefficient of Q is the main focus of this study, however to begin with an analysis of the regression as a whole is important to consider;

The R square[12], or coefficient of variation, indicates that the investment equation suggested by the model is a good fit for firms in the lower two quartiles – those firms that are less dependent on equity. However, the R square for quartile 3

[12]Adjusted R square is used to due to there being more than one x variable in the regression. Adjusted R square provides information on the explanatory power of Q and CF/A for firm investment.

indicates that the investment equation does not accurately depict the relationship between capital expenditure and the independent variables, Q and cash flow over assets, for this quartile. The significance of F for quartile 3 suggests that there is a 12.4 percent chance that the regression output for quartile 3 is a chance occurrence, in other words, there is a high probability that the output of the regression could have been obtained by chance. Using a significance level of 0.05 the significance of F would suggest that the regression output for quartile 3 is not statistically significant. The Quartile 4 results are more reliable than those for quartile 3 with only a 2 percent chance that the regression output occurred by chance. However the coefficient of variation indicates that the regression model is not a good fit.

The key focus of this study is the pattern in the coefficient of Q across the quartiles. With quartile 3 yielding a statistically insignificant result it is difficult to extract meaningful analysis.

Overall the regression for quartile 1, 2 and 4 suggests that a good fit was found for the investment equation as a whole, however the t-statistic and standard error for the coefficient of Q in each quartile indicate that the measured regression coefficient is not precise. The low t-statistic values indicate that there is a high likelihood that the true value for β_1 is nil. Furthermore the P-value for the coefficient of Q in each quartile is very high which suggests that there is a high chance that the observed result occurred by chance.

Had Q been found to be a good predictor of firm investment (β_1 being both economically significant in size and statistically significant) the pattern in the Q

coefficient is not as expected. Given that equity-dependence increases from quartile 1 to quartile 4 the Q coefficient is expected to increase in size from quartile 1, with the largest coefficient being observed for quartile 4. However the results of the regression analysis, as seen in table III above, do not show this.

As a side note it is interesting to examine the results for the coefficient of the cash flow variable, β_2.

The coefficients estimated for $\frac{CF_t}{A_{t-1}}$ have a low standard error relative to the value of the coefficients, a high t-statistic, which indicates that the β_2 values suggested by the regression analysis are precise. Looking at the pattern of β_2 across the quartiles

The hypothesis predicts that investment sensitivity to Q increases with increasing equity dependence, therefore the focus is on how the coefficient of Q changes across the Quartiles. However the regression output suggests that the coefficients predicted for Q are not precise therefore any analysis of the Q coefficients may be worthless.

If the regression output had suggested that the Q coefficients were more precise, and we could perform an analysis of the change in $\beta_1$across the quartiles, the results show that β_1 does not increase as equity-dependence increases.

Sub-sample results

As mentioned previously, the full sample period of 18 years has been split into three 6 year subsamples to isolate large market disturbances that may have an effect on the results. Furthermore, the subsamples are assessed separately, with

the firms being categorised into quartiles based on their KZ index over each 6 year sub period. In other words a firm may be in a different quartile each subsample period if their level of equity dependence changes over time. The shorter period of time over which equity dependence is measured allows for firms to be more accurately categorised into quartiles over time.

A separate regression analysis is run for each quartile for each of the subsamples. The regression analysis output is summarised in Table III below;

Table IV: Regression output for subsamples

Subsample: 1993 to 1998

	Adjusted R square	Significance of F (P value)
Quartile 1	0.864	0.000
Quartile 2	0.554	0.002
Quartile 3	0.135	0.154
Quartile 4	-0.114	0.796

	Q			CF/A		
	t stat	Std error	Coefficient	t stat	Std error	Coefficient
Quartile 1	-0.434	0.002	-0.001	9.771	0.086	0.837
Quartile 2	1.224	0.009	0.011	3.750	0.086	0.323
Quartile 3	0.207	0.172	0.036	-2.082	1.210	-2.520
Quartile 4	-0.583	0.003	-0.002	0.431	0.629	0.271

Subsample: 1999 to 2004

	Adjusted R square	Significance of F (P value)
Quartile 1	0.521	0.003
Quartile 2	0.560	0.002
Quartile 3	0.038	0.307
Quartile 4	0.662	0.000

	Q	CF/A

	t stat	Std error	Coefficient	t stat	Std error	Coefficient
Quartile 1	-0.809	0.005	-0.004	4.122	0.121	0.499
Quartile 2	0.283	0.005	0.001	4.574	0.137	0.628
Quartile 3	1.513	0.002	0.003	-1.435	0.601	-0.863
Quartile 4	0.165	0.006	0.001	-5.572	0.460	-2.565

Subsample: 2005 to 2010

	Adjusted R square	Significance of F (P value)
Quartile 1	0.133	0.156
Quartile 2	0.136	0.153
Quartile 3	0.302	0.038
Quartile 4	-0.046	0.530

	Q			CF/A		
	t stat	Std error	Coefficient	t stat	Std error	Coefficient
Quartile 1	0.524	0.001	0.000	1.932	0.141	0.272
Quartile 2	-0.180	0.029	-0.005	2.032	0.215	0.438
Quartile 3	-1.211	0.002	-0.003	2.901	0.219	0.635
Quartile 4	0.091	0.017	0.002	0.905	0.355	0.321

The R square[13] in all subsample periods indicates that the regression model does not sufficiently explain the relationship between investment and Q and CF/A across almost all quartiles. The significance of F paints the same picture; with none of the subsamples producing statistically significant[14] regressions across all four quartiles.

[13]Adjusted R square is used to due to there being more than one x variable in the regression. Adjusted R square provides information on the explanatory power of Q and CF/A for firm investment.

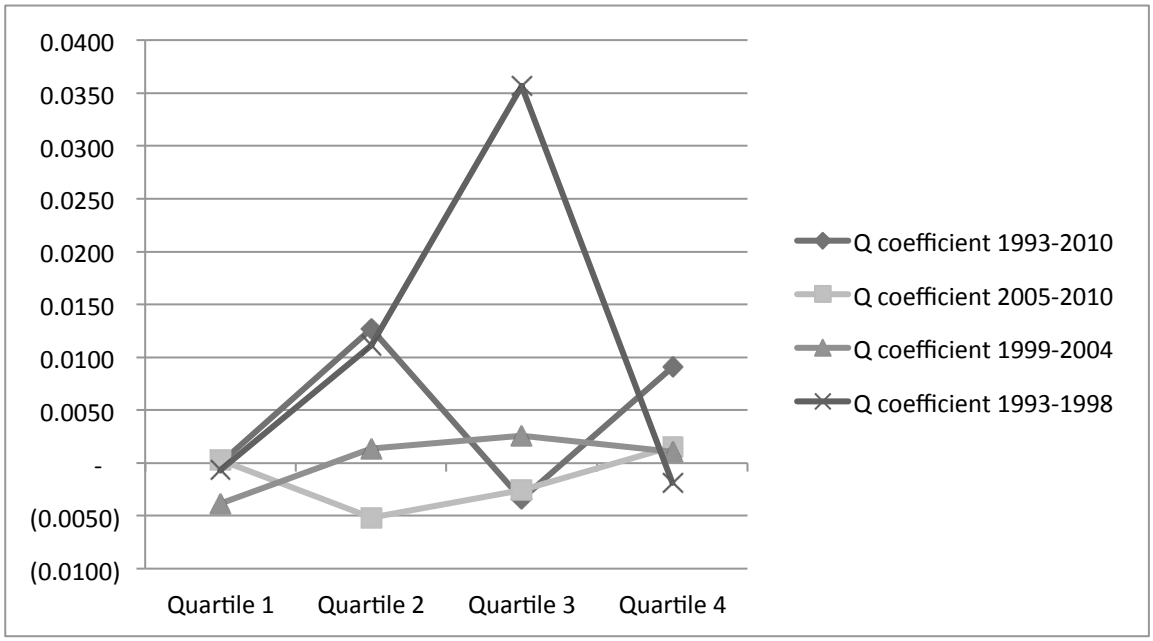
[14]At a significance level of α=0.05 the results are statistically insignificant. In other words, where the p-value is not less than 0.05 the null hypothesis that the parameters are zero cannot be rejected and the conclusion is that the parameters are jointly statistically insignificant.

Moreover, in cases where a statistically significant regression models are found the t-statistic, and related p-values, of the Q coefficients indicate that the estimated β_1 is not statistically significant. For example, in the 1999 to 2004 subsample the R square suggests that the regression model is a good fit for all quartiles, except quartile 3. However the standard error of Q across all four quartiles is high relative to the coefficient leading to a low t-statistic. Therefore in all four quartiles of the 1999 to 2004 subsample the null hypothesis that the β_1 coefficients are equal to zero cannot be rejected.

Furthermore, in all cases the estimated β_1 coefficient is small which indicates that Q is a poor predictor of firm investment. In other words, even in the absence of a lack of statistical significance, the effect of Q on investment behavior of firms appears to be economically insignificant.

The main focus of this study is the pattern in the Q coefficient across the quartiles however the statistical insignificance of the regression results and the size of β_1 make it difficult to draw any meaningful analysis. Moreover, if the results had been statistically and economically significant, the graphical plot of β_1 shows that there is no clear pattern in the Q coefficient. Refer to figure IV, below, for the graph depicting the Q coefficient across the quartiles. In other words the correlation between equity dependence and the sensitivity of investment to mispricing is low. Overall the null hypothesis is not rejected and the default conclusion is that investment sensitivity to mispricing does not differ between equity-dependent firms and non-equity-dependent firms.

Figure IV: Q coefficient across the quartiles



Hypothesis 2

The alternate hypothesis 2 predicts that equity-dependent firms will have investment which is more sensitive to future stock returns ,R_{t+3}, than firms which are less dependent on equity. Essentially Q is replaced by future stock return in the investment equation considered in hypothesis 1. However, while in hypothesis 1 a higher Q indicates overvaluation, hypothesis 2 suggests that a higher return indicates undervaluation. In other words the alternate hypothesis 2 predicts that future stock returns and investment sensitivity are negatively correlated.

The following investment equation is estimated for each quartile:

Equation IV: Investment and future stock return equation

$$\frac{CAPX}{A_{t-1}} = \beta_0 + \beta_1 R_{t+3} + \beta_2 \frac{CF_t}{A_{t-1}}$$

A separate regression analysis is run for each quartile using the average values of the variables, for each firm over the full sample period. Refer to appendix 2 for the full output from the regression performed. The table below displays the summarised results of the regression analysis.

Table V: Regression output for full sample period

Full sample: 1993 to 2010

			Return			CF/A		
	R square[15]	Significance F	t stat	Std error	Coefficient	t stat	Std error	Coefficient
Quartile 1	0.796	0.000	0.120	0.007	0.001	7.607	0.106	0.809
Quartile 2	0.766	0.000	2.009	0.005	0.010	5.285	0.139	0.735
Quartile 3	0.166	0.121	-1.608	0.013	-0.020	1.320	0.203	0.269
Quartile 4	0.600	0.001	3.198	0.003	0.009	-2.883	0.413	-1.192

The analysis of the effect of future stock returns on investment yields similar results to those obtained for hypothesis 1. The significance of F indicates that the regressions are not statistically significant across all four quartiles. Again quartile 3 yields a regression model that does not sufficiently explain the relationship between the dependent and independent variables. Furthermore,

[15] Adjusted R square is used to due to there being more than one x variable in the regression. Adjusted R square provides information on the explanatory power of Return and CF/A for firm investment.

even where a statistically significant regression is found in quartiles 1, 2 and 4 theβ_1 estimated by the regression is not significant as the standard error of the coefficient is large relative to the coefficient itself.

However, again the results show that the coefficients estimated for $\frac{CF_t}{A_{t-1}}$ have a low standard error relative to the value of the coefficients, a high t-statistic, which indicates that the β_2 value suggested by the regression analysis are more precise than for Q. These results are in contrast to the results found by Baker *et al.* (2003)

Overall the null hypothesis is not rejected and the default conclusion is that investment sensitivity to future stock returns does not differ between equity-dependent firms and non-equity-dependent firms.

Sub-sample results

The full results of the regression analysis for the subsample periods for hypothesis 2 can be found in the appendix. Much like the outcome found in hypothesis 1, analysing the data by splitting the 18 year period into three 6 year subsamples does not yield the expected results; the correlation between equity dependence and the sensitivity of investment to future stock returns is low. Therefore the default conclusion is that investment sensitivity to future stock returns does not differ between equity-dependent firms and non-equity-dependent firms. The null hypothesis cannot be rejected.

Chapter VI: Developed versus Emerging Markets

This chapter explores the potential reasons behind the unexpected results found in this study.

This study imitates the empirical work performed by Baker *et al.* (2003) in their study "When Does The Market Matter? Stock Prices And The Investment Of Equity-Dependent Firms" (2003, p.969). Baker *et al.* investigate the sensitivity of investment to stock prices for firms listed on the New York Stock Exchange (NYSE) and find that stock prices have a greater impact on the investment behaviour of firms that require external finance to fund marginal investments. This indicates that the stock price is an important factor in investment decisions made by management of firms listed on the NYSE.

Subsequent studies conducted using data obtained from developed markets do not contradict the Baker et al. (2003) findings; Polk and Sapienza (2002) explore the effect of investment horizon on corporate investment and find that stock mispricing is related to levels of corporate investment for firms listed on the NYSE and NASDAQ. Dong *et al.* (2006) explore the effect of stock price on takeover activity. Using the Baker *et al*. (2003) findings to introduce the idea that stock prices influence the sensitivity of investment Dong *et al.* (2006) find that stock mispricing affects takeover activity. Chen *et al*. (2007) investigate the sensitivity of investment to stock prices for firms listed on the NYSE, examining the effect of price informativesness, and find that managers incorporate information obtained from the stock price into their investment decisions.

Conversely within the context of emerging markets there have been mixed results; Wang i. (2009) find that "firm investment does not significantly respond to the stock market valuation." In contrast, Adjasi and Biekpe (2009) investigate the relationship between investment growth and stock prices using data from several African countries and find a positive relationship between corporate investment and stock price. "Further analysis based on interaction terms reveals that the sensitivity of investment to stock prices increases with stock market development."

However there does not appear to be literature which specifically investigates investment sensitivity of equity-dependent firms to the non-fundamental component of stock prices within developing markets.

Using the Baker *et al.* (2003) methodology on data taken from the Johannesburg Stock Exchange (JSE) this study finds no relationship between equity-dependent firms and investment sensitivity to stock price.

The difference between the levels of efficiency of the NYSE and the JSE may be the reason behind the differing results.

Comparing the two stock exchanges in the context of the efficient market hypothesis (EMH), the NYSE has been shown to be semi-strong form efficient (Seiler & Rom, 1997) while the JSE displays a market behaviour which indicates a weak form of efficiency (Van Rensburg & Robertson, 2003; Auret & Sinclaire, 2006; Basiewicz & Auret, 2009). "At best the efficient market hypothesis only applies to half of the shares traded on the Johannesburg Stock Exchange: those with average annual trading volumes in excess of at least 250,000. The trading

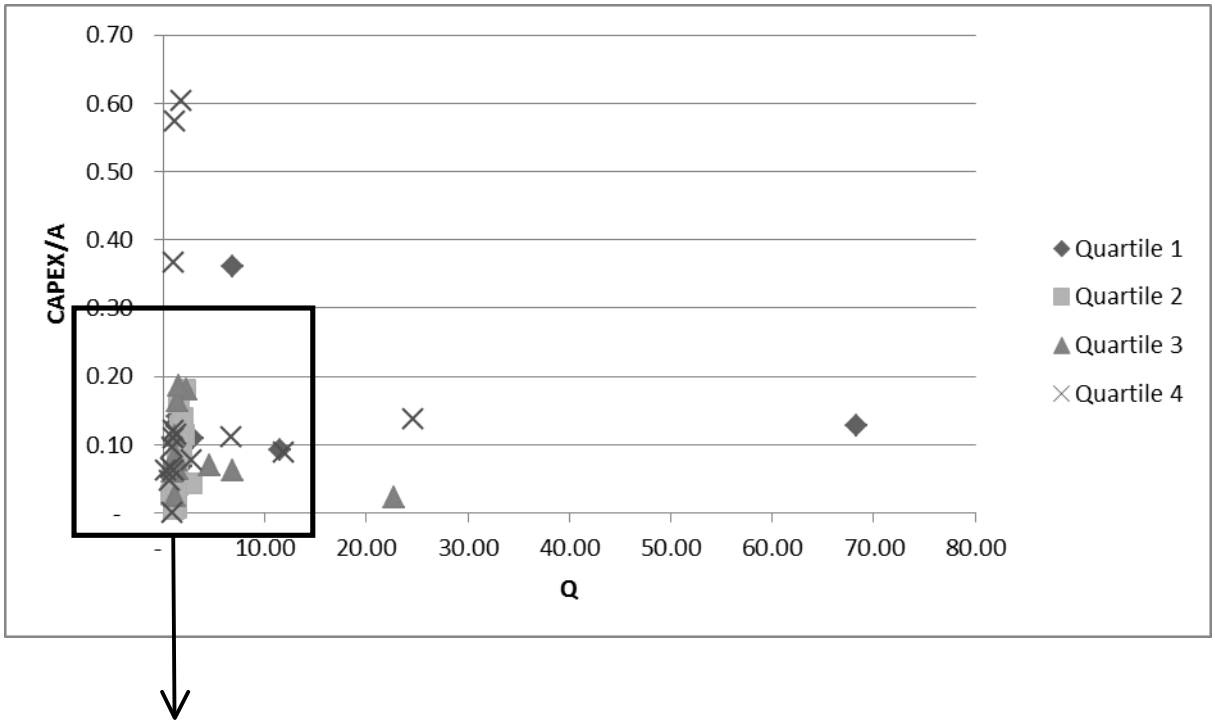
volumes of the others are so low that their market risk becomes volume dependent." (Strebel, 1977, p.20)

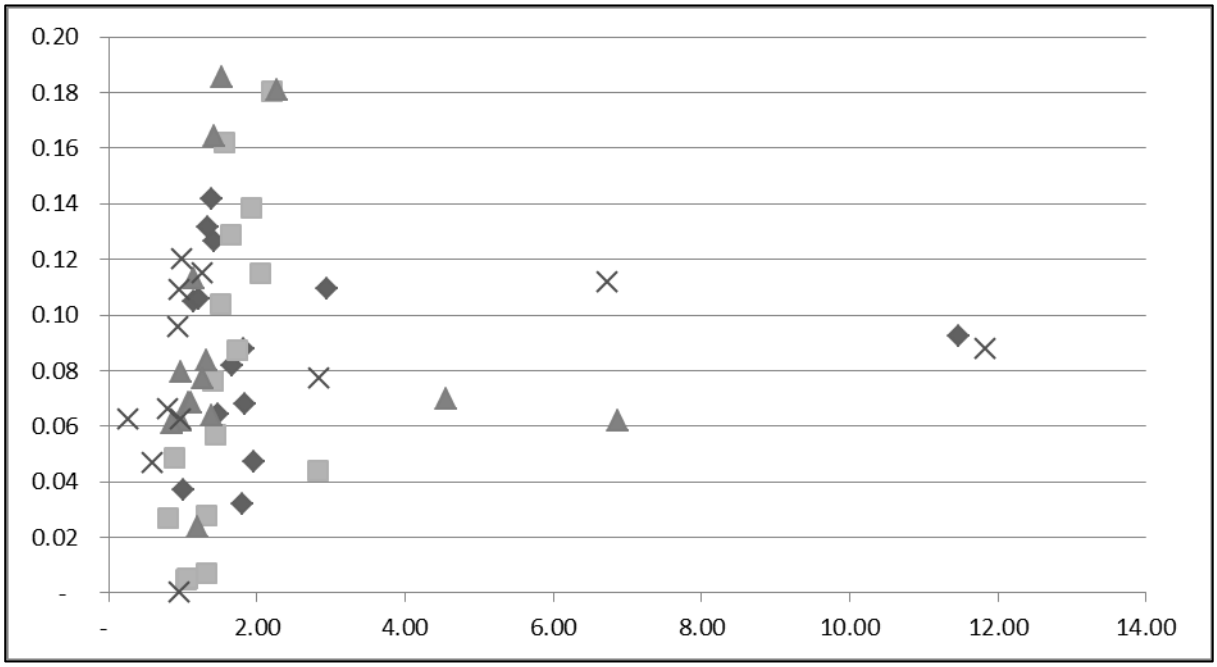
The weak-form efficiency of the JSE may result in stocks experiencing larger levels of mispricing for longer periods of time in comparison to the NYSE where the semi-strong form efficiency means that stocks experience smaller levels, and shorter periods, of mispricing. As an example, where a firm's stock is overpriced a firm is expected to issues as much equity as possible under the model suggested in this study, however if the stock is overpriced for a long period of time the firm may run out of investment opportunities. Under these circumstances while the stock continues to be overpriced the firm may not continue to make further investments.

Furthermore, where a stock is mispriced on the JSE the deviation from fair market value will be larger on average compared to the mispricing that occurs on stock listed on the NYSE where all publicly available information is almost instantaneously calculated into the stock prices. Therefore there is a greater range of variations in Q for stocks listed on the JSE. As an example, where a stock is overpriced a firm will invest at the 'first-best level' of investment regardless of the level of overpricing.

Baker *et al.* (2003) assume that the relationship between Q and investment sensitivity is linear while the two examples discussed above suggest that for stocks listed on the JSE this relationship is not linear. Figure V below shows that in cases where Q is very large the level of investment does not increase proportionately as expected.

Figure V: Scatter plot of the relationship between Q and the ratio of capital expenditure to assets for full sample period





Another potential reason for the unexpected results could be the limited access to debt faced by South African firms.

In developing economies, such as South Africa, firms often do not have sufficient access to debt due to under-developed credit markets (Higson, 2011). Rajan and Zingales (1996) show that firms dependent on external finance grow slower in developing markets; Love (2001) finds that firms are more sensitive to the availability of internal funds in less financially developed countries.

Therefore where a firm cannot access sufficient debt managers may underinvest in order to maintain their optimal capital structure. For example, where a firm's equity is overpriced management should invest at the 'first-best level' of investment however firms must also achieve an optimal debt to equity ratio. Therefore where further debt cannot be sourced it may not make sense for a firm to continue to issue further equity.

Chapter VII: Conclusion, Recommendations and Areas for Future Research

Summary of results

The outcome of this study is inconclusive; a low correlation and a lack of statistical significance between firm investment and the non-fundamental component of stock prices is found across many of the quartiles. Where a statistically significant regression model fit is found for a quartile the coefficient of Q (the proxy for the non-fundamental component of stock prices) is found to be statistically and/or economically insignificant. This makes it impossible to identify any meaningful pattern in the coefficient of Q across the quartiles. Therefore it is impossible to draw any meaningful conclusion about the effect of equity dependence.

Conclusion

The default conclusion for both hypothesis 1 and 2 is that the null hypothesis cannot be rejected. In other words, the alternate hypothesis that the investment behaviours of equity dependent firms display a stronger correlation to stock prices than firms that are not dependent on equity is rejected for firms listed on the Johannesburg Stock Exchange. The weak from efficiency of the JSE and the limited access to credit may be the reasons behind the results, or lack thereof, observed.

Recommendations and areas for future research

As discussed in chapter VI the relationship between Q and investment sensitivity may not be linear, therefore it would be interesting to investigate further into this relationship, to define this relationship in the context of the JSE.

Secondly, there is merit is replicating this study in the future when a larger pool of data is available. The population of data in this study is limited to those firms which were listed in 1991 and remained listed in 2013. Where a firm only listed after 1991, or was acquired by another firm between 1991 and 2013, or delisted before 2013 they were not included in this study. This left a small pool of 64 firms, 16 firms within each quartile.

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Appendices

Appendix I: Regression analysis output for full sample period for hypothesis 1

Quartile 1

Regression Statistics	
Multiple R	0.90719298
R Square	0.8229991
Adjusted R Square	0.79576819
Standard Error	0.03413944
Observations	16

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	2	0.07044986	0.03522493	30.2229772	1.2937E-05
Residual	13	0.01515152	0.0011655		
Total	15	0.08560138			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*
Intercept	-0.0456083	0.02147183	-2.1240994	0.05342044	-0.0919954
Q	-1.967E-05	0.00053562	-0.0367328	0.97125615	-0.0011768
CFA	0.81190515	0.10559884	7.68858044	3.4443E-06	0.58377273

Quartile 2

Regression Statistics	
Multiple R	0.8625879
R Square	0.74405789
Adjusted R Square	0.70468218
Standard Error	0.0311075
Observations	16

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	2	0.03657115	0.01828558	18.8963677	0.00014221
Residual	13	0.0125798	0.00096768		
Total	15	0.04915095			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*
Intercept	-0.0380335	0.02560332	-1.4854925	0.1612561	-0.0933461
Q	0.01271056	0.0177762	0.71503227	0.48723245	-0.0256926
CFA	0.79949811	0.16206181	4.93329137	0.00027343	0.44938486

Quartile 3

Regression Statistics	
Multiple R	0.52380024
R Square	0.27436669
Adjusted R Square	0.1627308
Standard Error	0.04535015
Observations	16

ANOVA

	df	*SS*	*MS*	*F*	*Significance*

					F
Regression	2	0.01010916	0.00505458	2.45769245	0.1243546
Residual	13	0.02673627	0.00205664		
Total	15	0.03684542			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*
Intercept	0.06624068	0.02258707	2.93268205	0.01165318	0.01744429
Q	-0.0034157	0.00215377	-1.5859197	0.13677262	-0.0080687
CFA	0.33614302	0.20253839	1.65965093	0.12090103	-0.1014146

Quartile 4

Regression Statistics	
Multiple R	0.67372943
R Square	0.45391135
Adjusted R Square	0.36989771
Standard Error	0.14508452
Observations	16

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	2	0.22745392	0.11372696	5.40282935	0.01959794
Residual	13	0.27364374	0.02104952		
Total	15	0.50109766			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*
Intercept	0.26493893	0.05067009	5.22870478	0.00016277	0.15547286
Q	0.0090826	0.00685326	1.3252969	0.20789371	-0.005723
CFA	-1.9042462	0.58313802	-3.2655154	0.00614206	-3.1640393

Appendix II: Regression analysis output for full sample period for hypothesis 2

Quartile 1

Regression Statistics	
Multiple R	0.907290879
R Square	0.82317674
Adjusted R Square	0.795973161
Standard Error	0.034122309
Observations	16

ANOVA

	df	SS	MS	F	Significance F
Regression	2	0.070465066	0.035232533	30.25986962	1.2853E-05
Residual	13	0.015136315	0.001164332		
Total	15	0.085601382			

	Coefficients	Standard Error	t Stat	P-value	Lower 95%
Intercept	-0.046251311	0.022072128	-2.095462257	0.056274041	-0.093935245
Return	0.000888453	0.007401039	0.120044312	0.906283463	-0.015100521
CFA	0.808830136	0.106329683	7.606814112	3.86551E-06	0.579118821

Quartile 2

Regression Statistics	
Multiple R	0.892745282
R Square	0.796994138
Adjusted R Square	0.765762467
Standard Error	0.027704389
Observations	16

ANOVA

	df	SS	MS	F	Significance F
Regression	2	0.039173019	0.01958651	25.51877983	3.15359E-05
Residual	13	0.009977931	0.000767533		
Total	15	0.04915095			

	Coefficients	Standard Error	t Stat	P-value	Lower 95%
Intercept	-0.026907046	0.01631252	-1.649472058	0.122991951	-0.062148102
Return	0.009854123	0.00490595	2.008606391	0.06581753	-0.000744538
CFA	0.735068313	0.139086906	5.284956973	0.000147654	0.434589322

Quartile 3

Regression Statistics	
Multiple R	0.526864328
R Square	0.277586021
Adjusted R Square	0.166445408
Standard Error	0.045249435
Observations	16

ANOVA

	Df	*SS*	*MS*	*F*	*Significance F*
Regression	2	0.010227774	0.005113887	2.497611044	0.120811957
Residual	13	0.026617648	0.002047511		
Total	15	0.036845422			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*
Intercept	0.089249337	0.02943271	3.032318059	0.009621807	0.025663834
Return	-0.020190276	0.012559499	-1.607570249	0.131934816	-0.047323423
CFA	0.268601547	0.203442758	1.320280699	0.209515812	-0.17090981

Quartile 4

Regression Statistics	
Multiple R	0.808108444
R Square	0.653039257
Adjusted R Square	0.599660681
Standard Error	0.115645751
Observations	16

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	2	0.327236443	0.163618222	12.2341079	0.001027596
Residual	13	0.173861216	0.01337394		
Total	15	0.50109766			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*
Intercept	0.2049793	0.045157444	4.539213995	0.000555979	0.107422574
Return	0.009208793	0.002879799	3.197721085	0.006998226	0.002987366
CFA	-1.192217548	0.413473363	-2.883420443	0.012809059	-2.085472441

Appendix III: Summary of regression output for subsample periods for hypothesis 2

Subsample: 1993 to 1998

			Return			CF/A		
	R square	Significance F	t stat	Std error	Coefficient	t stat	Std error	Coefficient
Quartile 1	0.863	0.000	0.327	0.006	0.002	9.803	0.085	0.830
Quartile 2	0.514	0.004	0.547	0.006	0.003	4.158	0.089	0.371
Quartile 3	0.980	0.000	23.688	0.001	0.014	5.312	0.242	1.284
Quartile 4	-0.142	0.937	-0.097	0.009	-0.001	0.363	0.657	0.238

Subsample: 1999 to 2004

			Return			CF/A		
	R square	Significance F	t stat	Std error	Coefficient	t stat	Std error	Coefficient
Quartile 1	0.677	0.000	2.689	0.006	0.015	5.758	0.096	0.553
Quartile 2	0.578	0.001	-0.812	0.010	-0.008	4.578	0.135	0.618
Quartile 3	-0.131	0.877	0.090	0.017	0.002	-0.511	0.477	-0.244
Quartile 4	0.832	0.000	3.630	0.027	0.097	-1.219	0.597	-0.728

Subsample: 2005 to 2010

			Return			CF/A		
	R square	Significance F	t stat	Std error	Coefficient	t stat	Std error	Coefficient
Quartile 1	0.179	0.110	-1.006	0.019	-0.019	2.244	0.140	0.315
Quartile 2	0.134	0.155	-0.057	0.027	-0.002	1.993	0.215	0.429
Quartile 3	0.225	0.075	0.176	0.022	0.004	2.258	0.235	0.531
Quartile 4	-0.018	0.444	-0.607	0.032	-0.019	1.146	0.291	0.333