The relationship between the future outlook of market risk and capital asset pricing

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Abstract

The most widely used Cost of Capital model is the Capital Asset Pricing Model. The Beta, Which is a key input into the model has proven to be unreliable and provides no correlation with systematic risk. As risk increases, so should the cost of capital of the firm. The Beta is a historic measure of risk and does not capture the future outlook of risk. The future of an organisation and its risk may look very different to the past and therefore the need to calculate the Cost of Capital of a firm based on the future outlook of the firm. The aim of this research was to analyse the different methodologies used to determine the Cost of Capital of a firm in order to determine which models are better ex ante predictor of Cost of Capital in the South African context. Regression analysis was used to make statistical inferences between the measure of risk used and the Cost of Capital model in question. The results of the research has shown that Market Capitalisation and Price to Book ratio are the best proxies for risk when comparing it with the ex ante Cost of Capital models. However, the Three Factor Pricing Model is shown to be the best Cost of Capital model to capture the future outlook of risk.

Keywords

Investment Finance

Three Factor Pricing Model

Implied Cost of Capital

Implied Beta

Market Derived Capital Pricing Model

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Declaration

I declare that this research project is my own work. It is submitted in partial fulfilment of the degree of Master of Business Administration at the Gordon Institute of Business Science, University of Pretoria. It has not been submitted before for any degree or examination in any other University. I further declare that I have obtained the necessary authorisation and consent to carry out this research.

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1. Introduction

1.1. Background

Calculating the Cost of Capital of an organisation is a critically important function for any organisation. Cost of Capital is the monetary investment for a firm that consists of both debt and private equity, where the weighted average determines what it costs the firm to have the capital employed (Firer, Ross, Westerfield, & Jordan, 2009). The Cost of Capital is used to determine the cost of investment projects and is important because it will determine whether or not projects are accepted or declined based on the net present value of a project. PriceWaterhouseCooper (van Aswegen, Venables, Groenewald, & Basson, 2006) in their valuation methodology survey shows that the capital asset pricing model (CAPM) is the most widely used methodology to calculate a firm's Cost of Capital in South Africa. One of the most important input variables into the CAPM is the Beta coefficient which indicates how much systematic risk an asset has relative to an average asset (Firer et al., 2009). They go on to say that the expected return and risk premium depends only on the systematic risk which is measured by the Beta coefficient.

However, research indicates there is little or no correlation between a firm's risk and the Beta or CAPM for that matter (McNulty, Yeh, Schulze, & Lubatkin, 2002; Fama & French, 1992; La Porta, 1996). While current Beta calculations are calculated based on historic realised average returns (Ex post), the theory calls for an expected (ex ante) measure of risk (Beta) (Borgman & Strong, 2006). The future of an organisation and its risk may look very different to the past and therefore the need to calculate the Cost of Capital of a firm based on the ex ante outlook of the firm. Vander Weide and

Carleton (1988) find that analyst's forecasts are generally better predictions of the future than historical growth rates.

1.2.Research Problem

Estimates in Cost of Capital in the CAPM have been proven to be unreliable (Fama & French, 1997). Van Rensburg (2003) has also proven that small cap firms has higher average returns in the long run, but also has a lower Beta. Yan-Leung Cheung and Ka-Tai Wong (1992) shows that there is a positive correlation between firm risk and average returns. Fama and French (1992) also confirm that there is a positive correlation between average returns and firm size. Therefore, if the risks of small cap firms are higher, the Cost of Capital should be higher and vice versa, due to the systematic risk of the firms. If the firm is not accurately represented for risk, in other words it's Cost of Capital, it would have a significant effect on strategic opportunities such as project selection or mergers and acquisitions.

There are many methods of determining the Cost of Capital for an organisation to evaluate projects of the firm itself. However the CAPM model has been the debate of inconsistency for many years with specific reference to the use of the market risk premium (Beta) to calculate the Cost of Capital (McNulty et al., 2002; Fama & French, 1992). Using the company Beta or estimating the Beta by use of comparables relies on the historic trends of the organisation that may be very different from what the future holds and what the market expectation is for the firm (Borgman & Strong, 2006). Thus, there is a need to investigate the attributes of an organisation that influences the Cost of Capital as well as the use of different ex ante Cost of Capital models in order to be able to estimate a more accurate Cost of Capital for a firm. "Expectations about long-term earnings growth are crucial to

valuation models and Cost of Capital estimates" and there is no persistence in long term earnings beyond chance (Chan, Karceski, & Lakonishok, 2003, p. 643).

1.3.Research Aim and Objectives

The aim of this research project is to analyse the different methodologies used to determine the Cost of Capital of a firm in order to determine which models are better ex ante predictors of Cost of Capital in the South African context. This will provide stakeholders in the corporate and investment finance community with a better understanding of what influences Cost of Capital and provide them with a better understating of what the best models are to be used based on the characteristics of the firm.

The Cost of Capital models will be evaluated against systematic measures of risk that are able to serve as a proxy of future returns. Thus, if a firm's risk that it takes is correlated with returns (Yan-Leung Cheung & Ka-Tai Wong, 1992), firms with higher risk should have a higher Cost of Capital to compensate for the risk that the investor has to take. The final result of the research will be to show empirically which ex ante Cost of Capital model is the best predictor of systematic risk and as a result, future returns.

1.4.Relevance and interested Stakeholders

With the global recession seen during 2008/9, companies' profits as well as their performance of stock exchanges have been virtually wiped out. This will have an impact of the historic view of calculating the organisations risk premium also known as the companies Beta. The question now for corporate finance houses will be whether or not models to calculate Cost of Capital with an ex ante view will produce different and / or more consistent results as well as understanding the attributes that influence Cost of Capital such as size and book-to-market ratio of the organisation.

Stakeholders that will be interested in the research will include corporate finances houses, investors, organisation approaching large projects, publicly listed companies, merger and acquisition companies etc. The academia will also be interested in the research in order to better understand and explain the use of different Cost of Capital models. The CAPM is the most widely used and taught valuation methodology and by performing this research one can validate how applicable the methodology still is and how much emphasis should be placed on it?

2. Literature Review

Recent surveys have shown that the CAPM is the capital pricing model most widely used in South Africa (Correia & Cramer, 2008; van Aswegen et al., 2006). However, many researchers have proven the CAPM model and more specifically the Beta to be flawed as it does not present a true representation of risk and return (Fama & French, 1992; McNulty et al., 2002; Gebhardt, Lee, & Swaminathan, 2001). Among those examples is Van Rensburg (2003) who has also applied size and price-to-book ratio to prove that it can be a proxy for risk for firms on the Johannesburg Stock Exchange and also found that there are empirical contradictions to the CAPM as well as that there are little or no correlation between a firms' Beta and its price-to-book ratio. All the above authors' arguments were that Beta does not represent a true reflection of risk and therefore an inaccurate compensation of risk and sparked a search for a Cost of Capital that can provide an estimate that is correlated with risk and return.

"Attempts to empirically verify the predictions of the CAPM model, however, have produced numerous inconsistencies with the theory. Most notable is the evidence that other variables such as book-to-market ratios, market capitalisation, price-to-earnings ratios and leverage are able to predict security returns beyond that explained by the risk factor Beta" (Van Rensburg, 2003, p. 7). It is required that different models to the conventional CAPM, are tested against the criteria of risk in order to determine if they conform to the theory. The Cost of Capital is a dependant on the systematic risk of the firm, and thus if the risk of the firm increases, the Cost of Capital should increase with the risk. Therefore, the literature review has to define and critically evaluate the work that has been done in the academia for the following:

1. The measures and key variables of future risk – It is required to know what are the key measures of risk that can be applied across the industry in order to evaluate the accuracy of a Cost of Capital model and if it truly reflects return for risk.

2. Ex Ante capital costing models that correlate with expected future risk and return – The Cost of Capital models that will be investigated in this research will be predominantly ex ante Cost of Capital models. In other words it will be Cost of Capital models that focuses on capturing future expected risk and return of a firm. The reason for this is that since the debate on the accuracy of the CAPM started with ex post measures of risk (Beta) cannot observe the future outlook of the risk of the firm.

2.1.Measures of Risk

The debate for an ex ante measures of a firm's risk is a very important aspect of assessing the accuracy of Cost of Capital estimates. Cost of Capital models are used to price the capital investment, through debt and / or equity, and should incorporate the future outlook of the riskiness of the asset. However, the future outlook of risk is not directly observable since future cash flows and stock price is unobservable. Thus, practitioners have to identify a reliable empirical proxy that can forecast what the systematic risk of the firm would be.

2.1.1. Firm Size as a Proxy for Risk

Banz (1981) has identified in his research of "The Relationship between Return and Market Value of Common Stocks" that risk can be measured by firm size. In the research he identifies size as the market exposure or market equity (ME) of the firm. He has also researched the relationship between the Beta coefficient and ME, and found empirical contradictions to the CAPM and its theory.

However, Berk (1995; 1997) argues that firm size measured in terms of ME is inaccurate and noisy as it contains future cash flow expectations. The market value of the firm is equal to the discounted future expected cash flows of the firm. All things being equal, the present value of cash flows depend on the riskiness of the cash flows. Riskier cash flows require a higher discount rate in order to have a lower present value than less risky cash flows. Thus ME is already adjusted for risk and cannot capture the true size of the firm.

Ozgulbas, Koyuncugil and Yilmaz (2006) also used firm size as a proxy for risk and found a positive correlation between risk and return. He however uses number of people, annual turnover and balance sheet. Lee (2009) shows that firm size is positively correlated and a key determinant in profitability. He uses assets and market share but also argues that firm concentration and barriers to entry plays a role in profitability and risk. Silva Serrasqueiro and Maçãs Nunes (2008) however have used firm turnover (sales), total assets and number of employees to explain firm performance.

Thus, the literature has shown that although firm size is an important proxy for risk, ME is not the best proxy of firm size as it contains the future cash flow expectations which are discounted for the riskiness of those cash flows. However, other variables have been used effectively to prove that there is a relationship between firm size and risk. These variables such as assets, turnover, number of employees etc. provides a proxy for firm size that is correlated with risk and also provides a less noisy proxy for firm size when compared to ME.

2.1.2. Price to Book Ratio as a Proxy for Risk

Fama and French (1992) in their research of "The Cross-Section of Expected Stock Returns" measures risk in terms of firm size (ME) as well as the ratio of common equity (BE) to market equity (ME), price-to-book ratio (BE/ME). They have also found empirical contradictions to the CAPM. Their research indicates that there is a negative correlation between size and average returns and therefore, there should be a negative correlation between size and risk.

Although the research indicates that ME is not a good proxy for firm size and as a result for risk, it does not mean that Price to Book ratio, which incorporates ME, will also not be a good proxy for risk. Botosan and Plumlee (2005) has applied Price to Book ratio as a proxy for risk and found that it correlates with the risk of the firm and expected future returns. Lui, Markov and Tamayo (2007) found that over time (1997 to 2003) that Price to Book is a very good proxy of risk. They have also found that Price to Book ratio can predict stock volatility which is also a characteristic of risk. Low Price to Book ratios produce high volatility over time and are also correlated with high risk and vice versa. Curcio, Kyaw and Thornton (2003) applied the Price to Book ratio when assessing the risk and returns of mutual funds. They found that Price to Book ratio was a good predictor of risk and that Price to Book ratio explained the relationship between risk and returns on mutual funds. Aretz, Bartram and Pope (2010) also found that Price to Book ratio explained the macro economical risks.

Thus there is overwhelming evidence that Price to Book ratio is a good proxy for ex ante risk of a firm. With the research of Lui et al (2007), Curcio et al (2003) and Aretz et al (2010) it was also shown that Price to Book ratio is a good proxy for risk on multiple levels of financial and economic analysis.

2.1.3. Altman Z Score as a Proxy for Risk

Altman (1968) identified that the academics started to move away from ratio analysis as an analytical technique to assess performance of a business enterprise. Altman, in an attempt to find the link between using ratio analysis and the prediction of corporate bankruptcy, had developed the Altman Z-Score model as a financial distress score of a firm. The initial model was developed on manufacturing industry and uses the following 5 ratios to test for the financial distress of a firm:

1. Working Capital/Total Assets
2. Retained Earnings/Total Assets
3. EBITDA/Total Assets
4. Market Value of Equity/Total Liabilities
5. Net Sales/Total Assets

Altman (1984) went on to show that the model can be applied internationally by comparing the model with ten different countries namely: Japan, Germany, Brazil, Australia, England, Ireland, Canada, Netherlands and France.

The Altman Z-Score model is therefore a good predictor of financial distress and hence a good predictor of risk for a firm.

2.1.4. Risk measures to be applied

Based on the literature that has been reviewed, it is important to first identify the risk measures that will be used as part of this research. The general view from the literature suggests that the most accurate proxies of risk are Price to Book ratio and firm size. Although firm size measured in terms of market capitalisation has been used in many research projects Banz (1981), more recent research has shown that market capitalisation is a noisy proxy for risk and return (Berk, 1995; Berk, 1997). Thus as a measure of risk, the following variables will be used as part of this research:

- Firm Size
    - Turnover (Revenue) –Used by Ozgulbas et al (2006) and Silva Serrasqueiro and Maçãs Nunes (2008)
    - Total Assets – Used by Silva Serrasqueiro and Maçãs Nunes (2008) and Lee (2009)
    - Market Capitalisation (Market Equity) – used by Ozgulbas et al (2006) and Lee (2009)
- Price-to-book ratio – Used by Fama and French (1992), Curcio et al (2003), Lui et al (2007) and Aretz et al (2010)
- Altman Z Score – Used by Altman (1984) as a financial distress indicator

2.2.Ex Ante Capital Pricing

2.2.1. Implied Cost of Capital

The Implied Cost of Capital model developed by Gebhardt et al (2001) uses the residual income model as well as market prices to derive a Cost of Capital for a firm. The research aimed at deriving an ex ante Cost of Capital and does not rely on average realized returns. This makes it different from the conventional CAPM. In their research they have made three very important findings:

1. The implied risk premiums are higher for certain industries thus proving that industry membership is an important characteristic in determining Cost of Capital;
2. The market consistently assigns higher risk premiums to firm's with higher book to market ratios, higher forecasted growth rates and lower dispersion in analysts forecasts; and
3. A model that combines the book to market ratio, dispersion in analysts forecasts, the long term consensus analysts growth forecasts, and the industry mean risk premium has a consistent and strong correlation with implied risk premium of the firm.

Thus, the Implied Cost of Capital model is relevant to the research because it uses ex ante proxies to derive Cost of Capital and that Gebhardt et al (2001) shows that the model is not only different to the CAPM model but also a better predictor of risk. Lee, Ng and Swaminathan (2009) showed in their research that across the G7 countries the Implied Cost of Capital model produced less that one tenth of the volatility than those based on ex post average returns.

Pastor, Sinha and Swaminathan (2008) applied the Implied Cost of Capital model in when they researched the trade off between risk and return. They applied the model using the G7 countries and their respective markets and found that the model is perfectly correlated with expected stock

return. Chen, Jorgensen and Yoo (2004) researched the Implied Cost of Capital model for international evidence, also using the G7 countries. They find that the model correlates with the ex ante proxies of risk. However, they also concluded that different models provide different correlations in different countries. Thus, although many ex ante models provide better estimates of Cost of Capital, they do differ in different markets as to which model provides the best estimate and correlations to ex ante proxies of risk.

Thus, although Lee et al (2009) were able to prove that the Implied Cost of Capital model is a better estimate of Cost of Capital when compared to ex post models, the research of Chen et al (2004) and Pastor et al (2008) leaves the following questions unanswered: 1) The research is mainly based on the G7 countries which are all developed countries. How will the theory of Implied Cost of Capital hold up in a developing country? 2) While Pastor et al (2008) and Lee et al (2009) argue that the Implied Cost of Capital model is a good ex ante estimate of Cost of Capital, Chen et al (2004) shows that the Implied Cost of Capital model is not always the best ex ante estimate when compared to ex ante proxies of risk.

2.2.2. Implied Beta

Borgman and Strong (2006) have built on the research of Fama and French (1997) in a search for an ex ante measure of systematic risk in order to determine a firm's Cost of Capital. They have come up with an Implied Beta calculation that can replace the conventional Beta used in the CAPM. The model employs analysts' forecasts of firms' earnings and dividend growth. The model was derived by combining the CAPM and the dividend discount model. They argue that since both the dividend discount model and the CAPM is dependant on a firm's growth rates, such a technique to employ the growth rates into the Beta calculation is justifiable.

Unlike other ex ante models to estimate Cost of Capital, the Implied Beta does not introduce a completely different model, but rather aims to address the way the Beta is calculated, since it is the Beta calculation and its relation to risk that has sparked the debate around ex ante measures of Cost of Capital. Borgman and Strong (2006) show in their research that the Implied Beta is consistent with the historical Beta for large aggregates, but they do show that the Implied Beta does produce a better prediction of ex ante risk for firms in transition. Thus they have shown that the Implied Beta can provide a very useful prediction of Cost of Capital for firms or industries where the past is very different from the future outlook of risk.

Thus, the Implied Beta model is relevant to the research as it does provide a better correlation to risk for firms in transition but is fairly consistent with high aggregate of firms' historical Beta. Unfortunately not a lot of additional research has been done with regards to the Implied Beta, but it may prove to be a very simple technique to employ by firms who seek an additional opinion on their Cost of Capital.

2.2.3. Three Factor Pricing Model

The Three Factor Pricing Model (TFPM) developed by Fama and French (1993) incorporates market excess return required for a firm based on risk, but also compensates for firm size (ME) and distress (measured by book-to-market equity ratio). Firm size is relevant to mimic sizes and book-to-market equity risk factors in returns. This was built on their research. The cross-section of expected stock returns where they have shows that firm size and Price to Book ratio explains the average returns and risk of a firm (Fama & French, 1992). Fama and French (1993) argue that the excess return of an asset or firm can be explained by three factors: 1) the excess return of a market portfolio; 2) the difference in return for small stocks and large stocks; and 3) the difference in return for portfolios with high and low price-to-book ratios.

The CAPM is unable to explain certain firm characteristics such as size, price earnings ratio, Price to Book ratio, growth rate etc. Because of this, these characteristics were called anomalies. However, Fama and French (1996) show that when using the TFPM, these anomalies largely disappear. Naceur and Ghazouani (2007) compared the CAPM with the TFPM in the Tunisian banking sector and found that the TFPM is consistent with the results of Fama and French (1996). Similarly, Gaunt (2004) applied the TFPM and compared it also to CAPM. He found that not only does the TFPM produce significant explanatory power, but also produced significant evidence that the Price to Book ratio places a significant role in capital asset pricing. Gregory and Michou (2009) compared multiple models of capital pricing in the UK and found that the TFPM does have a higher degree of explanatory power compared to CAPM.

Fama, French, Booth and Sinquefield (1993) found that "a three-factor asset-pricing model explains the average returns on the NYSE, AMEX and NASD…In their model, a security's expected return is determined by its sensitivity to an overall market risk factor and risk factors related to size and book-to-market-equity". They have researched the model by investigating the correlation between the Three Factor Pricing Model and a firm's ME and book-to-market ration and found that there is a correlation between the risk of a firm and it's Cost of Capital. They argue that the Three Factor Pricing Model is a more accurate predictor of future risk in order to determine the Cost of Capital of a firm when compared to Beta.

Thus, the TFPM is relevant to the research as many researchers have shown that the model does a sufficient job of compensating for risk and is able to produce more accurate estimates of Cost of Capital than the CAPM.

2.2.4. Market Derived Capital Pricing Model

McNulty et al (2002) in their research for an ex ante calculation of Cost of Capital has defined a market derived capital pricing model (MCPM) that employs an analysts' outlook of what the future holds for the firm. "This model is based on the traded prices of equity options on a company's shares, which means it incorporates the market's best estimates of the future price volatility of that company's shares rather than using historical data as in the case of CAPM" (McNulty et al., 2002, p. 6). They have applied the model in a case study comparing IBM and Apple which in their views should have had very similar Cost of Capital structures and found that the MCPM produces more consistent results within the context of their research.

They have also applied the model to real estate investment trusts and showed that there is a correlation between risk and the MCPM. They however use an FFO multiple (market capitalisation divided by funds from operations) as a measure of risk. This is slightly in contrast with the approach suggested by other literature as discussed earlier. However, they do find a much stronger correlation between the measure of risk and the MCPM compared to CAPM using the same FFO multiple.

Unfortunately very little has been done since they have developed the model but the model is still relevant to the research as it is able to produce another aspect of ex ante Cost of Capital estimates which the authors argue is a better representation of firm risk and return.

3. Research Hypotheses

The aim of the research is to prove that the four capital pricing models described in the literature review are correlated with the proxies for risks. In order to do so, four hypotheses relating to the four capital pricing models are derived as follow:

Hypothesis 1: The null hypothesis states that the coefficients (ICCC – Implied Cost of Capital Coefficient) of the explanatory variables are 0. The alternative hypothesis states that at least one of these coefficients is not 0. The dependant variable for the hypothesis is the risk proxies identified (Turnover, Total Assets, Total Equity, Price to Book and Altman Z Score). The explanatory variable for the hypothesis are the Implied Cost of Capital model.

H_0: $ICCC_i = 0$ for all i;

H_A: $ICCC_i \neq 0$ for at least one i

Where i = {Implied Turnover, Total Assets, Total Equity, Price to Book and Altman Z Score };

Hypothesis 2: The null hypothesis states that all the coefficients (IBC – Implied Beta Coefficient) of the explanatory variables are 0. The alternative hypothesis states that at least one of these coefficients is not 0. The dependant variable for the hypothesis is the risk proxies identified (Turnover, Total Assets, Total Equity, Price to Book and Altman Z Score). The explanatory variable for the hypothesis are the Implied Beta model.

H_0: $IBC_i = 0$ for all i;

H_A: $IBC_i \neq 0$ for at least one i

Where i = {Implied Turnover, Total Assets, Total Equity, Price to Book and Altman Z Score };

Hypothesis 3: The null hypothesis states that all the coefficients (TFPMC – Three Factor Pricing Model Coefficient) of the explanatory variables are 0. The alternative hypothesis states that at least one of these coefficients is not 0. The dependant variable for the hypothesis is the risk proxies identified (Turnover, Total Assets, Total Equity, Price to Book and Altman Z Score). The explanatory variable for the hypothesis are the Three Factor Pricing Model.

H_0: $TFPMC_i = 0$ for all i;

H_A: $TFPMC_i \neq 0$ for at least one i

Where i = {Implied Turnover, Total Assets, Total Equity, Price to Book and Altman Z Score };

Hypothesis 4: The null hypothesis states that all the coefficients (MDCPC – Market Derived Capital Pricing Model) of the explanatory variables are 0. The alternative hypothesis states that at least one of these coefficients is not 0. The dependant variable for the hypothesis is the risk proxies identified (Turnover, Total Assets, Total Equity, Price to Book and Altman Z Score). The explanatory variable for the hypothesis are the Market Derived Capital Pricing Model.

H_0: $MDCPM_i = 0$ for all i;

H_A: $MDCPM_i \neq 0$ for at least one i

Where i = {Implied Turnover, Total Assets, Total Equity, Price to Book and Altman Z Score };

4. Research Methodology

The research methodology used was a quantitative analysis of publicly listed companies on the Johannesburg Stock Exchange (JSE). The reason for this is for access to information provided by the JSE as well as it provided a large enough sample size to produce statistically significant results. The unit of analysis for the research was the market or firms listed on the JSE. The intention was to determine which models is a **better** predictor of the Cost of Capital for a specific firm.

4.1. Population

The population for this research will be publicly listed companies within South Africa. This will include South African companies that operate internationally as well. The reason for this is for access to public available financial information as well as the market instruments used by publicly listed firms.

The sampling frame for the research will be firms actively trading on the JSE, where actively trading is defined as shares changing hands for that firm more than once every week. Although some South African firms are listed on foreign stock exchanges, the research will make use of firms on the JSE to draw a conclusion. This makes the research simpler as all the firm's financial records will be based in the same currency and format.

4.2.Sampling

The sampling method used in the research was judgement sampling. Judgement sampling is defined as "a non probability sampling technique in which an experienced individual selects the sample based upon some appropriate characteristic of the sample members" (Zikmund, 2003, p. 362). Firms were selected based on specific criteria that depended on the type of model that was analysed.

All firms listed on the AltX and all preference shares listed on the JSE are excluded from the sample of the research due to the inconsistency of trades and noisiness of the data for the firms.

4.3.Data

The research will be performed using historic financial trading information for the sampled firms. This will be obtained using JSE data which can be obtained from sources such as I-Net Bridge. Data will be obtained for the 2009 year. This will include all the static data requirements needed to perform the analysis. Where time series data is required in order to determine aggregates required for calculations, data will be obtained from the same source for the 2009, 2008, 2007, 2006 and 2005 years.

Historic trading information and financial statements of the past 5 years should produce sufficient data in order to draw comparison and trends relating to the study. The primary source of the data would be the Johannesburg Stock Exchange.

4.4.Analysis

Regression analysis will be used to make statistical inferences between the relationship between the measure of risk used (the dependant variable) and the Cost of Capital model in question (the independent variable). The reason for using regression analysis is to determine the type of relationship / correlation (if any) that exists between the dependant and independent variable and to what degree they are related (Adrian and Rosenberg, 2008).

4.5.Risk Measures (Definition and Data Collection)

4.5.1. Turnover

In order to determine the turnover for each company, different line items for different industries had to be reviewed. Depending on the industry that the firm belongs to, the firm reports its turnover as a different line item. Thus for the industries available on the JSE, the following line items were used as their turnover for the specific year:

Industry	**Line Item for Turnover**
Banks	Net Interest Received
Insurance	Total Income
Industrials	Turnover
Mining	Working Revenue
Property	Turnover

Table 1: Line Items for Turnover by Industry

The above line items were obtained for all publicly listed companies for the JSE and then consolidated for further analysis. The Data were collected using Share Magic Pro.

4.5.2. Total Assets

All firms on the JSE report Total Assets in the same manner. The data was drawn from the JSE for all the firms and consolidated for further analysis. Data was collected using Share Magic Pro.

4.5.3. Market Capitalisation

All firms on the JSE report Total Equity in the same manner and are reported as Market Cap. The data was drawn from the JSE for all the firms and consolidated for further analysis. Data was collected using Share Magic Pro.

4.5.4. Price to Book

Price to Book is defined by the following equation:

$$Price\ to\ Book = \frac{\text{Market Cap}}{\text{Net Asset Value}}$$

The market Cap used in the equation is the same as defined for total equity and data was collected by using Share Magic Pro. Net Asset Value is defined by the following equation:

$$Net\ Asset\ Value = Total\ Assets - Total\ Liabilities - Intangible\ Assets$$

Data for all the listed firms were collected using Share Magic Pro.

4.5.5. Altman Z Score

There are 5 variables required to determine the Z Score:

6. **X1** = Working Capital/Total Assets
7. **X2** = Retained Earnings/Total Assets
8. **X3** = EBITDA/Total Assets
9. **X4** = Market Value of Equity/Total Liabilities
10. **X5** = Net Sales/Total Assets

For Public Companies, the Model is calculated using the following equation:

$$Z = 1.2 * \mathbf{X1} + 1.4 * \mathbf{X2} + 3.3 * \mathbf{X3} + 0.6 * \mathbf{X4} + 1.0 * \mathbf{X5}$$

Working capital was defined as Current Assets less Current Liabilities. EBITDA is defined as earnings before interest, tax depreciation and amortisation. Market value of equity is the same as total equity define previously. Net Sales are defined as the same as turnover defined previously. All the data required was collected using Share Magic Pro.

4.6.Capital Pricing Models (Definition, Sampling and Data Collection)

4.6.1. Implied Cost of Capital

The Implied Cost of Capital pricing model makes use of the residual income valuation model to value a firm. However, it relies on the market consensus forecasts to make inferences on what the expected stock price of a firm would be. The net equations described below shows how the expected stock price of a firm is calculated using the Implied Cost of Capital model.

$$P_t = B_t + \frac{FROE_{t+1} - r_e}{(1 + r_e)} B_t + \frac{FROE_{t+2} - r_e}{(1 + r_e)^2} B_{t+1} + TV$$

Where:

P_t = Expected stock price

B_t = Book value of the firm at time *t*

$FROE_t$ = Forecasted return on equity at time t

r_e = Cost of equity for the firm (Rf + β*(market risk premium))

$TV = Terminal\ Value\ of\ the\ firm$

$$B_{t+i} = B_{t+i-1} + FEPS_{t+i} - FDPS_{t+i}$$

$FEPS_t$ = Forecasted earnings per share of the firm at time *t*

$FDPS_t$ = Forecasted dividends per share of the firm at time *t*

$$TV = \sum_{i=3}^{T-1} \frac{FROE_{t+i} - r_e}{(1 + r_e)^i} B_{t+i-1} + \frac{FROE_{t+T} - r_e}{r_e(1 + r_e)^{T-1}} B_{t+T-1}$$

All firms for whom forecasts are made have been included in the sample of the study. The implicit forecast time horizon is 2 years. The implicit forecast is derived from analysts' consensus forecasts obtained from I-Net Bridge. Forecasted earnings per share and forecasted dividends per share have been collected for all the sampled firms. Forecasted Return on Equity has then been calculated by adding the forecasted earnings per share and forecasted dividends per share for each firm. Explicit forecasts were made up to the terminal year 6. Explicit forecast were done on a linear approach to industry target return on equity. Thus, the forecasted return on equity for each firm up to the terminal value is calculated by linearly extrapolating the firm's latest forecasted return on equity (Year 2) to the industry target return on equity. The industry target return on equity is calculated by averaging the growth of all the firms in the specific industry over the past 5 years.

In order to be able to compare the different firms with one anther, the book values are made equal at time 0. This is done so that one can compare expected return instead of expected share price for each firm against the different proxies for risk.

4.6.2. Implied Beta

The Implied Beta of a firm was calculated using the following equations:

$$Implied\ \beta\ = \frac{\frac{g}{b} - R_f}{E(R_m) - R_f}$$

Where:

b = the retention ratio for a firm at period i

$$b = \frac{EPS_i - EDS_i}{EPS_i}$$

EPS = Earnings per share for period i

DPS = dividends per share for period i

ROE = Return on equity

$$g = b[R_f + \beta(E(R_m) - R_f)]$$

$R_f = \text{Risk free rate}$

$E(R_m) = \text{Expected return of the market}$

Data has been collected using Share Magic Pro for all the firms as specified in the sample.

4.6.3. Three Factor Pricing Model

The expected return of a firm is determined using the following regression equation:

$$R_i(t) - RF(t) = a_i + b_i[RM(t) - RF(t)] + s_i SMB(t) + h_i HML(t) + e_i(t)$$

Where:

$R_i(t)$-RF(t) = The return on asset i in excess of the risk free rate for month t

RM(t)-RF(t) = The excess return for month t on a value weighted market portfolio

SMB = Small Minus Big, is a portfolio constructed to mimic the excess return of a small value stock compared to a big value stock

HML = High Minus Low, is a portfolio constructed to mimic the excess return of a high price to book stock versus a low price to book stock

In order to estimate the coefficients s_i and h_i, the following calculation steps were taken:

1) $R_i(t)$-RF(t) were calculated for all firms for the period 2005 to 2009. This was done by calculating the difference in share price for each month and then deducting the risk free rate for the specific month and determined by treasury bills.

2) RM(t)-RF(t) were calculated each month for the period 2005 to 2009. This was done by calculating the value weighted return of the market and then deducting the risk free rate for the specific month as determined by the treasury bills.

3) A SMB portfolio was constructed with the sampled firms every 6 months (January and July) based on the market capitalization of the firm at the time. Firms were divided into being either small cap or large cap. Thus 50% of firms belong to the small portfolio and 50% of the firms belong to the big portfolio.

4) A HML portfolio was constructed with the sampled firms every 6 months (January and July) based on the Price to Book ratio of the firm at the time. Firms were then divided into being either high, medium or low price to book values. 30% of firms were allocated to a high portfolio, 40% allocated to a medium portfolio and 30% allocated to a low portfolio.

5) The SMB return for each month was then calculated by taking the value weighted return of all the firms belonging to the small portfolio and subtracting the value weighted return of all the big portfolios.

6) The HML return for each month was then calculated by taking the value weighted return of all the firms belonging to the high portfolio and subtracting the value weighted return of all the low portfolios.

7) The values for the above regression were then analysed using NCSS statistical software to determine the coefficients (a_i, b_i, s_i, h_i) for each of the variables.

8) Expected excess return were then calculated for each firm by substituting the coefficients obtained in step 7 into the regression equation and deriving the excess returns for each firm.

All data collected for the regression analysis were done using I-Net Bridge for the period 2005 to 2009.

4.6.4. Market Derived Capital Pricing Model

In order to calculate the Cost of Capital of a firm using the market derived capital pricing model, the following four steps needs to be applied:

1) Calculate the forward break even price equation

$$Break\ Even\ Price = Spot\ Price\ \times (1 + Ineterst\ Rate)^{i}$$

Where:

Spot Price = The Spot price of the stock at the time

Interest Rate = Return on debt – Dividend yield of firm

2) Estimate the stock future volatility

Volatility was derived by calculating the volatility of the stock pricing over the last 50 days of the day in question.

3) Calculate the cost of downside insurance

The Black-Scholes pricing model was used in order to calculate the price of an option using the break even price as the strike price of the option and volatility calculated in step 1 and 2.

4) Derive the annualised excess equity returns

The excess equity return was then calculated using the following equation:

$$E(R) = \frac{\frac{\text{Option Price}}{\text{Spot Price}}}{\frac{1}{\text{R(d)}} - \frac{1}{\text{R(d)} \times (1 + \text{R(d)})^{\text{i}}}}$$

Where:

E(R) = Expected return of the firm

R(d) = Return on debt

i = Break even date used in step 1 and 2 (5 years)

Because of the reliance on accurate dividend forecast for the model, only firms for which I-Net Bridge supplies forecasted data for are included into the sample.

4.7.Research Limitations

The research conducted in this research project may have the following limitations:

- The results of the research can only be interpreted for publicly listed companies in South Africa. However, the results should provide a better understanding in selecting a comparable company when valuating a non listed firm.

- Some of the methods used to value a firm may only be applicable for firms' that do make use of the relevant market instruments. Thus while a correlation may exist between the dependant and independent variables, practical use of the model in real life may be limited. However this limitation will be addressed in more detail when more is known about the sample and the financial instruments used.

- Systematic error in the form of administrative error could arise if the models under investigation in this research are incorrectly applied. This will however be countered by obtaining as much as possible validation of the model application from academic experts or subject matter experts.

5. Results

5.1. Implied Cost of Capital

In order to calculate the Cost of Capital using the Implied Beta model, the following assumptions and variables are used:

- In order to calculate the cost of equity capital for each firm (r_e), a market risk premium of 6% was assumed and a 3 year Beta obtained from Share Magic Pro was used.
- The book value required for t = 0 was calculated by taking the total assets and subtracting the total liabilities
- The implicit forecast information was obtained from Share Magic Pro and market consensus forecasts were used
- Companies included in the analysis were all the companies for which consensus forecast were available
- Target return on equity was calculated for each economic industry (Basic Industries, Cyclical, Financial, General Industries, Information Technology, Non Cyclical and Resources) as specified by the JSE. The target return on equities was assumed to be the average return on equity for each economic industry as forecasted in the consensus forecasts. These target return on equities were then used for each firm for the explicit forecasts.
- Long term growth rates were assumed at 8%. 5% for the inflation target of South Africa which is between 3% and 6% plus and additional 3% for gross domestic product increase average year on year.

5.1.1. Turnover

The regression has been modelled between the dependent variable, Turnover, and the independent variable, Implied Cost of Capital. A total of 133 observations were made for the regression. There is a negative correlation of 0.0617 between the variables and the regression produced an R^2 value of 0.0038. Table 2 below shows the details of the statistical findings of the regression analysis and the results can be described by the following equation:

Turnover = 17411923.65 - 1526838.149*(Implied Cost of Capital)

Table 2: Summary Statistics –Implied Cost of Capital VS Turnover

Parameter	Value	Parameter	Value
Dependent Variable	Turnover	Rows Processed	136
Independent Variable	ImpCC	Rows Used in Estimation	133
Frequency Variable	None	Rows with X Missing	0
Weight Variable	None	Rows with Freq Missing	0
Intercept	17411923.65	Rows Prediction Only	3
Slope	-1526838.149	Sum of Frequencies	133
R-Squared	0.0038	Sum of Weights	133
Correlation	-0.0617	Coefficient of Variation	1.5809
Mean Square Error	5.37E+14	Square Root of MSE	2.32E+07

Figure 1 below shows a graphical representation and trend line of the regression data.

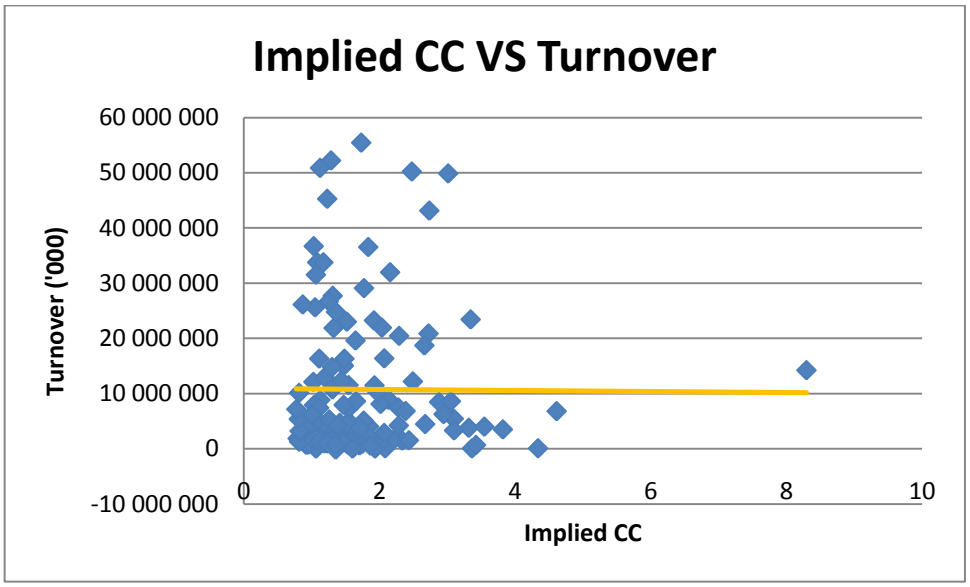

Figure 1: Scatter Plot – Implied Cost of Capital VS Turnover

The hypothesis test results shows that the null hypothesis could not be rejected based on the regression results and that there is not a correlation between the turnover of a company and the Implied Cost of Capital.

Table 3: Hypothesis Results – Implied Cost of Capital VS Turnover

Parameter	Intercept B(0)	Slope B(1)
T Value	3.9793	-0.7075
Prob Level (T Test)	0.0001	0.4805
Reject H0 (Alpha = 0.0500)	Yes	No
Power (Alpha = 0.0500)	0.9767	0.1081

5.1.2. Total Assets

The regression has been modelled between the dependent variable, Total Assets, and the independent variable, Implied Cost of Capital. A total of 128 observations were made for the regression. There is a negative correlation of 0.1013 between the variables and the regression produced an R^2 value of 0.0103. Table 4 below shows the details of the statistical findings of the regression analysis and the results can be described by the following equation:

Total Assets = 22057220.96- 2671001.421*(Implied Cost of Capital)

Table 4: Summary Statistics –Implied Cost of Capital VS Total Assets

Parameter	Value	Parameter	Value
Dependent Variable	TotalAssets	Rows Processed	136
Independent Variable	ImpCC	Rows Used in Estimation	128
Frequency Variable	None	Rows with X Missing	0
Weight Variable	None	Rows with Freq Missing	0
Intercept	22057220.96	Rows Prediction Only	8
Slope	-2671001.421	Sum of Frequencies	128
R-Squared	0.0103	Sum of Weights	128
Correlation	-0.1013	Coefficient of Variation	1.4491
Mean Square Error	6.21E+14	Square Root of MSE	2.49E+07

Figure 2 below shows a graphical representation and trend line of the regression data.

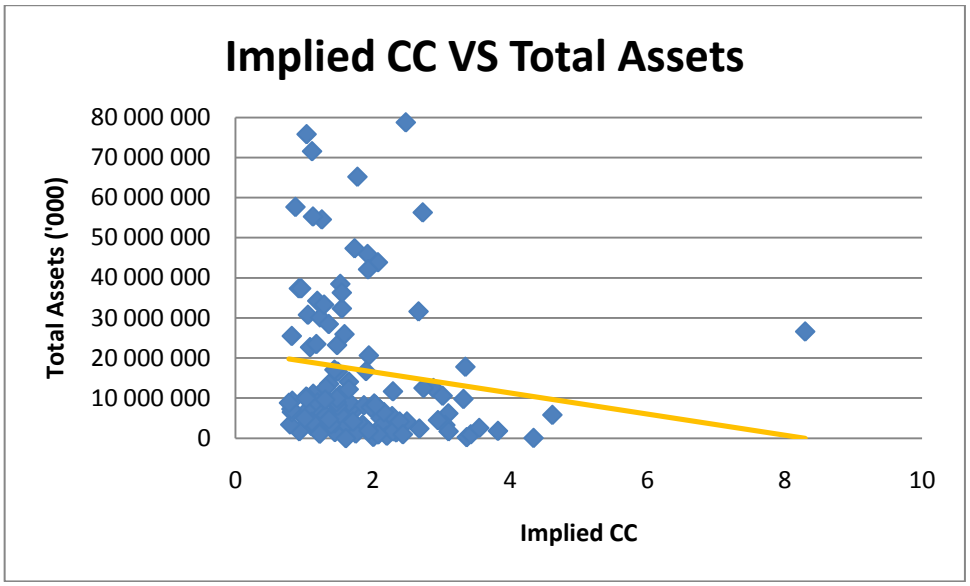

Figure 2: Scatter Plot – Implied Cost of Capital VS Total Assets

The hypothesis test results shows that the null hypothesis could not be rejected based on the regression results and that there is not a correlation between the Total Assets of a company and the Implied Cost of Capital.

Table 5: Hypothesis Results – Implied Cost of Capital VS Total Assets

Parameter	Intercept B(0)	Slope B(1)
T Value	4.6033	-1.1429
Prob Level (T Test)	0	0.2552
Reject H0 (Alpha = 0.0500)	Yes	No
Power (Alpha = 0.0500)	0.9954	0.2055

5.1.3. Market Capitalisation

The regression has been modelled between the dependent variable, Market Capitalisation, and the independent variable, Implied Cost of Capital. A total of 134 observations were made for the regression. There is a positive correlation of 0.3945 between the variables and the regression produced an R^2 value of 0.1556. Table 6 below shows the details of the statistical findings of the regression analysis and the results can be described by the following equation:

Market Capitalisation = -23914233.88 + 30288625.27*(Implied Cost of Capital)

Table 6: Summary Statistics –Implied Cost of Capital VS Market Capitalisation

Parameter	Value	Parameter	Value
Dependent Variable	MCap	Rows Processed	136
Independent Variable	ImpCC	Rows Used in Estimation	134
Frequency Variable	None	Rows with X Missing	0
Weight Variable	None	Rows with Freq Missing	0
Intercept	-23914233.88	Rows Prediction Only	2
Slope	30288625.27	Sum of Frequencies	134
R-Squared	0.1556	Sum of Weights	134
Correlation	0.3945	Coefficient of Variation	2.1663
Mean Square Error	4.37E+15	Square Root of MSE	6.61E+07

Figure 3 below shows a graphical representation and trend line of the regression data.

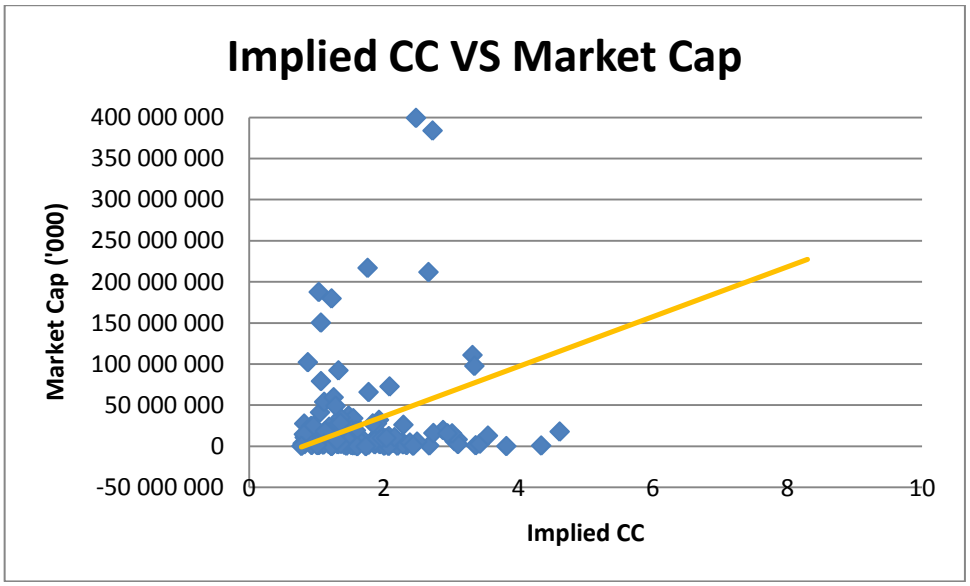

Figure 3: Scatter Plot – Implied Cost of Capital VS Market Capitalisation

The hypothesis test results shows that the null hypothesis could not be rejected based on the regression results and that there is not a correlation between the Market Capitalisation of a company and the Implied Cost of Capital.

Table 7: Hypothesis Results – Implied Cost of Capital VS Market Capitalisation

Parameter	Intercept B(0)	Slope B(1)
T Value	-1.9246	4.9326
Prob Level (T Test)	0.0564	0
Reject H0 (Alpha = 0.0500)	No	Yes
Power (Alpha = 0.0500)	0.4804	0.9983

5.1.4. Price to Book

The regression has been modelled between the dependent variable, Price to Book, and the independent variable, Implied Cost of Capital. A total of 129 observations were made for the regression. There is a positive correlation of 0.5945 between the variables and the regression produced an R^2 value of 0.3535. Table 8 below shows the details of the statistical findings of the regression analysis and the results can be described by the following equation:

Price to Book = -5.0113 + 5.7141*(Implied Cost of Capital)

Table 8: Summary Statistics –Implied Cost of Capital VS Price to Book

Parameter	Value	Parameter	Value
Dependent Variable	PriceToBook	Rows Processed	136
Independent Variable	ImpCC	Rows Used in Estimation	129
Frequency Variable	None	Rows with X Missing	0
Weight Variable	None	Rows with Freq Missing	0
Intercept	-5.0113	Rows Prediction Only	7
Slope	5.7141	Sum of Frequencies	129
R-Squared	0.3535	Sum of Weights	129
Correlation	0.5945	Coefficient of Variation	1.1422
Mean Square Error	30.2	Square Root of MSE	5.49

Figure 4 below shows a graphical representation and trend line of the regression data.

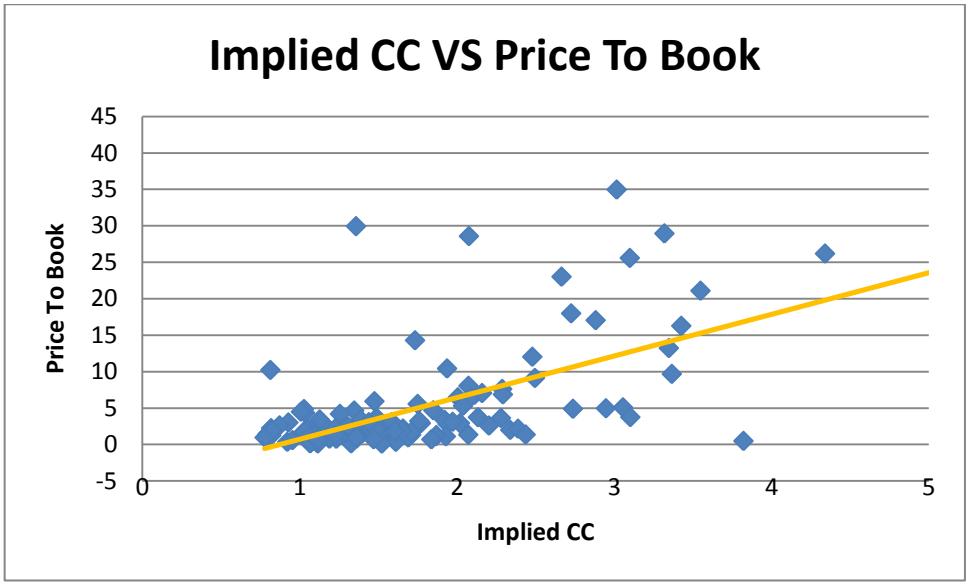

Figure 4: Scatter Plot – Implied Cost of Capital VS Price to Book

The hypothesis test results show that the null hypothesis was rejected based on the regression results and that there is a correlation between the Price to Book of a company and the Implied Cost of Capital.

Table 9: Hypothesis Results – Implied Cost of Capital VS Price to Book

Parameter	Intercept B(0)	Slope B(1)
T Value	-3.9346	8.3327
Prob Level (T Test)	0.0001	0
Reject H0 (Alpha = 0.0500)	Yes	Yes
Power (Alpha = 0.0500)	0.9741	1

5.1.5. Altman Z Score

The regression has been modelled between the dependent variable, Z Score, and the independent variable, Implied Cost of Capital. A total of 124 observations were made for the regression. There is a positive correlation of 0.4649 between the variables and the regression produced an R^2 value of 0.2161. Table 10 below shows the details of the statistical findings of the regression analysis and the results can be described by the following equation:

$$Z\ Score = -0.4987 + 2.5519*(Implied\ Cost\ of\ Capital)$$

Table 10: Summary Statistics –Implied Cost of Capital VS Z Score

Parameter	Value	Parameter	Value
Dependent Variable	ZScore	Rows Processed	136
Independent Variable	ImpCC	Rows Used in Estimation	124
Frequency Variable	None	Rows with X Missing	0
Weight Variable	None	Rows with Freq Missing	0
Intercept	-0.4987	Rows Prediction Only	12
Slope	2.5519	Sum of Frequencies	124
R-Squared	0.2161	Sum of Weights	124
Correlation	0.4649	Coefficient of Variation	1.1054
Mean Square Error	21.6	Square Root of MSE	4.65

Figure 5 below shows a graphical representation and trend line of the regression data.

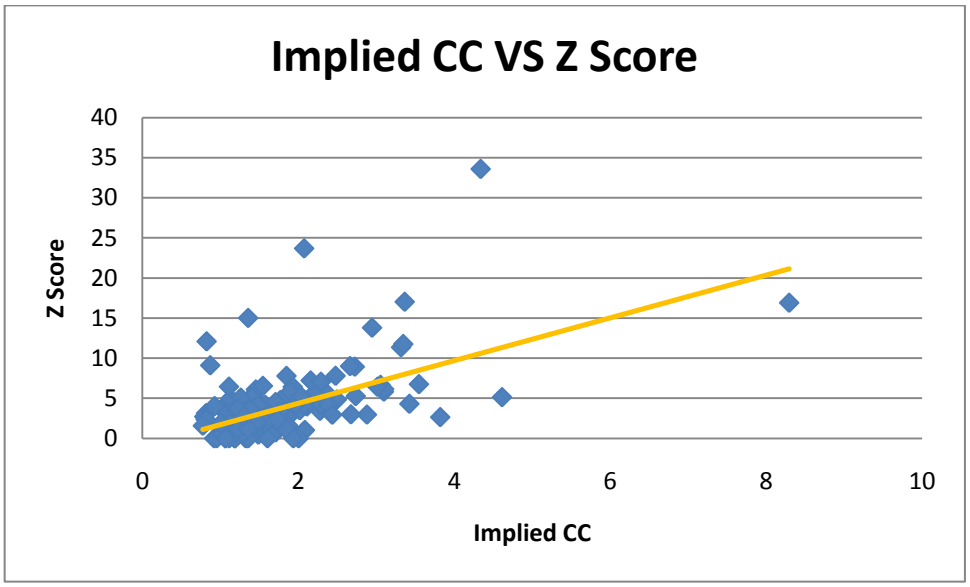

Figure 5: Scatter Plot – Implied Cost of Capital VS Z Score

The hypothesis test results shows that the null hypothesis was rejected based on the regression results and that there is a correlation between the Z Score of a company and the Implied Cost of Capital.

Table 11: Hypothesis Results – Implied Cost of Capital VS Z Score

Parameter	Intercept B(0)	Slope B(1)
T Value	-0.547	5.7994
Prob Level (T Test)	0.5854	0
Reject H0 (Alpha = 0.0500)	No	Yes
Power (Alpha = 0.0500)	0.0844	0.9999

5.2.Implied Beta

In order to calculate the Cost of Capital using the Implied Beta model, the following assumptions and variables are used:

- The risk free rate was defined by the Treasury Bill rate for South Africa.
- The date for the risk free rate and all other variables used were taken as the last recorded and/or published data for 2009. Thus the analysis date applied is the end of 2009.
- A 3 year Beta was used as recorded by Share Magic Pro
- Dividends per share and earnings per share were used to determine the retention ratio and data were obtained from Share Magic Pro
- All companies that were not listed for at least 3 years prior to the analysis date were excluded by default due to the fact the no 3 year Beta could be calculate for the companies.
- All companies listed on the AltX were excluded from the analysis
- All companies that recorded a negative Beta for the period under analysis were also excluded due to the fact that although negative Betas can be recorded they are not valid

5.2.1. Turnover

A regression analysis has been modelled between the dependent variable, Turnover, and the independent variable, Implied Beta. The sample size for the regression was 207 as described in the descriptive statistics section above. Table 12 below shows the details of the statistical findings of the regression analysis and the results can be described by the following Equation:

Turnover = 8259522.628 + 1322445.038*(Implied Beta)

Table 12: Summary Statistics –Implied Beta VS Turnover

Parameter	Value	Parameter	Value
Dependent Variable	Turnover	Rows Processed	207
Independent Variable	ImpBeta	Rows Used in Estimation	207
Frequency Variable	None	Rows with X Missing	0
Weight Variable	None	Rows with Freq Missing	0
Intercept	8259522.628	Rows Prediction Only	0
Slope	1322445.038	Sum of Frequencies	207
R-Squared	0.0014	Sum of Weights	207
Correlation	0.0368	Coefficient of Variation	2.1113
Mean Square Error	3.8036E+14	Square Root of MSE	19502810

The regression between a firm's turnover and its Implied Beta gives a positive correlation of 0.0368 with an R^2 value of 0.0014. Figure 6 below shows the relationship between the firms' Implied Beta and its Turnover.

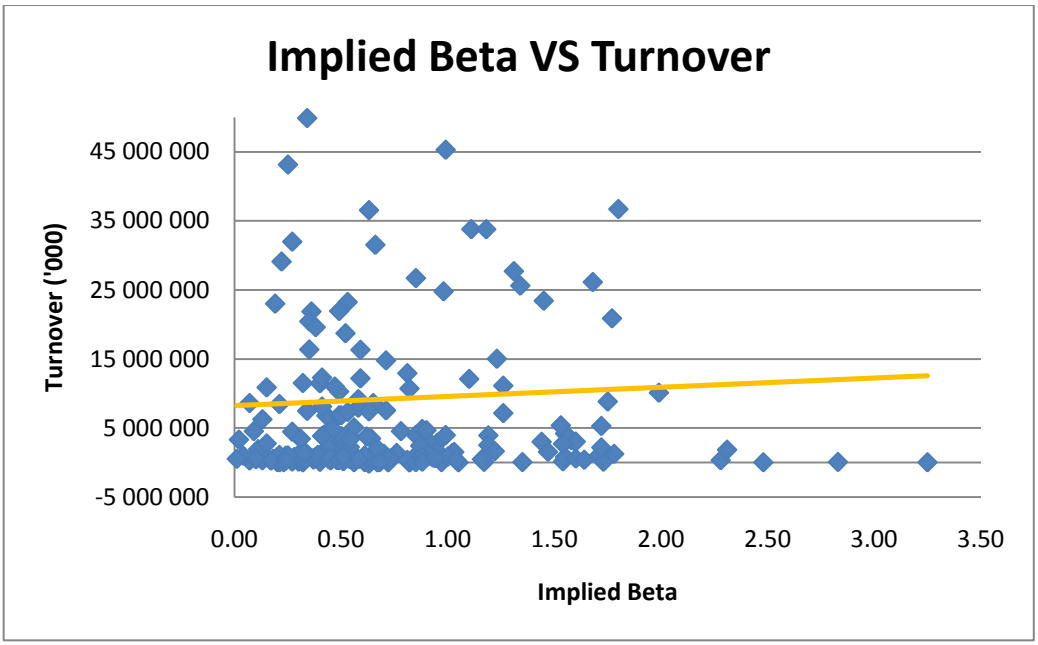

Figure 6: Scatter Plot – Implied Beta VS Turnover

The hypothesis test results show that the null hypothesis could not be rejected based on the regression results and that there is not a correlation between the Turnover of a company and the Implied Beta.

Table 13: Hypothesis Results – Implied Beta VS Turnover

Parameter	Intercept B(0)	Slope B(1)
T Value	1.4129	0.1906
Prob Level (T Test)	0.1594	0.849
Reject H0 (Alpha = 0.0500)	No	No
Power (Alpha = 0.0500)	0.2901	0.0541

5.2.2. Total Assets

A regression analysis has been modelled between the dependent variable, Total Assets, and the independent variable, Implied Beta. The sample size for the regression was 207 as described in the descriptive statistics section above. Table 14 below shows the details of the statistical findings of the regression analysis and the results can be described by the following equation:

Total Assets = 30732470.14 - 5013064.928*(Implied Beta)

Table 14: Summary Statistics –Implied Beta VS Total Assets

Parameter	Value	Parameter	Value
Dependent Variable	TotAssets	Rows Processed	207
Independent Variable	ImpBeta	Rows Used in Estimation	207
Frequency Variable	None	Rows with X Missing	0
Weight Variable	None	Rows with Freq Missing	0
Intercept	30732470.14	Rows Prediction Only	0
Slope	-5013064.928	Sum of Frequencies	207
R-Squared	0.0005	Sum of Weights	207
Correlation	-0.0234	Coefficient of Variation	4.3053
Mean Square Error	1.35E+16	Square Root of MSE	1.16E+08

The regression between a firm's Total Assets and its Implied Beta gives a negative correlation of 0.0234 with an R^2 value of 0.0005. The graph below shows the relationship and trend line between the firm's Implied Beta and Total Assets

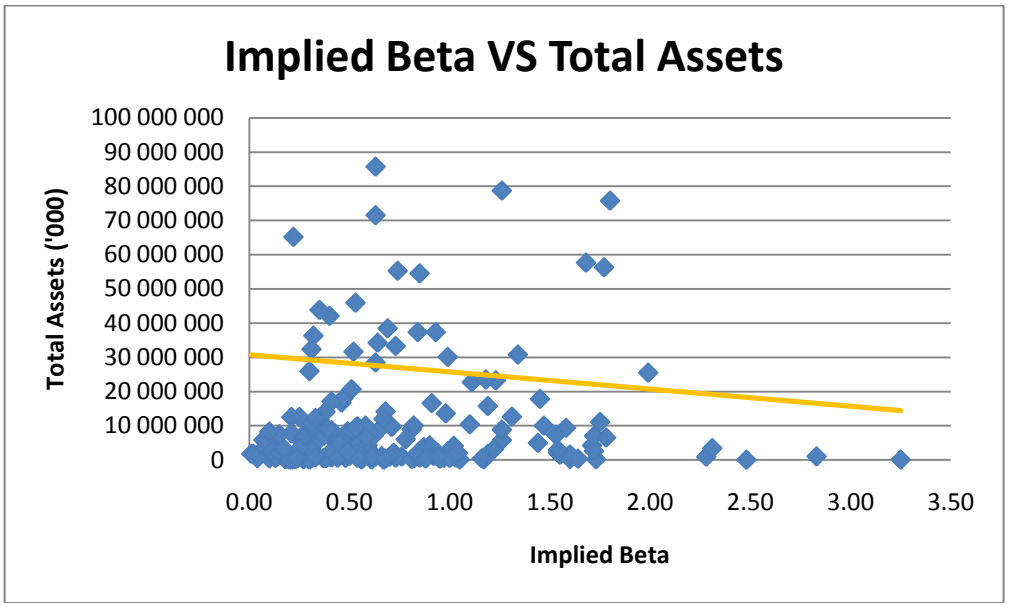

Figure 7: Scatter Plot – Implied Beta VS Total Assets

The hypothesis test results show that the null hypothesis could not be rejected based on the regression results and that there is not a correlation between the Total Assets of a company and the Implied Beta

Table 15: Hypothesis Results – Implied Beta VS Total Assets

Parameter	Intercept B(0)	Slope B(1)
T Value	2.2421	-0.3349
Prob Level (T Test)	0.026	0.738
Reject H0 (Alpha = 0.0500)	Yes	No
Power (Alpha = 0.0500)	0.6071	0.0628

5.2.3. Market Capitalisation

A regression analysis has been modelled between the dependent variable, Market Cap, and the independent variable, Implied Beta. The sample size for the regression was 207 as described in the descriptive statistics section above. Table 16 below shows the details of the statistical findings of the regression analysis and the results can be described by the following equation:

Market Cap = 5811417.571 + 15505793.58*(Implied Beta)

Table 16: Summary Statistics –Implied Beta VS Market Capitalisation

Parameter	Value	Parameter	Value
Dependent Variable	MCap	Rows Processed	207
Independent Variable	ImpBeta	Rows Used in Estimation	207
Frequency Variable	None	Rows with X Missing	0
Weight Variable	None	Rows with Freq Missing	0
Intercept	5811417.571	Rows Prediction Only	0
Slope	15505793.58	Sum of Frequencies	207
R-Squared	0.0286	Sum of Weights	207
Correlation	0.1692	Coefficient of Variation	2.8389
Mean Square Error	2.41E+15	Square Root of MSE	4.90E+07

The regression between a firm's Total Assets and its Implied Beta gives a positive correlation of 0.1692 with an R^2 value of 0.0286. Figure 8 below shows the relationship and trend line between the firm's Implied Beta and Market Cap.

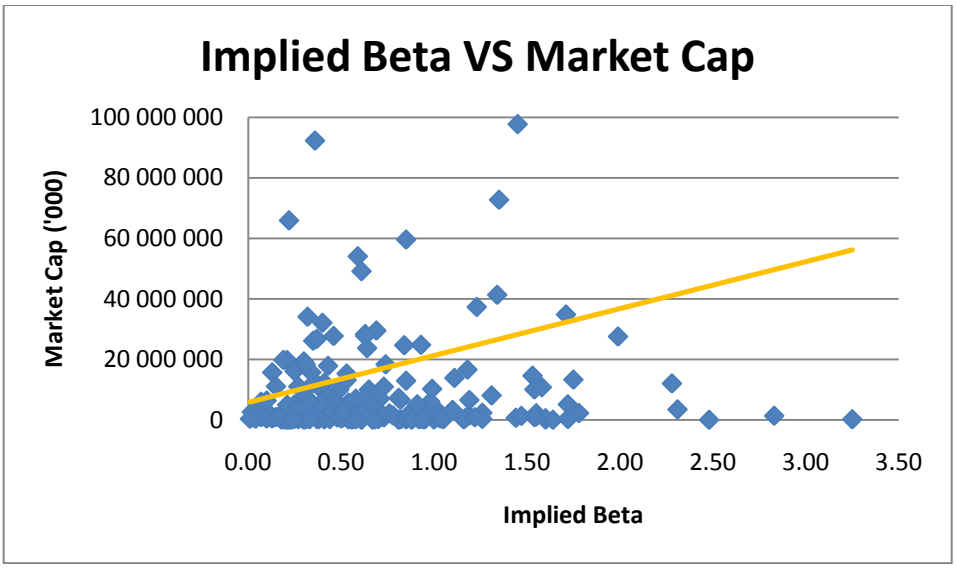

Figure 8: Scatter Plot – Implied Beta VS Market Capitalisation

The hypothesis test results show that the null hypothesis could not be rejected based on the regression results and that there is not a correlation between the Market Capitalisation of a company and the Implied Beta

Table 17: Hypothesis Results – Implied Beta VS Market Capitalisation

Parameter	Intercept B(0)	Slope B(1)
T Value	1.0059	2.4577
Prob Level (T Test)	0.3157	0.0148
Reject H0 (Alpha = 0.0500)	No	Yes
Power (Alpha = 0.0500)	0.1704	0.6866

5.2.4. Price to Book

A regression analysis has been modelled between the dependent variable, Price to Book, and the independent variable, Implied Beta. The sample size for the regression was 207 as described in the descriptive statistics section above; however, due to availability of Price to Book data for firms, only 202 observations were assessed. Table 18 below shows the details of the statistical findings of the regression analysis and the results can be described by the following equation:

Price to Book = 7.4825 - 0.1516*(Implied Beta)

Table 18: Summary Statistics –Implied Beta VS Price to Book

Parameter	Value	Parameter	Value
Dependent Variable	PriceBook	Rows Processed	207
Independent Variable	ImpBeta	Rows Used in Estimation	202
Frequency Variable	None	Rows with X Missing	0
Weight Variable	None	Rows with Freq Missing	0
Intercept	7.4825	Rows Prediction Only	5
Slope	-4.5096	Sum of Frequencies	202
R-Squared	0.023	Sum of Weights	202
Correlation	-0.1516	Coefficient of Variation	3.9098
Mean Square Error	257	Square Root of MSE	16

The regression between a firm's Price to Book ratio and its Implied Beta gives a negative correlation of 0.1516 with an R^2 value of 0.023. Figure 9 below show the relationship and trend line between the firm's Implied Beta and Price to Book Ratio.

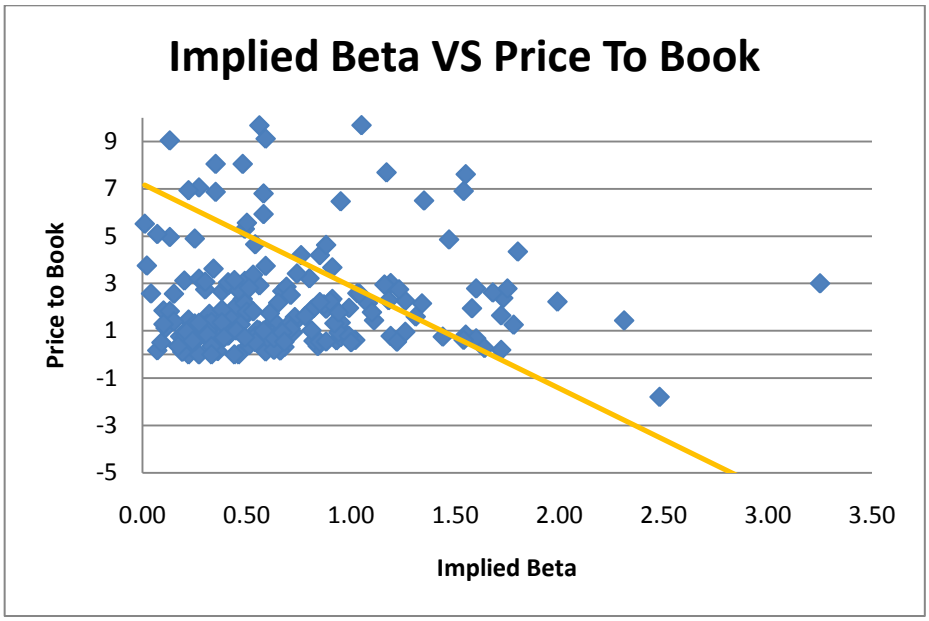

Figure 9: Scatter Plot – Implied Beta VS Price to Book

The hypothesis test results show that the null hypothesis was rejected based on the regression results and that there is a correlation between the Price to Book of a company and the Implied Beta

Table 19: Hypothesis Results – Implied Beta VS Price to Book

Parameter	Intercept B(0)	Slope B(1)
T Value	3.89	-2.1693
Prob Level (T Test)	0.0001	0.0312
Reject H0 (Alpha = 0.0500)	Yes	Yes
Power (Alpha = 0.0500)	0.972	0.5789

5.2.5. Altman Z Score

A regression analysis has been modelled between the dependent variable, Z Score, and the independent variable, Implied Beta. The sample size for the regression was 207 as described in the descriptive statistics section above; however, due to availability of data required for the Z Score, only 187 observations were assessed. Table 20 below shows the details of the statistical findings of the regression analysis and the results can be described by the following equation:

Price to Book = 5.0648 + 0.7254*(Implied Beta)

Table 20: Summary Statistics –Implied Beta VS Z Score

Parameter	Value	Parameter	Value
Dependent Variable	ZScore	Rows Processed	207
Independent Variable	ImpBeta	Rows Used in Estimation	187
Frequency Variable	None	Rows with X Missing	0
Weight Variable	None	Rows with Freq Missing	0
Intercept	5.0648	Rows Prediction Only	20
Slope	0.7254	Sum of Frequencies	187
R-Squared	0.0002	Sum of Weights	187
Correlation	0.014	Coefficient of Variation	5.1997
Mean Square Error	852	Square Root of MSE	29.2

The regression between a firm's Price to Book ratio and its Implied Beta gives a negative correlation of 0.14 with an R^2 value of 0.0002. Figure 10 below shows the relationship and trend line between the firm's Implied Beta and Z Score.

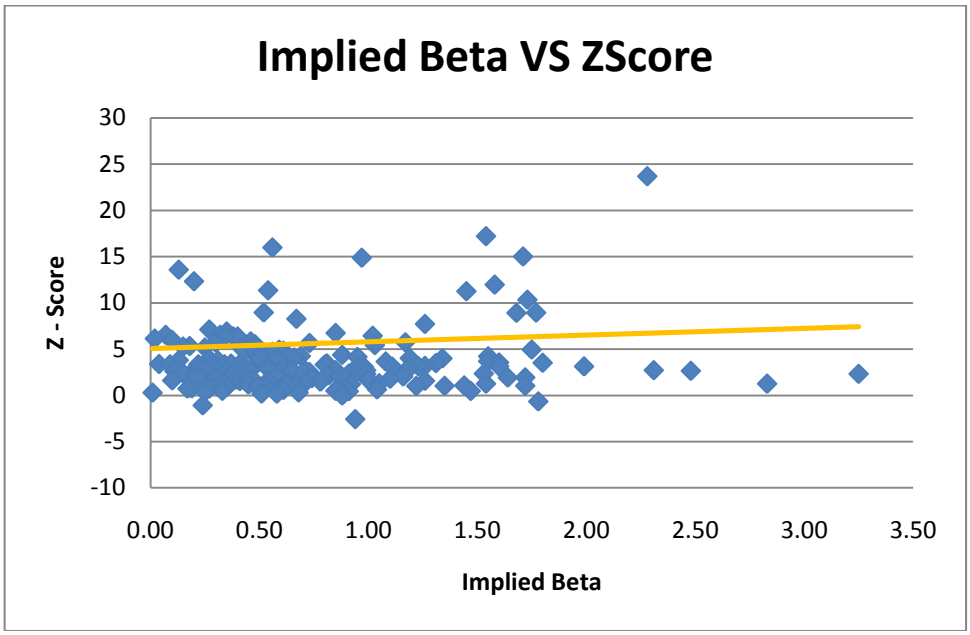

Figure 10: Scatter Plot – Implied Beta VS Z Score

The hypothesis test results show that the null hypothesis could not be rejected based on the regression results and that there is not a correlation between the Z Score of a company and the Implied Beta

Table 21: Hypothesis Results – Implied Beta VS Z Score

Parameter	Intercept B(0)	Slope B(1)
T Value	2.3293	-0.6201
Prob Level (T Test)	0.0233	0.5376
Reject H0 (Alpha = 0.0500)	Yes	No
Power (Alpha = 0.0500)	0.6298	0.0936

5.3.Three Factor Pricing Model

The following assumptions and variables were used when the Three Factor Pricing Model was applied to firms on the JSE:

- Company returns were calculated monthly by calculating the percentage difference between the beginning of the month and the end of the months' share price
- Market capitalisation for each firm was calculated by multiplying the number of shares in issue with the share price for the specific month
- Price to Book was calculated for each firm each month by dividing the firm's market cap for the month by the firm's net asset value at the time
- Net asset value was calculated by Total Assets-Total Liabilities-Intangible Assets
- The risk free rate was determined by the treasury bill rate at the end of each month
- The market return was calculated as a value weighted return of all stocks included into the portfolio for analysis and was calculated at the end of each month

5.3.1. Calculating the Coefficients required

The time series regression used to determine the coefficients was analysed for the period 2005 to 2009 on a monthly basis. Companies listed at the end of 2002 and still listed at the end of 2009 was included into the analysis to ensure stability and reliability of the data needed for the time series regression. Companies for the regression analysis were selected if they adhered to the above criteria and if they were listed within the top 100 companies at the end of 2009. Portfolio's were formed at the start of each year and again reformed after month 6 of each year.

The dependent variable for the multiple-regression was the excess return of a company over the risk free rate (RiRf). The independent variables for the regression was the excess return of the market over the risk free rate (RmRf), the difference in return between small and high market cap (SMB) and the difference in return between high and low price to book stocks (HML). The sample size for the analysis was 72 companies which adhered to the criteria of selection. A total of 4 200 observations were made over the 5 year period under review. The R Squared value for the regression was 0.3069. Table 22 below shows descriptive statistics for the regression.

Table 22: Summary Statistics –Calculating Three Factor Pricing Coefficients

Parameter	Value	Parameter	Value
Dependent Variable	RiRf	Rows Processed	4200
Number Ind. Variables	3	Rows Filtered Out	0
Weight Variable	None	Rows with X's Missing	0
R 2	0.3069	Rows with Weight Missing	0
Adj R2	0.3064	Rows with Y Missing	0
Coefficient of Variation	9.2408	Rows Used in Estimation	4200
Mean Square Error	0.0062836	Sum of Weights	4200
Square Root of MSE	0.0793	Completion Status	Normal Completion

The regression analysis has calculated the coefficients as follows:

$$R_i(t) - RF(t) = a_i + b_i[RM(t) - RF(t)] + s_i SMB(t) + h_i HML(t) + e_i(t)$$

Where:

$$a_i = -0.0058$$

$$b_i = 0.967$$

$$s_i = 0.7685$$

$$h_i = 0.3776$$

Table 23 below shows the detailed statistical results for the regression.

Table 23: Summary Statistics –Three Factor Pricing Model Coefficients

Independent Variable	Regression Coefficient b(i)	Standard Error Sb(i)	T-Value to test H0:B(i)=0	Prob Level	Reject H0 at 5%?	Power of Test at 5%
Intercept	-0.0058	0.0013	-4.539	0	Yes	0.995
HML	0.3776	0.0328	11.528	0	Yes	1
RmRf	0.967	0.0231	41.818	0	Yes	1
SMB	0.7685	0.0417	18.442	0	Yes	1

The coefficients as calculated in the multiple-regression were then substituted into the Three Factor Pricing Model. The Small Minus Big and High Minus Low portfolios were then recalculated for 2010 and an expected return were calculated for the companies included in the study.

5.3.2. Turnover

The regression has been modelled between the dependent variable, Turnover, and the independent variable, Three Factor Pricing Model Cost of Capital. A total of 70 observations were made for the regression. There is a negative correlation of 0.4508 between the variables and the regression produced an R^2 value of 0.2032. Table 24 below shows the details of the statistical findings of the regression analysis and the results can be described by the following equation:

Turnover = 63446243.85 - 0.4508*(TFPReturn)

Table 24: Summary Statistics –Three Factor Pricing Model VS Turnover

Parameter	Value	Parameter	Value
Dependent Variable	Turnover	Rows Processed	72
Independent Variable	TFPReturn	Rows Used in Estimation	70
Frequency Variable	None	Rows with X Missing	0
Weight Variable	None	Rows with Freq Missing	0
Intercept	63446243.85	Rows Prediction Only	2
Slope	-2447364.997	Sum of Frequencies	70
R-Squared	0.2032	Sum of Weights	70
Correlation	-0.4508	Coefficient of Variation	1.2502
Mean Square Error	6.74E+14	Square Root of MSE	2.60E+07

Figure 11 below shows a graphical representation and trend line of the regression data.

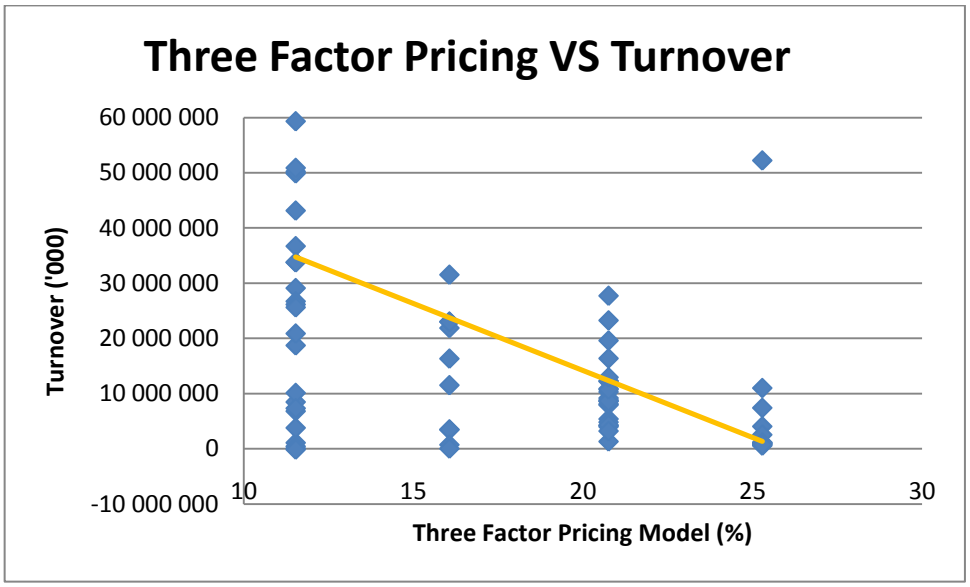

Figure 11: Scatter Plot – Three Factor Pricing Model VS Turnover

The hypothesis test results show that the null hypothesis was rejected based on the regression results and that there is a correlation between the turnover of a company and the Three Factor Pricing Model.

Table 25: Hypothesis Results – Three Factor Pricing Model VS Turnover

Parameter	Intercept B(0)	Slope B(1)
T Value	5.9246	-4.1643
Prob Level (T Test)	0	0.0001
Reject H0 (Alpha = 0.0500)	Yes	Yes
Power (Alpha = 0.0500)	0.9999	0.984

5.3.3. Total Assets

The regression has been modelled between the dependent variable, Total Assets, and the independent variable, Three Factor Pricing Model Cost of Capital. A total of 70 observations were made for the regression. There is a negative correlation of 0.1487 between the variables and the regression produced an R^2 value of 0.0221. Table 26 below shows the details of the statistical findings of the regression analysis and the results can be described by the following equation:

Total Assets = 184187272.7 - 5903870.446*(TFPReturn)

Table 26: Summary Statistics –Three Factor Pricing Model VS Total Assets

Parameter	Value	Parameter	Value
Dependent Variable	TotalAssets	Rows Processed	72
Independent Variable	TFPReturn	Rows Used in Estimation	72
Frequency Variable	None	Rows with X Missing	0
Weight Variable	None	Rows with Freq Missing	0
Intercept	184187272.7	Rows Prediction Only	0
Slope	-5903870.446	Sum of Frequencies	72
R-Squared	0.0221	Sum of Weights	72
Correlation	-0.1487	Coefficient of Variation	2.566
Mean Square Error	4.33E+16	Square Root of MSE	2.08E+08

Figure 12 below shows a graphical representation and trend line of the regression data.

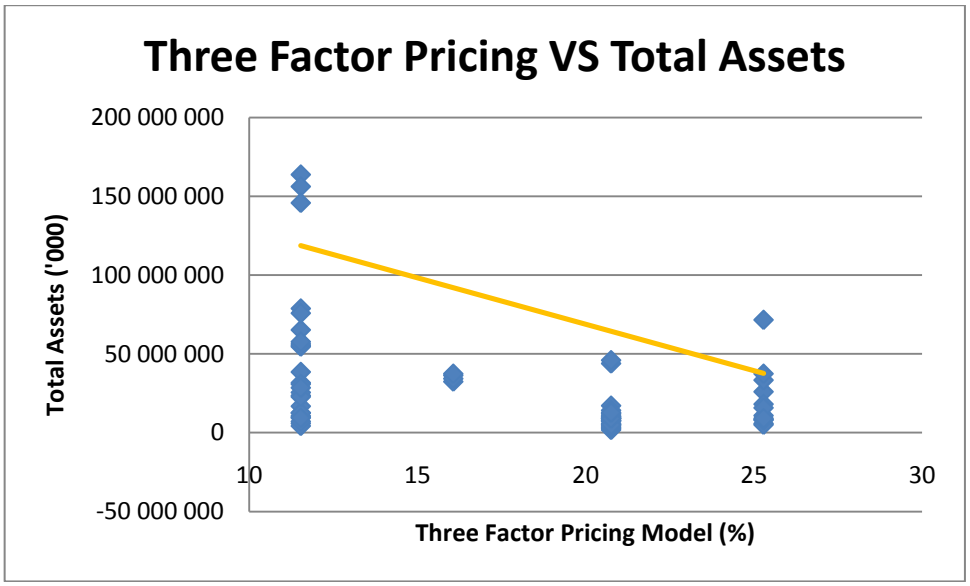

Figure 12: Scatter Plot – Three Factor Pricing Model VS Total Assets

The hypothesis test results show that the null hypothesis was not rejected based on the regression results and that there is not a correlation between the Total Assets of a company and the Three Factor Pricing Model

Table 27: Hypothesis Results – Three Factor Pricing Model VS Total Assets

Parameter	Intercept B(0)	Slope B(1)
T Value	2.1524	-1.2578
Prob Level (T Test)	0.0348	0.2126
Reject H0 (Alpha = 0.0500)	Yes	No
Power (Alpha = 0.0500)	0.5647	0.2366

5.3.4. Market Capitalisation

The regression has been modelled between the dependent variable, Market Capitalisation, and the independent variable, Three Factor Pricing Model Cost of Capital. A total of 70 observations were made for the regression. There is a negative correlation of 0.4655 between the variables and the regression produced an R^2 value of 0.2167. Table 28 below shows the details of the statistical findings of the regression analysis and the results can be described by the following equation:

Market Capitalisation = 163185909.3 - 6791218.194*(TFPReturn)

Table 28: Summary Statistics –Three Factor Pricing Model VS Market Capitalisation

Parameter	Value	Parameter	Value
Dependent Variable	MarketCap	Rows Processed	72
Independent Variable	TFPReturn	Rows Used in Estimation	72
Frequency Variable	None	Rows with X Missing	0
Weight Variable	None	Rows with Freq Missing	0
Intercept	163185909.3	Rows Prediction Only	0
Slope	-6791218.194	Sum of Frequencies	72
R-Squared	0.2167	Sum of Weights	72
Correlation	-0.4655	Coefficient of Variation	1.5349
Mean Square Error	4.68E+15	Square Root of MSE	6.84E+07

Figure 13 below shows a graphical representation and trend line of the regression data.

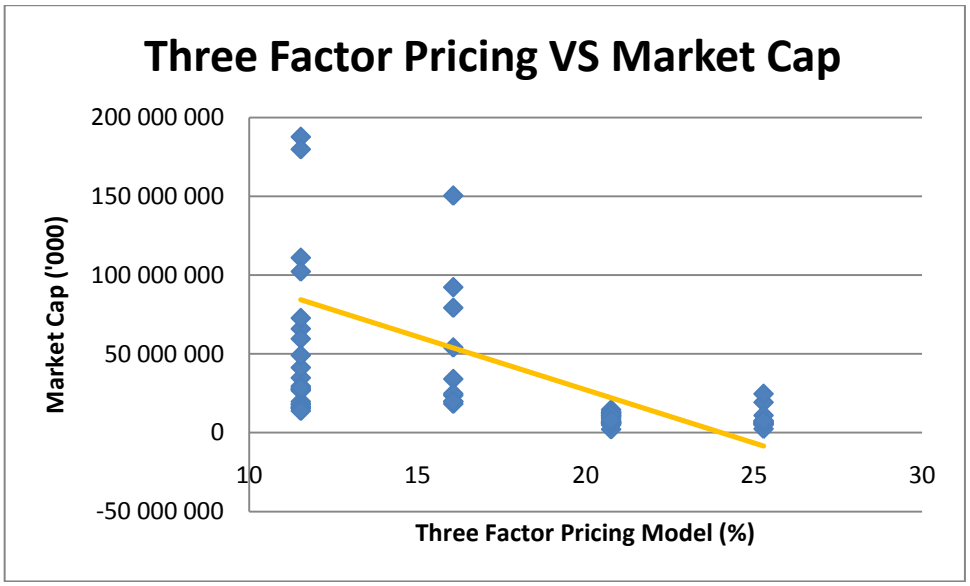

Figure 13: Scatter Plot – Three Factor Pricing Model VS Market Capitalisation

The hypothesis test results show that the null hypothesis was rejected based on the regression results and that there is a correlation between the Market Capitalisation of a company and the Three Factor Pricing Model

Table 29: Hypothesis Results – Three Factor Pricing Model VS Market Capitalisation

Parameter	Intercept B(0)	Slope B(1)
T Value	5.7996	-4.4004
Prob Level (T Test)	0	0
Reject H0 (Alpha = 0.0500)	Yes	Yes
Power (Alpha = 0.0500)	0.9999	0.9913

5.3.5. Price to Book

The regression has been modelled between the dependent variable, Price To Book, and the independent variable, Three Factor Pricing Model Cost of Capital. A total of 70 observations were made for the regression. There is a negative correlation of 0.2798 between the variables and the regression produced an R^2 value of 0.0783. Table 30 below shows the details of the statistical findings of the regression analysis and the results can be described by the following equation:

Price to Book = 23.7071- 0.9386*(TFPReturn)

Table 30: Summary Statistics –Three Factor Pricing Model VS Price to Book

Parameter	Value	Parameter	Value
Dependent Variable	PriceToBook	Rows Processed	72
Independent Variable	TFPReturn	Rows Used in Estimation	68
Frequency Variable	None	Rows with X Missing	0
Weight Variable	None	Rows with Freq Missing	0
Intercept	23.7071	Rows Prediction Only	4
Slope	-0.9386	Sum of Frequencies	68
R-Squared	0.0783	Sum of Weights	68
Correlation	-0.2798	Coefficient of Variation	2.3689
Mean Square Error	294	Square Root of MSE	17.1

Figure 14 below shows a graphical representation and trend line of the regression data.

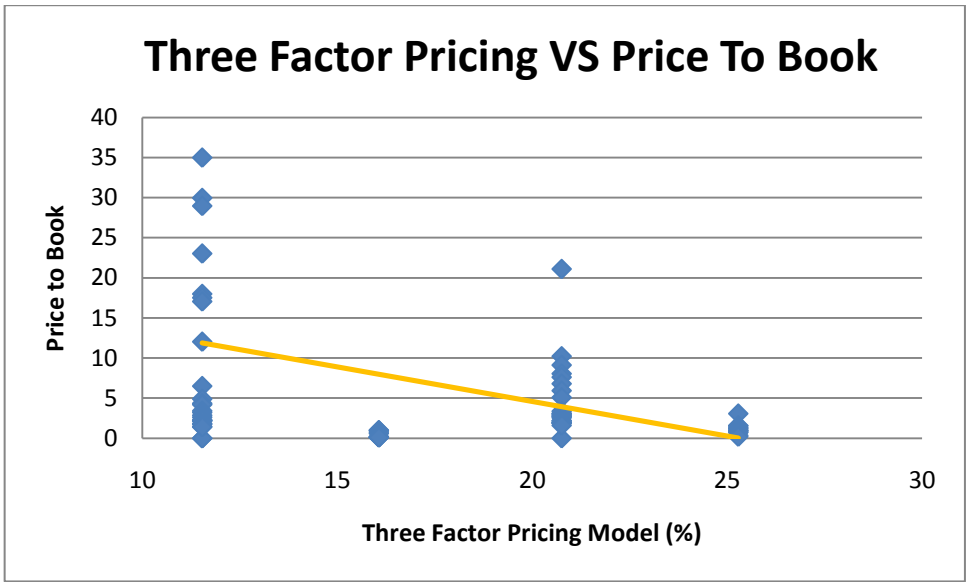

Figure 14: Scatter Plot – Three Factor Pricing Model VS Price to Book

The hypothesis test results show that the null hypothesis was rejected based on the regression results and that there is a correlation between the Price to Book of a company and the Three Factor Pricing Model

Table 31: Hypothesis Results – Three Factor Pricing Model VS Price to Book

Parameter	Intercept B(0)	Slope B(1)
T Value	3.2656	-2.3677
Prob Level (T Test)	0.0017	0.0208
Reject H0 (Alpha = 0.0500)	Yes	Yes
Power (Alpha = 0.0500)	0.8958	0.6455

5.3.6. Altman Z Score

The regression has been modelled between the dependent variable, Price To Book, and the independent variable, Three Factor Pricing Model Cost of Capital. A total of 70 observations were made for the regression. There is a negative correlation of 0.2798 between the variables and the regression produced an R^2 value of 0.0783. The table below shows the details of the statistical findings of the regression analysis and the results can be described by the following equation:

Z Score = 4.7973 - 0.0703*(TFPReturn)

Parameter	Value	Parameter	Value
Dependent Variable	ZScore	Rows Processed	72
Independent Variable	TFPReturn	Rows Used in Estimation	61
Frequency Variable	None	Rows with X Missing	0
Weight Variable	None	Rows with Freq Missing	0
Intercept	4.7973	Rows Prediction Only	11
Slope	-0.0703	Sum of Frequencies	61
R-Squared	0.0065	Sum of Weights	61
Correlation	-0.0805	Coefficient of Variation	1.3346
Mean Square Error	22.8	Square Root of MSE	4.77

Table 32: Summary Statistics –Three Factor Pricing Model VS Z Score

Figure 15 below shows a graphical representation and trend line of the regression data.

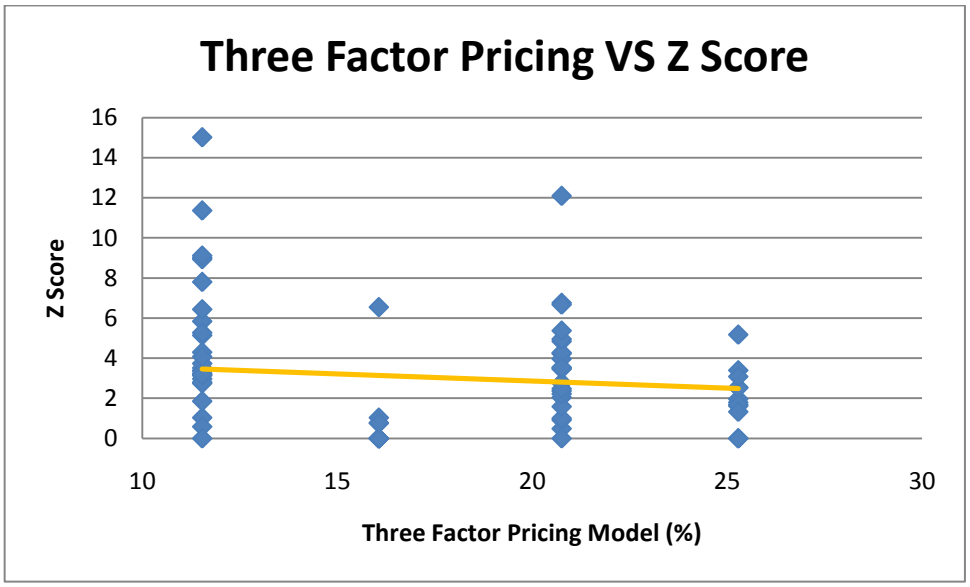

Figure 15: Scatter Plot – Three Factor Pricing Model VS Z Score

The hypothesis test results shows that the null hypothesis was not rejected based on the regression results and that there is not a correlation between the Total Assets of a company and the Three Factor Pricing Model

Table 33: Hypothesis Results – Three Factor Pricing Model VS Z Score

Parameter	Intercept B(0)	Slope B(1)
T Value	2.3293	-0.6201
Prob Level (T Test)	0.0233	0.5376
Reject H0 (Alpha = 0.0500)	Yes	No
Power (Alpha = 0.0500)	0.6298	0.0936

5.4.Market Derived Capital Pricing Model

In order to calculate the Cost of Capital using the Implied Beta model, the following assumptions and variables are used:

- The interest rated required to calculate the break even is the difference between the return on debt (or risk free rate) less the dividend yield for the firm. The risk free rate is assumed as being equal to the Treasury bill rate at the time.
- The dividend yield was calculated using the analysts forecasts obtained from I-Net Bridge and the market consensus forecast was used for the firms included in the forecast exercise.
- Companies included in the analysis were all the companies for which consensus forecast were available for.
- Volatility was calculated using the historic daily share price information of each firm

5.4.1. Turnover

The regression has been modelled between the dependent variable, Turnover, and the independent variable, Market Derived Capital Pricing Model. A total of 133 observations were made for the regression. There is a negative correlation of 0.0521 between the variables and the regression produced an R^2 value of 0.0027. Table 34 below shows the details of the statistical findings of the regression analysis and the results can be described by the following equation:

Turnover = 16466400.66 - 43113789.57*(MCPM)

Table 34: Summary Statistics –Market Derived Capital Pricing Model VS Turnover

Parameter	Value	Parameter	Value
Dependent Variable	Turnover	Rows Processed	137
Independent Variable	MCPM	Rows Used in Estimation	133
Frequency Variable	None	Rows with X Missing	0
Weight Variable	None	Rows with Freq Missing	0
Intercept	16466400.66	Rows Prediction Only	4
Slope	-43113789.57	Sum of Frequencies	133
R-Squared	0.0027	Sum of Weights	133
Correlation	-0.0521	Coefficient of Variation	1.5817
Mean Square Error	5.38E+14	Square Root of MSE	2.32E+07

Figure 16 below shows a graphical representation and trend line of the regression data.

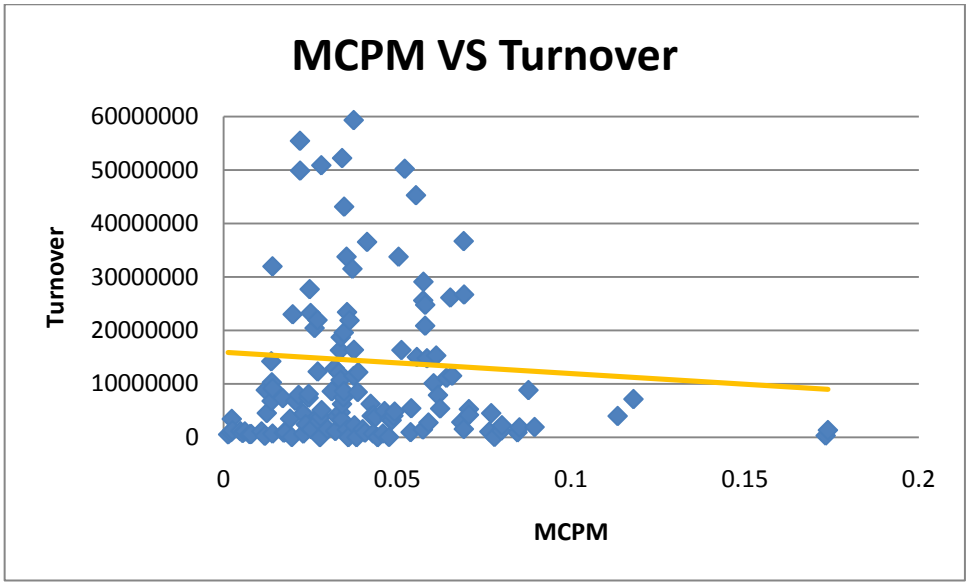

Figure 16: Scatter Plot – Market Derived Capital Pricing Model VS Turnover

The hypothesis test results show that the null hypothesis was not rejected based on the regression results and that there is not a correlation between the Turnover of a company and the Market Derived Capital Pricing Model.

Table 35: Hypothesis Results – Market Derived Capital Pricing Model VS Turnover

Parameter	Intercept B(0)	Slope B(1)
T Value	4.5393	-0.5977
Prob Level (T Test)	0	0.5511
Reject H0 (Alpha = 0.0500)	Yes	No
Power (Alpha = 0.0500)	0.9945	0.0912

5.4.2. Total Assets

The regression has been modelled between the dependent variable, Total Assets, and the independent variable, Market Derived Capital Pricing Model. A total of 135 observations were made for the regression. There is a negative correlation of 0.0200 between the variables and the regression produced an R^2 value of 0.0004. Table 36 below shows the details of the statistical findings of the regression analysis and the results can be described by the following equation:

Total Assets = 51763621.38 - 112964997.4*(MCPM)

Table 36: Summary Statistics –Market Derived Capital Pricing Model VS Total Assets

Parameter	Value	Parameter	Value
Dependent Variable	TotalAssets	Rows Processed	137
Independent Variable	MCPM	Rows Used in Estimation	135
Frequency Variable	None	Rows with X Missing	0
Weight Variable	None	Rows with Freq Missing	0
Intercept	51763621.38	Rows Prediction Only	2
Slope	-112964997.4	Sum of Frequencies	135
R-Squared	0.0004	Sum of Weights	135
Correlation	-0.0200	Coefficient of Variation	3.3416
Mean Square Error	2.47E+16	Square Root of MSE	1.57E+08

Figure 17 below shows a graphical representation and trend line of the regression data.

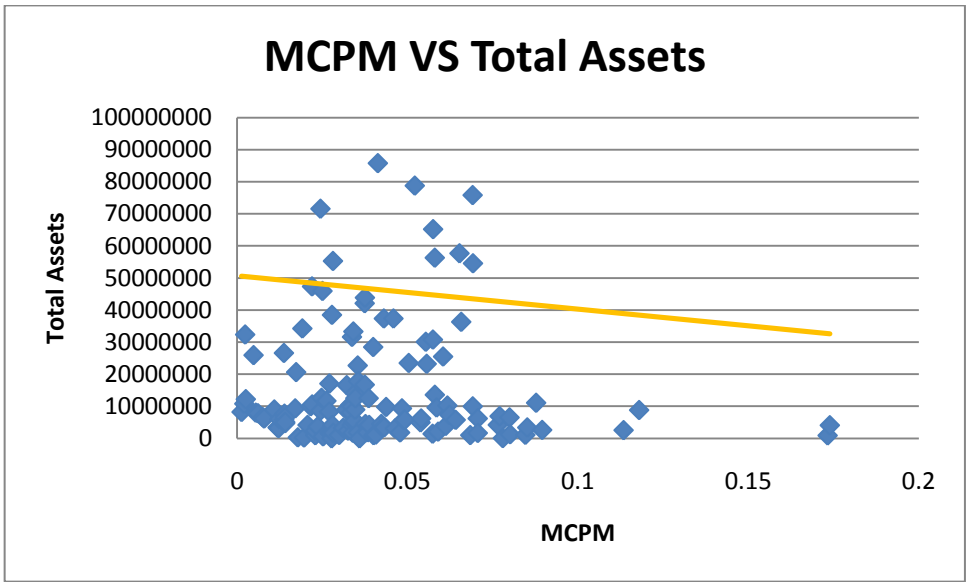

Figure 17: Scatter Plot – Market Derived Capital Pricing Model VS Total Assets

The hypothesis test results show that the null hypothesis was not rejected based on the regression results and that there is not a correlation between the Total Assets of a company and the Market Derived Capital Pricing Model

Table 37: Hypothesis Results – Market Derived Capital Pricing Model VS Total Assets

Parameter	Intercept B(0)	Slope B(1)
T Value	2.1107	-0.2311
Prob Level (T Test)	0.0367	0.8176
Reject H0 (Alpha = 0.0500)	Yes	No
Power (Alpha = 0.0500)	0.5539	0.0561

5.4.3. Market Capitalisation

The regression has been modelled between the dependent variable, Market Capitalisation, and the independent variable, Market Derived Capital Pricing Model. A total of 134 observations were made for the regression. There is a positive correlation of 0.0210 between the variables and the regression produced an R^2 value of 0.0004. Table 38 below shows the details of the statistical findings of the regression analysis and the results can be described by the following equation:

Market Capitalisation = 28241191.37 + 54216735.65*(MCPM)

Table 38: Summary Statistics –Market Derived Capital Pricing Model VS Market Capitalisation

Parameter	Value	Parameter	Value
Dependent Variable	MCap	Rows Processed	137
Independent Variable	MCPM	Rows Used in Estimation	134
Frequency Variable	None	Rows with X Missing	0
Weight Variable	None	Rows with Freq Missing	0
Intercept	28241191.37	Rows Prediction Only	3
Slope	54216735.65	Sum of Frequencies	134
R-Squared	0.0004	Sum of Weights	134
Correlation	0.0210	Coefficient of Variation	2.3569
Mean Square Error	5.17E+15	Square Root of MSE	7.19E+07

Figure 18 below shows a graphical representation and trend line of the regression data.

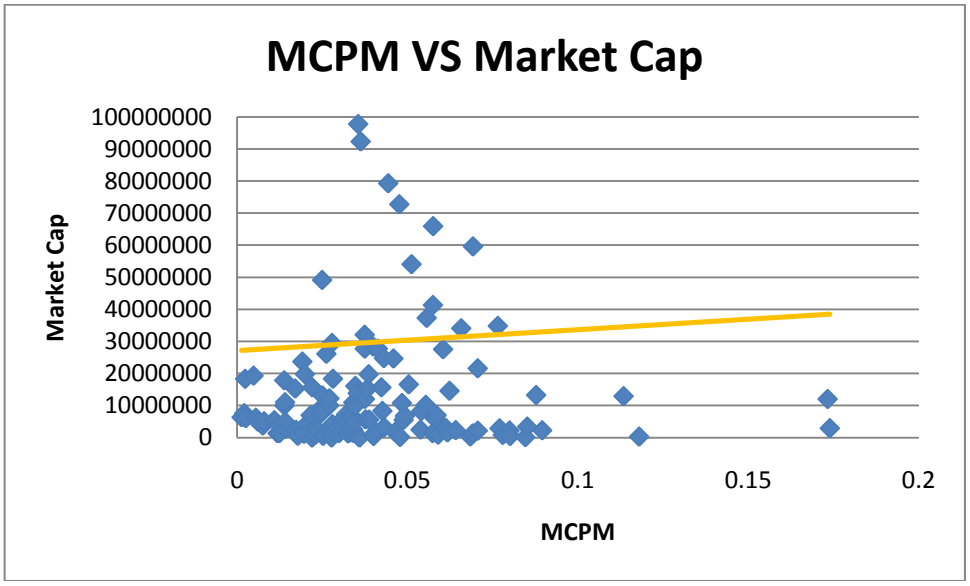

Figure 18: Scatter Plot – Market Derived Capital Pricing Model VS Market Capitalisation

The hypothesis test results show that the null hypothesis was not rejected based on the regression results and that there is not a correlation between the Market Capitalisation of a company and the Market Derived Capital Pricing Model

Table 39: Hypothesis Results – Market Derived Capital Pricing Model VS Market Capitalisation

Parameter	Intercept B(0)	Slope B(1)
T Value	2.504	0.2419
Prob Level (T Test)	0.0135	0.8092
Reject H0 (Alpha = 0.0500)	Yes	No
Power (Alpha = 0.0500)	0.7005	0.0566

5.4.4. Price to Book

The regression has been modelled between the dependent variable, Price to Book, and the independent variable, Market Derived Capital Pricing Model. A total of 133 observations were made for the regression. There is a positive correlation of 0.0474 between the variables and the regression produced an R^2 value of 0.0022. Table 40 below shows the details of the statistical findings of the regression analysis and the results can be described by the following equation:

Price to Book = 4.3316 + 32.512*(MCPM)

Table 40: Summary Statistics –Market Derived Capital Pricing Model VS Price to Book

Parameter	Value	Parameter	Value
Dependent Variable	PriceToBook	Rows Processed	137
Independent Variable	MCPM	Rows Used in Estimation	133
Frequency Variable	None	Rows with X Missing	0
Weight Variable	None	Rows with Freq Missing	0
Intercept	4.3316	Rows Prediction Only	4
Slope	32.512	Sum of Frequencies	133
R-Squared	0.0022	Sum of Weights	133
Correlation	0.0474	Coefficient of Variation	3.3437
Mean Square Error	363	Square Root of MSE	19.1

Figure 19 below shows a graphical representation and trend line of the regression data.

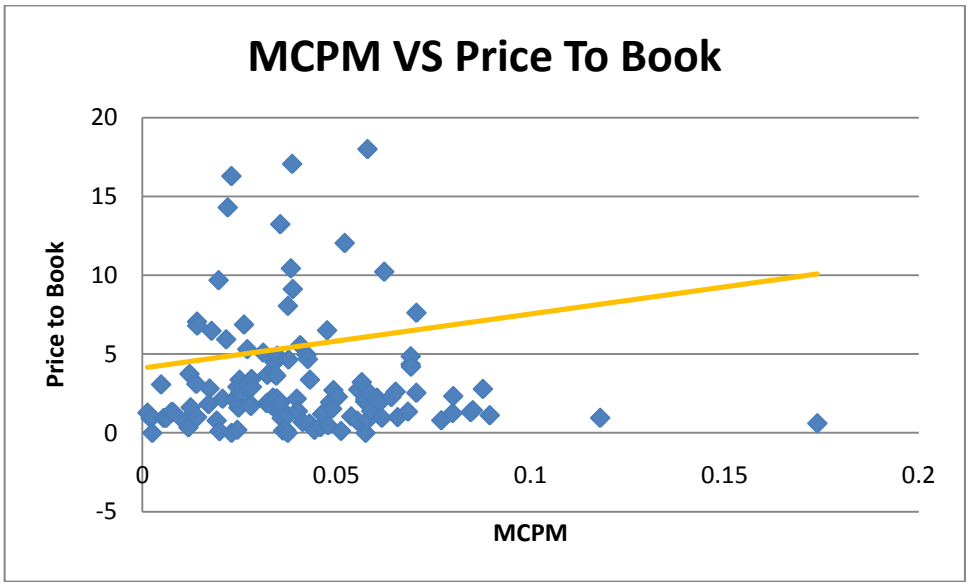

Figure 19: Scatter Plot – Market Derived Capital Pricing Model VS Price to Book

The hypothesis test results shows that the null hypothesis was not rejected based on the regression results and that there is not a correlation between the Price to Book of a company and the Market Derived Capital Pricing Model

Table 41: Hypothesis Results – Market Derived Capital Pricing Model VS Price to Book

Parameter	Intercept B(0)	Slope B(1)
T Value	1.4393	0.5434
Prob Level (T Test)	0.1525	0.5878
Reject H0 (Alpha = 0.0500)	No	No
Power (Alpha = 0.0500)	0.298	0.084

5.4.5. Altman Z Score

The regression has been modelled between the dependent variable, Z Score, and the independent variable, Market Derived Capital Pricing Model. A total of 124 observations were made for the regression. There is a positive correlation of 0.2877 between the variables and the regression produced an R^2 value of 0.0827. Table 42 below shows the details of the statistical findings of the regression analysis and the results can be described by the following equation:

Price to Book = 2.0036 + 52.2071*(MCPM)

Table 42: Summary Statistics –Market Derived Capital Pricing Model VS Z Score

Parameter	Value	Parameter	Value
Dependent Variable	ZScore	Rows Processed	137
Independent Variable	MCPM	Rows Used in Estimation	124
Frequency Variable	None	Rows with X Missing	0
Weight Variable	None	Rows with Freq Missing	0
Intercept	2.0036	Rows Prediction Only	13
Slope	52.2071	Sum of Frequencies	124
R-Squared	0.0827	Sum of Weights	124
Correlation	0.2877	Coefficient of Variation	1.1957
Mean Square Error	25.2	Square Root of MSE	5.02

Figure 20 below shows a graphical representation and trend line of the regression data.

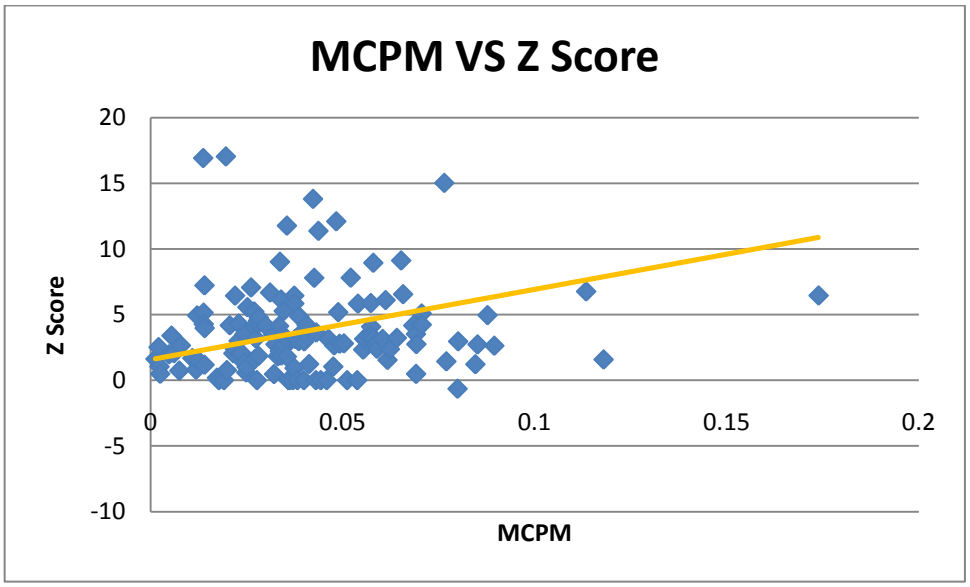

Figure 20: Scatter Plot – Market Derived Capital Pricing Model VS Z Score

The hypothesis test results show that the null hypothesis was rejected based on the regression results and that there is a correlation between the Z Score of a company and the Market Derived Capital Pricing Model

Table 43: Hypothesis Results – Market Derived Capital Pricing Model VS Z Score

Parameter	Intercept B(0)	Slope B(1)
T Value	2.4989	3.3176
Prob Level (T Test)	0.0138	0.0012
Reject H0 (Alpha = 0.0500)	Yes	Yes
Power (Alpha = 0.0500)	0.6982	0.9085

6. Discussion of Results

6.1. Implied Cost of Capital

Hypothesis 1: The null hypothesis states that all the coefficients (ICCC – Implied Cost of Capital Coefficient) of the explanatory variables are 0. The alternative hypothesis states that at least one of these coefficients is not 0. The dependant variable for the hypothesis is the risk proxies identified (Turnover, Total Assets, Total Equity, Price to Book and Altman Z Score). The explanatory variable for the hypothesis are the Implied Cost of Capital model.

H_0: $ICCC_i = 0$ for all i;

H_A: $ICCC_i \neq 0$ for at least one i

Where i = {Turnover, Total Assets, Total Equity, Price to Book and Altman Z Score };

Thus, this means that at least one of the regressions that are run between the dependent and independent variables has to be rejected in order to reject the null hypothesis. This means that anyone of the below alternate hypotheses can reject the null hypothesis:

- H_{A1}: $ICCC_{\text{Turnover}} \neq 0$; OR
- H_{A2}: $ICCC_{\text{Total Assets}} \neq 0$; OR
- H_{A3}: $ICCC_{\text{Market Capitalisation}} \neq 0$; OR
- H_{A4}: $ICCC_{\text{Price to Book}} \neq 0$; OR
- H_{A5}: $ICCC_{\text{Z Score}} \neq 0$;

6.1.1. Turnover

The null hypothesis states that the coefficient (ICCC – Implied Cost of Capital Coefficient) of the explanatory variable is 0. The alternative hypothesis states that the coefficient is not 0. The dependant variable for the hypothesis is the Turnover of a company. The explanatory variable for the hypothesis is the Implied Cost of Capital model.

H_0: $ICCC_{Turnover} = 0$

H_{A1}: $ICCC_{Turnover} \neq 0$

The results from the regression between the Turnover of a company and the Implied Cost of Capital could not reject the null hypothesis. Although there is a slight correlation, the R^2 value tells us that only 3.8% of observations could be explained and are not sufficient to reject the null hypothesis. Thus it tells us that there is no statistically significant correlation between the Turnover of a company and the Implied Cost of Capital model.

6.1.2. Total Assets

The null hypothesis states that the coefficient (ICCC – Implied Cost of Capital Coefficient) of the explanatory variable is 0. The alternative hypothesis states that the coefficient is not 0. The dependant variable for the hypothesis is the Total Assets of a company. The explanatory variable for the hypothesis is the Implied Cost of Capital model.

H_0: $ICCC_{Total\ Assets} = 0$

H_{A2}: $ICCC_{Total\ Assets} \neq 0$

The regression results show that the null hypothesis could not be rejected and that there is no existing relationship between the Total Assets of the company and the Implied Cost of Capital model. The regression could only explain 1.03% of the variations in the regression and could therefore not show that there is a statistically significant correlation between the Total Assets of a company and the Implied Cost of Capital Model.

6.1.3. Market Capitalisation

The null hypothesis states that the coefficient (ICCC – Implied Cost of Capital Coefficient) of the explanatory variable is 0. The alternative hypothesis states that the coefficient is not 0. The dependant variable for the hypothesis is the Market Capitalisation of a company. The explanatory variable for the hypothesis is the Implied Cost of Capital model.

H_0: $ICCC_{Market\ Capitalisation} = 0$

H_{A3}: $ICCC_{Market\ Capitalisation} \neq 0$

The regression results for the dependent variable Market Capitalisation was able to reject the null hypothesis. This shows that there is a statistically significant correlation between the Market Capitalisation of a company and the Implied Cost of Capital Model. Although there is a statistically significant correlation between the Market Capitalisation and the Implied Cost of Capital Model, the regression model can only explain 15.6% of the variations in the linear regression. Thus it means that although there is a correlation between the variables, they are not a very good predictor of each other.

The Implied Cost of Capital Model also has a positive correlation with the Market Capitalisation of a company. This is a surprising result though, as the literature tells us that there should be a negative correlation between the Price to Book of a company and the Cost of Capital of a company. Yet, the regression results for the Implied Cost of Capital model tell us that there is a positive correlation between the Market Capitalisation of a company and it's Implied Cost of Capital.

6.1.4. Price to Book

The null hypothesis states that the coefficient (ICCC – Implied Cost of Capital Coefficient) of the explanatory variable is 0. The alternative hypothesis states that the coefficient is not 0. The dependant variable for the hypothesis is the Price to Book of a company. The explanatory variable for the hypothesis is the Implied Cost of Capital model.

H_0: $ICCC_{Price\ to\ Book} = 0$

H_{A4}: $ICCC_{Price\ to\ Book} \neq 0$

The regression analysis for the dependent variable, Price to Book, and the independent variable, Implied Cost of Capital, has rejected the null hypothesis. This means that there is a statistically significant correlation between the Price to Book of a company and its Implied Cost of Capital. However, although the regression model could reject the null hypothesis, it still only explains 35.6% of the variation of the linear regression.

There is also a positive correlation between the Price to Book of a company and the Implied Cost of Capital Model. Although this is still able to reject the null hypothesis, it is in strong contradiction of the literature which tells us the correlation should be negative.

6.1.5. Altman Z Score

The null hypothesis states that the coefficient (ICCC – Implied Cost of Capital Coefficient) of the explanatory variable is 0. The alternative hypothesis states that the coefficient is not 0. The dependant variable for the hypothesis is the Z Score of a company. The explanatory variable for the hypothesis is the Implied Cost of Capital model.

H_0: $ICCC_{Z\ Score} = 0$

H_{A5}: $ICCC_{Z\ Score} \neq 0$

The regression analysis of the dependent variable, Z Score, and the independent variable, Implied Cost of Capital, was able to reject the null hypothesis. This shows that there is a statistically significant correlation between the Z Score and the Implied Cost of Capital Model. The linear regression does not however explain a lot of the variation of the variables and are there for not a very good predictor of the variables.

6.1.6. Summary Results and Hypothesis Conclusion

Table 44 below shows a summary result of the regression results between the risk proxies and the Implied Beta Coefficient. All of the hypotheses have rejected the null hypothesis except for the Turnover and Total Assets of a company. This means that the null hypothesis is rejected for the Implied Beta Coefficient and there is a statistically significant correlation between risk and the Implied Beta Coefficient.

Table 44: Summary Results – Implied Cost of Capital

	Correlation	R-Square	H0
Turnover	-0.0617	0.0038	Not Rejected
Total Assets	-0.1013	0.0103	Not Rejected
Market Cap	0.3945	0.1556	Rejected
Price To Book	0.5945	0.3535	Rejected
Z Score	0.4649	0.2161	Rejected

Thus the results show that there is a correlation between risk and the Implied Cost of Capital Model. The concerning point is the number of variations that are explained by the regressions. This is represented by the R Squared values which are fairly low and lower than expected. However, it is important to acknowledge that there are many other factors driving value and return I companies that has nothing to do with the variables that indicate risk. It also has to do with how well companies that are more risky mitigate those risks.

The other interesting finding was the positive correlation of both the Price to Book and Market Capitalisation and the Implied Cost of Capital Model. The literature suggests that larger companies have less risk that smaller companies and there would thus be a negative correlation. The same applies for the Price to Book ratio of a company. Smaller price to Book ratios are seen as more risky investments and would therefore have a negative correlation with the Cost of Capital of the company.

Since the cornerstone of the Implied Cost of Capital Model is the analysts forecasts used in the implicit forecasting of earnings, the question comes to how accurate and realistic those forecasts are? The regression analysis data suggests that although there is a correlation with risk, the correlation is inversely related to the expected correlation based on the literature.

6.2.Implied Beta

Hypothesis 2: The null hypothesis states that all the coefficients (IBC – Implied Beta Coefficient) of the explanatory variables are 0. The alternative hypothesis states that at least one of these coefficients is not 0. The dependant variable for the hypothesis is the risk proxies identified (Turnover, Total Assets, Total Equity, Price to Book and Altman Z Score). The explanatory variable for the hypothesis are the Implied Beta Cost of Capital model.

H_0: $IBC_i = 0$ for all i;

H_A: $IBC_i \neq 0$ for at least one i

Where i = {Turnover, Total Assets, Total Equity, Price to Book and Altman Z Score };

Thus, this means that at least one of the regressions that are run between the dependent and independent variables has to be rejected in order to reject the null hypothesis. This means that anyone of the below alternate hypotheses can reject the null hypothesis:

- H_{A1}: $IBC_{\text{Turnover}} \neq 0$; OR
- H_{A2}: $IBC_{\text{Total Assets}} \neq 0$; OR
- H_{A3}: $IBC_{\text{Market Capitalisation}} \neq 0$; OR
- H_{A4}: $IBC_{\text{Price to Book}} \neq 0$; OR
- H_{A5}: $IBC_{\text{Z Score}} \neq 0$; OR

6.2.1. Turnover

The null hypothesis states that the coefficient (IBC – Implied Beta Coefficient) of the explanatory variable is 0. The alternative hypothesis states that the coefficients is not 0. The dependant variable for the hypothesis is Turnover. The explanatory variable for the hypothesis are the Implied Beta model.

H_0: $IBC_{Turnover} = 0$

H_{A1}: $IBC_{Turnover} \neq 0$

The results from the regression between the Turnover of a company and its Implied Beta Coefficient could not reject the null hypothesis. That means that there is no correlation that is statistically significant between the Turnover of a company and its Implied Beta Coefficient. The regression model was also only able to explain 0.14% of observations made.

6.2.2. Total Assets

The null hypothesis states that the coefficient (IBC – Implied Beta Coefficient) of the explanatory variable is 0. The alternative hypothesis states that the coefficients is not 0. The dependant variable for the hypothesis is Total Assets. The explanatory variable for the hypothesis is the Implied Beta model.

H_0: $IBC_{Total\ Assets} = 0$

H_{A2}: $IBC_{Total\ Assets} \neq 0$

The regression analysis between the total Assets of a company and its Implied Beta Coefficient could not reject the null hypothesis. This means that there is no statistically significant correlation between the Total Assets of a company and the Implied Bet Coefficient. This is supported by the fact that the R^2 value for the regression is 0.05% meaning only 0.05% of observations could be explained.

6.2.3. Market Capitalisation

The null hypothesis states that the coefficient (IBC – Implied Beta Coefficient) of the explanatory variable is 0. The alternative hypothesis states that the coefficients is not 0. The dependant variable for the hypothesis is Market Capitalisation. The explanatory variable for the hypothesis is the Implied Beta model.

H_0: $IBC_{Market\ Capitalisation} = 0$

H_{A3}: $IBC_{Market\ Capitalisation} \neq 0$

The regression analysis between the Market Capitalisation of a company and the Implied Beta Coefficient was able to reject the null hypothesis. This means that there is a statistically significant relationship between the Market Capitalisation of a company and the Implied Beta of the company. It is important to note that although there is a statistically significant relationship between the variables, the regression model can only explain 2.86% of the variance of the observations. This shows us that although the correlation exists, the linear relationship equation is not a very good predictor of the variables.

6.2.4. Price to Book

The null hypothesis states that the coefficient (IBC – Implied Beta Coefficient) of the explanatory variable is 0. The alternative hypothesis states that the coefficients is not 0. The dependant variable for the hypothesis is Price to Book. The explanatory variable for the hypothesis are the Implied Beta model.

H_0: H_{A4}: $IBC_{Price\ to\ Book} = 0$

H_{A4}: $IBC_{Price\ to\ Book} \neq 0$

The regression analysis between the Price to Book of a company and the Implied Beta Coefficient was able to reject the null hypothesis. This shows that there is a statistically significant correlation between the Price to Book of a company and the Implied Beta Coefficient. However, although there is a correlation that is explained statistically, the linear regression equation is not a good predictor of the variables as it can only explain 2.3% of the variations.

6.2.5. Altman Z Score

The null hypothesis states that the coefficient (IBC – Implied Beta Coefficient) of the explanatory variable is 0. The alternative hypothesis states that the coefficients is not 0. The dependant variable for the hypothesis is Z Score. The explanatory variable for the hypothesis are the Implied Beta model.

H_0: $IBC_{Z\ Score} = 0$

H_{A5}: $IBC_{Z\ Score} \neq 0$

The regression model between the Z Score of a company and the Implied Beta Coefficient was not able to reject the alternative hypothesis. This means that there is no statistically significant correlation between the Z Score and the Implied Beta Coefficient.

6.2.6. Summary Results and Hypothesis Conclusion

Table 45 below shows a summary result of the regression results between the risk proxies and the Implied Beta Coefficient. Only the regression with the Market Capitalisation of a company and the Price to book of a company was able to reject the null hypothesis. This means that the null hypothesis is rejected for the Implied Beta Coefficient and there is a statistically significant correlation between risk and the Implied Beta Coefficient.

Table 45: Summary Results – Implied Beta

	Correlation	R-Square	H0
Turnover	0.0368	0.0014	Not Rejected
Total Assets	-0.0234	0.0005	Not Rejected
Market Cap	0.1692	0.0286	Rejected
Price To Book	-0.1516	0.023	Rejected
Z Score	0.0140	0.0002	Not Rejected

However, it is important to note that although the hypothesis test rejected the null hypothesis for Market Capitalisation and Price to Book respectively, the regression models was not able to explain the variation of the variables very accurately.

It is difficult to make inferences to the relationship between the size of a company and the expected return. Size is represented by Turnover, Total Assets and Market Capitalisation but only Market Capitalisation was able to reject the null hypothesis. This leaves the question of whether or not the other 2 variables are a valid representation of size of a company. Using the Implied Beta Coefficient as an indicator thereof, one would have to say that Turnover and Total Assets does not reflect the Size and risk of a firm as well as Market Capitalisation and therefore is not such a good predictor of future returns.

6.3.Three Factor Pricing Model

Hypothesis 3: The null hypothesis states that all the coefficients (TFPMC – Three Factor Pricing Model Coefficient) of the explanatory variables are 0. The alternative hypothesis states that at least one of these coefficients is not 0. The dependant variable for the hypothesis is the risk proxies identified (Turnover, Total Assets, Total Equity, Price to Book and Altman Z Score). The explanatory variable for the hypothesis are the Three Factor Pricing Model.

H_0: $TFPMC_i = 0$ for all i;

H_A: $TFPMC_i \neq 0$ for at least one i

Where i = {Turnover, Total Assets, Total Equity, Price to Book and Altman Z Score };

Thus, this means that at least one of the regressions that are run between the dependent and independent variables has to be rejected in order to reject the null hypothesis. This means that anyone of the below alternate hypotheses can reject the null hypothesis:

- H_{A1}: $TFPMC_{Turnover} \neq 0$; OR
- H_{A2}: $TFPMC_{Total\ Assets} \neq 0$; OR
- H_{A3}: $TFPMC_{Market\ Capitalisation} \neq 0$; OR
- H_{A4}: $TFPMC_{Price\ to\ Book} \neq 0$; OR
- H_{A5}: $TFPMC_{Z\ Score} \neq 0$;

6.3.1. Turnover

The null hypothesis states that the coefficient (TFPMC – Three Factor Pricing Model Coefficient) of the explanatory variable is 0. The alternative hypothesis states that the coefficient is not 0. The

dependant variable for the hypothesis is the Turnover. The explanatory variable for the hypothesis is the Three Factor Pricing Model.

H_0: $TFPMC_{Turnover} = 0$

H_{A1}: $TFPMC_{Turnover} \neq 0$

The regression results between the Turnover of a company and the Three Factor Pricing Model was able to reject the null hypothesis. This means that there is a statistically significant correlation between the Turnover of a company and the Three Factor Pricing Model. The correlation is negative which is in line with the expectations formed by the literature. The linear regression model can however only explain 20.3% of the variations which does not make the linear regression equation a good predictor of the variables itself.

6.3.2. Total Assets

The null hypothesis states that the coefficient (TFPMC – Three Factor Pricing Model Coefficient) of the explanatory variable is 0. The alternative hypothesis states that the coefficient is not 0. The dependant variable for the hypothesis is the Total Assets. The explanatory variable for the hypothesis are the Three Factor Pricing Model.

H_0: $TFPMC_{Total\ Assets} = 0$

H_{A2}: $TFPMC_{Total\ Assets} \neq 0$

The regression results between the Total Assets of a company and the Three Factor Pricing Model was not able to reject the null hypothesis. This means that there is not a statistically significant correlation between the Total Assets of a company and the Three Factor Pricing Model.

6.3.3. Market Capitalisation

The null hypothesis states that the coefficient (TFPMC – Three Factor Pricing Model Coefficient) of the explanatory variable is 0. The alternative hypothesis states that the coefficient is not 0. The dependant variable for the hypothesis is the Market Capitalisation. The explanatory variable for the hypothesis are the Three Factor Pricing Model.

H_0: $TFPMC_{Market\ Capitalisation} = 0$

H_{A3}: $TFPMC_{Market\ Capitalisation} \neq 0$

The regression results between the Market Capitalisation of a company and the Three Factor Pricing Model was able to reject the null hypothesis. This means that there is a statistically significant correlation between the Market Capitalisation of a company and the Three Factor Pricing Model. The correlation is negative which is in line with the expectations formed by the literature. The linear regression model can however only explain 21.67% of the variations which does not make the linear regression equation a good predictor of the variables itself.

6.3.4. Price to Book

The null hypothesis states that the coefficient (TFPMC – Three Factor Pricing Model Coefficient) of the explanatory variable is 0. The alternative hypothesis states that the coefficient is not 0. The dependant variable for the hypothesis is the Price to Book. The explanatory variable for the hypothesis are the Three Factor Pricing Model.

H_0: $TFPMC_{Price\ to\ Book} = 0$

H_{A4}: $TFPMC_{Price\ to\ Book} \neq 0$

The regression results between the Price to Book of a company and the Three Factor Pricing Model was able to reject the null hypothesis. This means that there is a statistically significant correlation between the Price to Book of a company and the Three Factor Pricing Model. The correlation is negative which is in line with the expectations formed by the literature. The linear regression model can however only explain 7.83% of the variations which does not make the linear regression equation a good predictor of the variables itself.

6.3.5. Altman Z Score

The null hypothesis states that the coefficient (TFPMC – Three Factor Pricing Model Coefficient) of the explanatory variable is 0. The alternative hypothesis states that the coefficient is not 0. The dependant variable for the hypothesis is the Z Score. The explanatory variable for the hypothesis are the Three Factor Pricing Model.

H_0: $TFPMC_{Z\ Score} = 0$

H_{A5}: $TFPMC_{Z\ Score} \neq 0$

The regression results between the Z Score of a company and the Three Factor Pricing Model was not able to reject the null hypothesis. This means that there is not a statistically significant correlation between the Z Score of a company and the Three Factor Pricing Model.

6.3.6. Summary Results and Hypothesis Conclusion

Table 46 below shows a summary result of the regression results between the risk proxies and the Implied Beta Coefficient. All of the null hypotheses were rejected except for the Total Assets and Z Score Hypotheses. This means that the null hypothesis for the Three Factor Pricing Model is rejected and that there is a statistically significant correlation between the risk of a company and the Three Factor Pricing Model.

Table 46: Summary Results – Three Factor Pricing Model

	Correlation	R-Square	H0
Turnover	-0.4508	0.2032	Rejected
Total Assets	-0.1487	0.0221	Not Rejected
Market Cap	-0.4655	0.2167	Rejected
Price To Book	-0.2798	0.0783	Rejected
Z Score	-0.0805	0.0065	Not Rejected

Although the results show that there is a correlation between the risk of a firm and the Three Factor Pricing Model, it is important to note that not a lot of the variation in the regression is explained. This value which is represented by the R^2 value shows that at best only 21.67% of the variation is explained through the regressions.

All of the correlations where the null hypothesis has been rejected do perform has expected and the Three Factor pricing Model thus provides a good predictor for expected return on investments.

6.4.Market Derived Capital Pricing Model

Hypothesis 4: The null hypothesis states that all the coefficients (MDCPC – Market Derived Capital Pricing Model) of the explanatory variables are 0. The alternative hypothesis states that at least one of these coefficients is not 0. The dependant variable for the hypothesis is the risk proxies identified (Turnover, Total Assets, Total Equity, Price to Book and Altman Z Score). The explanatory variable for the hypothesis are the Market Derived Capital Pricing Model.

H_0: $MDCPM_i = 0$ for all i;

H_A: $MDCPM_i \neq 0$ for at least one i

Where i = {Turnover, Total Assets, Total Equity, Price to Book and Altman Z Score };

Thus, this means that at least one of the regressions that are run between the dependent and independent variables has to be rejected in order to reject the null hypothesis. This means that anyone of the below alternate hypotheses can reject the null hypothesis:

- H_{A1}: $MDCPM_{Turnover} \neq 0$; OR
- H_{A2}: $MDCPM_{Total\ Assets} \neq 0$; OR
- H_{A3}: $MDCPM_{Market\ Capitalisation} \neq 0$; OR
- H_{A4}: $MDCPM_{Price\ to\ Book} \neq 0$; OR
- H_{A5}: $MDCPM_{Z\ Score} \neq 0$;

6.4.1. Turnover

The null hypothesis state that the coefficient (MDCPC – Market Derived Capital Pricing Model) of the explanatory variable is 0. The alternative hypothesis states that the coefficient is not 0. The

dependant variable for the hypothesis is the Turnover. The explanatory variable for the hypothesis are the Market Derived Capital Pricing Model.

H_0: MDCPM $_{Turnover} = 0$

H_{A1}: MDCPM $_{Turnover} \neq 0$

The results from the regression between the Turnover of a company and the Market Derived Capital Pricing Model were not able to reject the null hypothesis. This means that there is not a statistically significant correlation between the Turnover of a company and the Market Derived Capital Pricing Model.

6.4.2. Total Assets

The null hypothesis state that the coefficient (MDCPC – Market Derived Capital Pricing Model) of the explanatory variable is 0. The alternative hypothesis states that the coefficient is not 0. The dependant variable for the hypothesis is the Total Assets. The explanatory variable for the hypothesis are the Market Derived Capital Pricing Model.

H_0: MDCPM $_{Total\ Assets} = 0$

H_{A2}: MDCPM $_{Total\ Assets} \neq 0$

The results from the regression between the Total Assets of a company and the Market Derived Capital Pricing Model were not able to reject the null hypothesis. This means that there is not a statistically significant correlation between the Total Assets of a company and the Market Derived Capital Pricing Model.

6.4.3. Market Capitalisation

The null hypothesis state that the coefficient (MDCPC – Market Derived Capital Pricing Model) of the explanatory variable is 0. The alternative hypothesis states that the coefficient is not 0. The dependant variable for the hypothesis is the Market Capitalisation. The explanatory variable for the hypothesis is the Market Derived Capital Pricing Model.

H_0: MDCPM $_{\text{Market Capitalisation}} = 0$

H_{A3}: MDCPM $_{\text{Market Capitalisation}} \neq 0$

The results from the regression between the Market Capitalisation of a company and the Market Derived Capital Pricing Model were not able to reject the null hypothesis. This means that there is not a statistically significant correlation between the Market Capitalisation of a company and the Market Derived Capital Pricing Model.

6.4.4. Price to Book

The null hypothesis state that the coefficient (MDCPC – Market Derived Capital Pricing Model) of the explanatory variable is 0. The alternative hypothesis states that the coefficient is not 0. The dependant variable for the hypothesis is the Price to Book. The explanatory variable for the hypothesis is the Market Derived Capital Pricing Model.

H_0: MDCPM $_{\text{Price to Book}} = 0$

H_{A4}: MDCPM $_{\text{Price to Book}} \neq 0$

The results from the regression between the Price to Book of a company and the Market Derived Capital Pricing Model were not able to reject the null hypothesis. This means that there is not a statistically significant correlation between the Price to Book of a company and the Market Derived Capital Pricing Model.

6.4.5. Altman Z Score

The null hypothesis state that the coefficient (MDCPC – Market Derived Capital Pricing Model) of the explanatory variable is 0. The alternative hypothesis states that the coefficient is not 0. The dependant variable for the hypothesis is the Z Score. The explanatory variable for the hypothesis is the Market Derived Capital Pricing Model.

H_0: MDCPM $_{Z\ Score} = 0$

H_{A5}: MDCPM $_{Z\ Score} \neq 0$

The results from the regression between the Z Score of a company and the Market Derived Capital Pricing Model were able to reject the null hypothesis. This means that there is a statistically significant correlation between the Z Score of a company and the Market Derived Capital Pricing Model. However, it is important to note that although the null hypothesis is rejected, the regression model only explains 8.27% of the variation and would not be a very good predictor of the variables.

6.4.6. Summary Results and Hypothesis Conclusion

Table 47 below shows a summary result of the regression results between the risk proxies and the Implied Beta Coefficient. Only the Z Score was able to reject the null hypothesis. Thus, the null hypothesis for the Market Derived Capital Pricing Model is rejected and there is a statistically significant correlation between risk and the Market Derived Capital Pricing Model.

Table 47: Summary Results – Market Derived Capital Pricing Model

	Correlation	R-Square	H0
Turnover	-0.0521	0.0027	Not Rejected
Total Assets	0.0004	-0.0200	Not Rejected
Market Cap	0.0210	0.0004	Not Rejected
Price To Book	0.0474	0.0022	Not Rejected
Z Score	0.2877	0.0827	Rejected

Although the null hypothesis is rejected for the Market Derived Capital Pricing Model, it is important to note that the regression cannot explain the variation of the observations very accurately.

7. Conclusion

Table 48 bellow shows the relationship between the risk proxies and the Cost of Capital models evaluated. Table 49 indicates where a Hypothesis was rejected, the specific R^2 value of the hypothesis. Table 50 shows where the null hypothesis was rejected the correlation coefficient for the model.

Table 48: Consolidated Results – Hypothesis Results

	Implied Cost of Capital	Implied Beta	Three Factor Pricing Model	Market Derived Capital Pricing
Turnover	Not Rejected	Not Rejected	Rejected	Not Rejected
Total Assets	Not Rejected	Not Rejected	Not Rejected	Not Rejected
Market Cap	Rejected	Rejected	Rejected	Not Rejected
Price To Book	Rejected	Rejected	Rejected	Not Rejected
Z Score	Rejected	Not Rejected	Not Rejected	Rejected

Table 49: Consolidated Results – R^2

	Implied Cost of Capital	Implied Beta	Three Factor Pricing Model	Market Derived Capital Pricing
Turnover	Not Rejected	Not Rejected	0.2032	Not Rejected
Total Assets	Not Rejected	Not Rejected	Not Rejected	Not Rejected
Market Cap	0.1556	0.0286	0.2167	Not Rejected
Price To Book	0.3535	0.023	0.0783	Not Rejected
Z Score	0.2161	Not Rejected	Not Rejected	0.0827

Table 50: Consolidated Results – Correlation

	Implied Cost of Capital	Implied Beta	Three Factor Pricing Model	Market Derived Capital Pricing
Turnover	Not Rejected	Not Rejected	-0.4508	Not Rejected
Total Assets	Not Rejected	Not Rejected	Not Rejected	Not Rejected
Market Cap	0.3945	0.1692	-0.4655	Not Rejected
Price To Book	0.5945	-0.1516	-0.2798	Not Rejected
Z Score	0.4649	Not Rejected	Not Rejected	0.2877

7.1.Assessment of Risk Measures

There does not seem to be a very strong correlation with company size as a proxy for risk. Size has been defined through 3 proxies, namely: 1) Turnover, 2) Total Assets and 3) Market Capitalisation. Based on the statistical results obtained, it is only Market Capitalisation that consistently shows a correlation with Cost of Capital. However, only when applied with the Three Factor Pricing Model does it produce a negative correlation as expected through the literature. This now leaves the following question: Is Turnover, Total Assets and Market Capitalisation a true representation of firm size and through this, a valid representation of risk? The literature states that all the variables have been proven to be a valid representation of risk. The conclusion that we are forced to draw is that Cost of Capital is not explained by the size of a company.

When we look at the results of Market Capitalisation and Price to Book as risk proxies, they seem to produce the best results when we look at the R^2 values as described in Table 49. But again, when we look at the correlation between the two variables and each of the Cost of Capital models, they appear to be inconsistent. Neither one of the two variables can consistently provide a negative or positive correlation with the Cost of Capital models. The literature is very unwavering on the fact that the correlations should be negative. That leaves us to conclude that where the variables are positively correlated, they do not capture the ex ante outlook of risk and return.

Another conclusion that can be drawn is that a company's return is not the result of the risk that it's exposed to, but rather how well the company is able to mitigate the risk that it takes on and turn the risk into value.

7.2.Assessment of Cost of Capital Models

This leaves us to conclude that the Three Factor Pricing Model is the capital pricing model that is best to capture the ex ante outlook of risk and return. The null hypothesis was rejected for the Turnover, Market Capitalisation and Price to Book risk proxies. Turnover is negatively correlated with return as expected. Market capitalisation is negatively correlated with return as expected. Price to book is negatively correlated with return as expected. It does also seem that size is better for explaining expected returns in the model than the Price to Book of the firm. It is also important to note that there is some bias in the Three Factor Pricing Model, as two of the factors used in the model, also appears in the risk measures against which it is evaluated.

Although the Three Factor Pricing Model coefficients calculated explains only 30.7% of the variances, this research has shown that there is sufficient evidence that the model is a viable option for calculating the ex ante Cost of Capital of a company. In search of a Three Factor Pricing Model that will explain more than 30.7% of the variance, we are left with two options for further research in this field:

The first option is to investigate how a more accurate coefficient can be calculated by further investigating the process in which the coefficients are calculated. This can be done by: A) Looking at a longer sample period than the 5 years monthly returns which were used in this study. B) Investigating longer portfolio periods than the 6 month Small Minus Big and High Minus Low portfolio calculations that were is in this study. C) Investigating the Three Factor Pricing Model for different sectors of the JSE. D) Making use of any combination of the above mentioned changes to calculating the coefficients.

The second option is to research the use of the factors that is used to explain the expected returns of a company. This can be done by either identifying alternative factors to the Small Minus Big and High Minus Low factors used in this study or by identifying additional factors that can expand on the Three Factor Pricing Model to a Multiple Factor Pricing Model. Additional factors that can be considered include Price Earnings Ratio used by Lam and Li (2008) or a momentum factors applied by He, Huh and Lee (2010)

The Implied Cost of Capital Model is a close second best model in terms of explaining expected returns. Although the literature tells us that the correlation of Market Capitalisation and Price to Book should be negatively correlated, the model has produced some strong findings with independent variables in which it is measured. The conclusion here is that it may not be a good ex ante model of Cost of Capital, but provides some strong evidence that there is a correlation with risk proxies and that the model requires further attention to derive whether it is a more accurate model than what is being currently used today.

The Market Derived Capital Pricing Model can be argued to have provided the worst evidence of being correlated with risk. It has no statistically significant correlation with Turnover, Total Assets, Market Capitalisation or Price to Book. The only correlation it does provide is with the Z Score. The conclusion here is that the Market Derived Capital Pricing Model needs some addition research or validation before it can be accepted as an ex ante Cost of Capital model. However, all the other capital pricing models support their authors claims of being an ex ante predictor of risk and return.

7.3.Application for the Industry

The use of an ex ante Cost of Capital model has a lot of application in the investment finance industry. The models used and analysed in this research provides the investment finance industry with a better understanding of what explains returns and what does not. This will assist in making more informed investment decisions and narrowing down investment opportunities to form higher yielding portfolios.

I do not believe that any of the models will replace the controversial Capital Asset Pricing Model any time soon. Although the CAPM model does also not provide a correlation with risk, it is so widely used and taught, that replacing it with a better model will require extensive research and very string results from such research to persuade such a large industry to convert. However, the models discussed in this research can provide a "second opinion" assessment of what an ex ante outlook will look like for a specific company that requires to be valued.

8. References

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