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# **Gordon Institute of Business Science**

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**AN APPLICATION OF MONTIER'S C-SCORE TO THE JOHANNESBURG  
SECURITIES EXCHANGE:  
A TOOL FOR SHORT SELLING**

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## ABSTRACT

One of the assumptions upon which modern portfolio theory is based is the efficient market hypothesis which postulates that market prices fully reflect all available information, which implies that an abnormal return cannot be made. Evidence has amassed in contradiction to the efficient market hypothesis as demonstrated by Jegadeesh and Titman (1993); Mohanram (2005); Montier (2009) and Piotroski, (2000). However these studies demonstrated earning an abnormal return by buying an asset as opposed to selling an asset. Evidence by Altman (2000) and Beneish, Lee and Nichols (2013) affirmed that abnormal returns may be earned by selling a declining asset. There has been no published work conducted on the South African market pertaining to an instrument that may be used to detect a decline in share price due to prior earnings manipulation, thereby providing the scope of this research.

In recent years the focus of the discipline of asset pricing has shifted away from theoretical modelling towards empirical analysis. The C-score by Montier (2008) is a binary earnings manipulation detection model, designed to identify stocks that may be shorted for an abnormal return. An exploratory study of stocks on the Johannesburg Stock Exchange (JSE) from 2002 to 2010 was conducted. Vital focus areas included the resources and industrials sector.

Results of this research prove that C-score is insufficient as a stand-alone tool for detecting shortable stocks on the JSE. Whilst negative relative returns were earned for certain holding periods of certain sectors, a consistent trend could not be isolated.

### ***Key Words***

***Earnings manipulation, C-score, Short selling***

## DECLARATION

I declare that this research project is my own work. It is submitted in partial fulfilment of the requirements for 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.



Dr Yushavia Govender

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# CHAPTER 1: INTRODUCTION TO THE RESEARCH PROBLEM

## 1.1 RESEARCH TITLE

An application of Montier's C-score to the Johannesburg Securities Exchange (JSE): A tool for short selling.

## 1.2 RESEARCH PROBLEM

Modern portfolio theory is an investment framework for the selection and construction of investment portfolios, based on maximizing the expected returns of the portfolio and minimizing the investment risk (Fabozzi, Gupta & Markowitz, 2002). One of the assumptions upon which modern portfolio theory is based is that markets are perfectly efficient (Mangram, 2013). An efficient market as defined by the Efficient Market Hypothesis (EMH) is one in which prices provide accurate signals for resource allocation because it can be assumed that security prices at any time "fully reflect" all available information (Fama, 1970). A considerable amount of literature has been developed that challenges the notion of efficiency, demonstrating that abnormal returns are available to investors with information advantages (Giroux, 2008; Jegadeesh & Titman, 1993; Lamont, 2004; Mangram, 2013; Montier, 2008; Hancock & Seng, 2012). Whilst the bulk of this literature (Jegadeesh & Titman, 1993; Montier, 2009; Piotroski, 2000) seeks to capture abnormal returns by buying mispriced (undervalued) assets, it is equally possible to capture abnormal returns by selling mispriced (overpriced) assets (Altman, 1968; Altman, 2000; Beneish, Lee & Nichols, 2013; Montier, 2008). Notably, this second avenue for capturing inefficiencies is relatively underexplored, providing fertile ground to further examine the efficient market hypothesis.

Various tools have been developed to identify shortable stocks such as the Z-score by Altman (1968), the Zeta credit risk model (Altman, Halderman & Narayanan, 1977) and a model called "Z" which is a revised version of the Z-score (Altman, 2000, p.3).

The Z-score is a discriminant-ratio model that is able predict bankruptcy up to two years prior to failure, the sample however was limited to publicly listed manufacturing corporations (Altman, 1968). The ZETA model was developed by Altman, Halderman and Narayanan (1977) and it displayed bankruptcy prediction accuracy ranging from over 96% for one period

prior to bankruptcy, to 70% for five annual reporting periods prior (Altman, 2000, p.50). Both the Z-score and Zeta models were revised by Altman (2000) to produce the Z model which extended “tests and findings to include application to firms not traded publicly, to non-manufacturing entities, and also refer to a new bond-rating equivalent model for emerging markets corporate bonds” (Altman, 2000, p.2).

The M-score by Beneish (1999) is a “model for detecting earnings’ manipulation using sample manipulators and industry-matched firms in the period 1982-1988 and evaluate the model's performance on a holdout sample in the period 1989-1992. The model distinguishes manipulators from non-manipulators, and has pseudo-R<sup>2</sup>s of 30.6% and 37.1% for two different estimation methods” (p.4). The model was later used by Beneish, Lee and Nichols (2013) to predict lower earnings by companies with high M-scores and it was found to be successful.

The F-score by Piotroski (2000) is a fundamental analysis strategy that, when applied to a broad portfolio of high book to market firms, allows the investor to identify winner and loser stocks, whereby the investor can buy winner stocks and short loser stocks. “This strategy yielded a 23% return over the time period 1976-1996” (Piotroski, 2000, p.1).

The G-score by Mohanram (2005) is derived from the F-Score (Piotroski, 2001) but is designed to separate winner and loser stocks amongst low book to market firms using fundamental analysis.

More recently, the C-score designed by James Montier (2008) is another tool for identifying shortable stocks. The “C” stands for ‘cooking the books’, and the C-score is considered to be the first step in analysing whether or not companies may be manipulating their earnings (Montier, 2008. P.1). The rationale of the C-score is that executives in control of companies with “high flying stocks may be tempted to ‘cheat’ to maintain their status” (Montier, 2008. p.1).

### **1.3 RESEARCH AIMS**

Montier (2008) evidenced that the C-score, in combination with the price to sales ratio, yielded a negative absolute return of 4% per annum in the United States and Europe.

The aim of this research is to investigate the efficacy of the C-score to identify stocks on the JSE that may be guilty of earnings' manipulation and can therefore be shorted to earn an abnormal return. Additionally, this research aims to provide investors with additional information pertaining to stock selection.

## CHAPTER 2: LITERATURE REVIEW

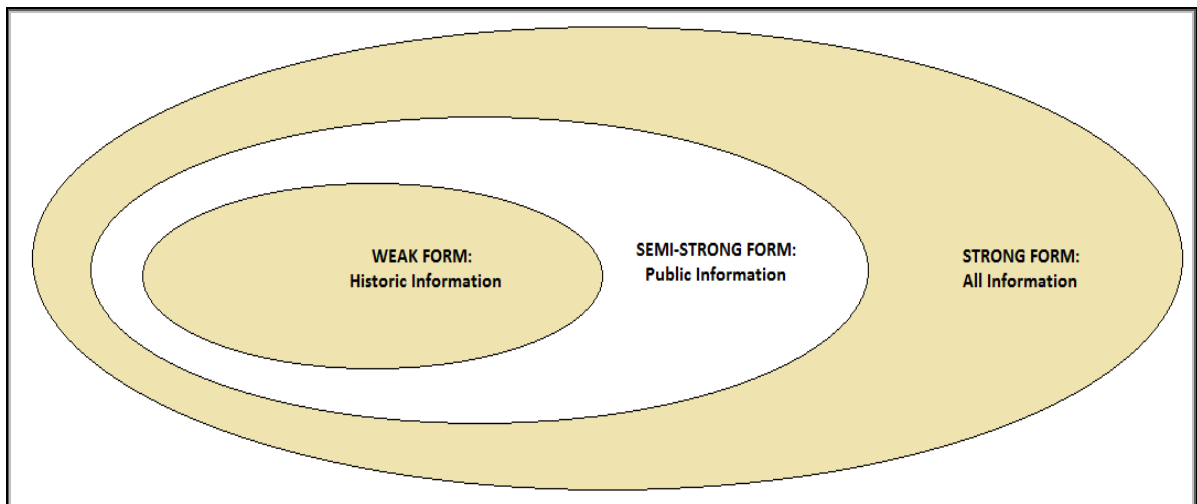
### 2.1 INTRODUCTION

The aim of this research was to determine whether the C-score can identify earnings' manipulation on the JSE, such that these stocks may be shorted to earn an abnormal return. The literature review that follows includes evidence in support of the C-score and short selling as an investment strategy. The effect on traditional finance theory pertaining to the EMH is discussed. The types of earnings manipulation that takes place and the managerial incentives associated with earnings manipulation are also discussed.

### 2.2 THE EFFICIENT MARKET HYPOTHESIS (EMH)

The efficient market hypothesis by Fama (1970) suggested that markets are rational and security prices always effusively reflect all the available information. The ability of security prices to adjust to new information is tested against three information subsets (Figure 1), namely: The weak form test, the semi-strong test and the strong form test (Fama, 1970).

**Figure 1 EMH adapted from Shiller (2013)**



The weak form tests are concerned with historic security price information and tests in this subset affirm the EMH (Fama, 1970). If the weak form holds, abnormal returns cannot be earned using past information but may be earned using fundamental analysis and private information (Latif, Arshad, Fatima & Farooq, 2011).

The semi-strong form tests are concerned with the speed of price adjustment to publicly available information such as annual reports (Fama, 1970). The test in this subset affirms the EMH and the time for price adjustment on average is deemed “consistent” (Fama, 1970, p.409). If the semi-strong form holds, abnormal returns cannot be made using historic data or fundamental analysis but can be earned with private information (Latif et al. 2011).

The strong form tests are concerned with monopolistic access to information relevant for price formation by a few investors or group of investors (Fama, 1970). This research study found that these occurrences are limited to corporate insiders and specialist traders, and reflects the majority; therefore the EMH can be seen as the closest approximation to reality (Fama, 1970). If the strong form holds, an investor cannot earn an abnormal return regardless of the information he/she can access (Latif et al. 2011).

In cases of fraud and earnings’ manipulation by management, the efficient market hypothesis cannot be considered realistic as information is kept from the public and disguised by creative accounting (Lamont, 2004). History is littered with cases of corporate fraud and bankruptcy. Examples include the collapse of Enron, Worldcom and AIG; and serve as reminders that information is not always disclosed in an honest and transparent manner (Giroux, 2008).

## **2.3 CAPITAL ASSET PRICING MODEL**

The Capital asset pricing model (CAPM) developed by Sharpe (1964) and Lintner (1965) represents the birth of asset pricing theory in financial economics (Fama & French, 2004). The CAPM describes a simple linear model for estimating the expected return on an asset in terms of its systematic risk, beta ( $\beta$ ) (Muller & Ward, 2012).

CAPM is expressed by the following equation as derived from Fama and French (2004):

$$E(R_i) = R_f + [E(R_m) - R_f] * \beta_i$$

Where:

$E(R_i)$  = Expected return of asset  $i$  or portfolio  $i$

$R_f$  = Risk free rate

$E(R_m)$  = Return on the market portfolio

$\beta_i$  = Market beta of asset  $i$ , which expressed by the following equation derived from Fama and French (2004):

$$\beta_i = \frac{\text{Cov}(R_i, R_m)}{\sigma^2(R_m)}$$

Where:

$\text{Cov}(R_i, R_m)$  = Covariance of the asset  $i$ 's return with the market return.

$\sigma^2(R_m)$  = Variance of the market return

According to Dempsey (2013); "The capital asset pricing model (CAPM) states that assets are priced commensurate with a trade-off between systematic risk (beta) and expectations of return" (p.7).

A large amount of evidence has accumulated in contradiction of CAPM over the years, evidence from a study by Fama and French (1992) confirmed that size, earnings-price, debt-equity and book-to-market ratios add to the explanation of expected stock returns provided by market beta (Fama & French, 2004). Research by Avramov and Chordia (2006) support the findings of Fama and French (1992) stating that; "subsequent works by Basu (1977), Banz (1981), Jegadeesh (1990), and Fama and French (1992) suggests that cross-sectional differences in average returns are determined not only by the market risk, as prescribed by the CAPM, but also by firm-level market capitalization, book-to-market, and prior return...the



failure of the CAPM has also been attributed to its static nature, and, thus, to its incomplete description of asset prices” (p.1001).

According to Auret and Basiewicz (2010), two asset pricing anomalies have attracted a considerable amount of attention: the size effect and the value effect. “The market capitalization effect or size effect, first noted by Banz (1981), holds that small market capitalization shares outperform large capitalization shares, after adjusting for risk” (Auret & Cline, 2011, p.29). An explanation for the size effect is “the information cost or risk hypothesis which states that due to the lack of information surrounding small firms, investors require a premium to invest in them (Banz (1981) and Zeghal (1984)). Since more information is produced and distributed about large firms, investors have an easier time anticipating the performance of a company.” (Auret & Cline, 2011, p.30).

“Waelkens and Ward (1997) studied the size effect on the JSE industrial sector for the period 1st of November 1983 to 31st of October 1993. The results showed...that they also did not find a significant size effect. This is consistent with de Villiers *et al.*'s (1986) finding. Thus they do not find evidence of a size effect. Robins *et al.* (1999) also did not find a significant size effect. Contrary to this and more in line with international evidence, more recent studies done in South Africa by van Rensburg and Robertson (2003) and Basiewicz and Auret (2009), found a size effect on the JSE.” (Auret & Cline, 2011, p.30).

Auret and Basiewicz (2009) investigated the efficacy of the Fama and French (1993) three factor model on the JSE. The three factor model was based on earlier findings by Fama and French (1992) as mentioned above; the model essentially uses book to market ratio (HML) and market capitalization (SMB) as additional factors to calculate market beta (Fama & French, 1993). The findings of the Auret and Basiewicz (2009) study state: “although the size effect does diminish somewhat after correction with the three factor model, it remains robust. Importantly, it remains significant at the 1% level in most regressions. However, the value effect dissipates after adjustment for risk is made” (p.21). It is on this basis that the researcher has further analysed the data set pertaining to this paper into categories of market capitalisation (size).

## 2.4 SHORT SELLING AS AN INVESTMENT STRATEGY

Short selling (shorting) is the process whereby an investor has borrowed stocks, from a brokerage house or large institutional investor, which he/she believes will decline in price (Hung Wan, 2007). The investor then sells the stock on the market and purchases it at a later stage when the price has decreased (Hung Wan, 2007). As a final step in short selling the investor returns the borrowed stock to the brokerage house and takes the difference (Hung Wan, 2007). If the stock price appreciates, the investor typically makes a loss (Hung Wan, 2007).

Shorting appears in a myriad of investment literature and is seen as a regulator of market prices, a contributor of market information and as an investment strategy that takes advantage of short term overreactions of stock price, firms in financial distress or undergoing acquisition (Dechow, Hutton, Meulbroek & Sloan, 2001) (Dieter, Lee & Werner, 2009) (Saffi & Sigurdsson, 2011).

According to Hung Wan (2007) the motives for shorting selling can be summarised into four hypotheses, namely:

**The Trend hypothesis;** which pertains to the momentum effect described by Jegadeesh and Titman (1993) whereby share price that has decreased in the short term will continue to decrease. According to Bodie, Kane and Marcus (2007), the weak form of the efficient market hypothesis holds that all the past information including past prices and returns is already reflected in the current price of stocks; therefore future prices cannot be predicted on the basis of past information. Yet, Jegadeesh and Titman (1993) demonstrated that there is a price continuation over a three to twelve month horizon, and that “the momentum strategies of buying winners and selling losers, can earn returns of around 1% per month” (Hung Wan, 2007, p.124). A study by Hon and Tonks (2003) investigated the momentum effect in the UK stock market and found that momentum strategies are present and that investors could gain an advantage by using them. Additionally, Diether *et al.* (2009) noted that short sellers tend to time their trades relative to short term price trends.

**The Overpricing hypothesis;** which pertains to inside knowledge that the firm’s future performance will be poor, and that the share price will decrease. According to the Efficient Market Hypothesis (EMH), full reflection of information entails “two equilibria in the same market: the first equilibrium occurs if everyone has access to and knows all of the

information, and the second is what is actually observed” (Gilson & Kraakman, 1984, p.558). “The market is efficient if the two equilibria are identical” (Gilson & Kraakman, 1984, p.558). Gilson and Kraakman (1984) further noted weak, semi-strong and strong form tests of the EMH sample different sets of information; which implied that each set would have their own process for price formation and their own efficiency dynamics (Gilson & Kraakman, 1984). Hence, the wider the initial distribution of information, the more rapidly the market would become efficient (Gilson & Kraakman, 1984). It is therefore implied that less available information requires more time for full reflection in price (Gilson & Kraakman, 1984). Hence the investor who initially learns of new information can capture an increasing portion of its trading value (Gilson & Kraakman, 1984); short selling would thus be a lucrative choice for an investor with access to private information (Hung Wan, 2007). “Dechow *et al.* (2001) found a strong relation between the trading strategies of short sellers and ratios of fundamentals to market prices” (Hung Wan, 2007). This is consistent with claims made by Montier (2008) about short sellers being the “accounting police”. Additionally, the increase of short selling activity of a particular stock may also serve as a way of distributing private information to the market, which would promote the incorporation of that information into the share price thus restoring efficiency (Gilson & Kraakman, 1984).

**The Arbitrage hypothesis** is an example of merger arbitrage; whereby the stock of the acquiring company is shorted after the announcement of a merger (Hung Wan 2007). According to Gilson and Kraakman (1984) “the relative efficiency of market mechanisms determines the magnitude of arbitrage opportunities that new information creates for the fortunate traders who know it first” (Gilson & Kraakman, 1984, p.560). However, the information of a merger is considered to be public, therefore the time required for share prices to reflect this new information is minimal, hence the return expected would not be very high (Gilson & Kraakman, 1984).

**The Taxation hypothesis** explained that one should avoid paying capital gains tax on profits made by shorting; this law however changed in 2007 (Hung Wan, 2007).

The results of the Hung Wan (2007) study support the above hypotheses. Dechow *et al.* (2001) demonstrated the use of fundamental analysis by short sellers to position themselves in stocks that would yield a lower return. The EMH is again challenged in that historical, public data would be used to predict security price movement for profitable gain. Short selling intensifies on days preceding negative returns and is strongly positively related to past

returns (Diether et al. 2009). In contrast these activities also represent ways in which the uninformed become informed and information is therefore distributed to restore market efficiency (Gilson & Kraakman, 1984).

### **Short selling strategies**

Three shorting strategies are proposed by Diether *et al.* (2009):

First, exploitation of price differential: market friction or behavioural biases may cause the stock price to deviate from the fundamental value in the short term; this price difference is exploited by short sellers (Diether et al. 2009). This is consistent with the Overpricing hypothesis by Hung Wan (2007).

Second, short sellers as voluntary liquidity providers: during a buy-order imbalance in the market short sellers provide liquidity, and as buying pressure decreases, prices revert to fundamental value and short sellers can cover their positions at a profit (Diether et al. 2009). Thus, compensation for providing immediacy is gained (Diether et al. 2009).

Lastly, short sellers provide risk bearing capacity during periods of uncertainty: uncertainty is described as a “difference of opinion” or “asymmetric information” (Diether et al. 2009). For short selling activity to increase during periods of difference of opinion, it should coincide with market conditions of high intraday volatility and low spread (Diether et al. 2009). For short selling activity to increase during periods of asymmetric information, inventory risk must be compensated for, thus it should coincide with market conditions of high intraday volatility and wide spread (Diether et al. 2009). As information becomes public, volatility and spread decreases (Diether et al. 2009).

Greater short selling activity is observed in high capitalisation stocks and growth stocks, which are stocks with low book to market ratio, when compared to value stocks and low capitalisation stocks (Diether et al, 2009). This is consistent with the Overpricing hypothesis by Hung Wan (2007), where growth stocks on the NASDAQ are associated with high shorting activity. Dechow *et al.* (2001), demonstrated strong relations between short selling strategies and ratios of fundamentals to market prices, therefore stocks with low fundamentals to price ratios are targeted.

According to Dechow *et al.* (2001); to maximise their returns, short sellers refine their strategies in three ways. Firstly, by avoiding stocks with high transaction costs; secondly, by using information with predicative ability for future returns and lastly, by “avoiding stocks with

low fundamentals to price ratios attributed to temporarily low fundamentals” (Dechow et al. 2001, p.78).

The use of classifying stocks by their sector has proven useful to investors, in that stocks in the same sector may be compared to one another and benchmarked against the relevant sector index (Little, 2013). Two broad categories include defensive and cyclical, defensive pertaining to stocks that remain stable during economic downturn such as consumer staples, these stocks also don't rise as much during an economic upturn (Little, 2013). The cyclical category refers to stocks that react to business cycles and a variety of market conditions rendering them more volatile (Little, 2013). According to Little (2013) investment decisions should not be made in a vacuum, by using sector information a comparative advantage is rendered to the investor. Research by Muller and Ward (2013) affirm the use of sector classification; the study demonstrates “two portfolios using only the top 160 companies: resources companies and non-resources companies. Over the full time-series, we find that Non-resource shares do somewhat better. The graph shows the effect of commodity cycles. Resource stocks out-perform over the period 1998 – 2002 and to a lesser extent over the period 2005 – mid 2008. As many other researchers have noted, given the dominance of resource counters on the JSE, the commodity cycle is a significant determinant of returns. It is not however, a persistent style, and requires market timing skills to predict commodity cycles” (p.74).

### **Constraints on short selling**

Evidence from the Lamont (2004) study affirmed that the imposition of short-selling constraints allows stocks to become overpriced. It also shows that these stock returns are significantly lower in the following months and years (Lamont, 2004). This represents an opportunity for a firm to issue equity when the stock is overpriced and re-purchase when the stocks are under-priced (Lamont, 2004).

A study by Beber and Pagano (2013), sought to identify the effect of short selling constraints around the world during the 2008/2009 financial crisis. Their findings were:

- A disruption in market liquidity that affected all stocks, although the effect on small capitalisation stocks, high volatility stocks and stocks without listed options were more pronounced (Beber & Pagano, 2013).

- A reduced time period for price discovery, especially pertaining to negative news (Beber & Pagano, 2013).
- The effect on stock prices remained neutral, with the exception of the US, which showed a price increase (Beber & Pagano, 2013).
- The obligation to disclose short sales was associated with a significant improvement in market liquidity (Beber & Pagano, 2013).

## **2.5 EARNINGS MANAGEMENT AND MANIPULATION**

Earnings manipulation as defined by Beneish (1999) is “an instance where management violates Generally Accepted Accounting Principles (GAAP) in order to beneficially represent the firm’s financial performance” (p.3).

“The literature defines earnings management as a subset of earnings manipulation, it refers to a technique that managers deliberately employ to achieve a desired level of reported earnings” (Rosner, 2003, p.367). Earnings management was defined as “the grey area between legitimacy and outright fraud”, as explained by Former SEC chairman Arthur Levitt (1998) in Rosner (2003, p.367).

Results from Nelson, Elliot and Tarpley (2002) indicated that earnings management attempts occurred in many areas, including revenue recognition, intangibles, fixed assets, investments and leases, but by far the most frequently identified attempts involved reserves. Observations by Beneish (1999) affirmed that manipulation comprises either of the artificial inflation of revenue or the deflation of expenses.

Findings by Strobl (2012) revealed that the “differences in the extent of earnings manipulation over the business cycle has an impact on the correlation structure of the firm's cash flow with the market” (p.2). “The relationship between earnings manipulation and the correlation of a firm's cash flow with the market has a number of empirical implications. First, since most stock returns are more highly correlated with the market when the market goes down than when it goes up, it predicts a higher incidence of earnings manipulation during periods of economic expansion. This prediction seems to be consistent with recent corporate scandals. Many firms (including Enron, WorldCom, and Global Crossing) were found guilty of fraudulent accounting during the economic boom of the late 1990s” (Strobl, 2012, p.3).

## **Methods employed in earnings management**

Earnings management may differ in the kinds of techniques employed and the severity to which they are applied (Rosner, 2003). Some techniques include deliberate operating, financing and investing transactions or changes in accounting principles, which are considered to be within the generally accepted accounting principles (GAAP) as they are usually disclosed (Rosner, 2003). Another less obvious technique is accruals management and is generally considered to be within GAAP, provided it does not materially mis-state the financial statements (Rosner, 2003).

A study by Doyle, Jennings and Soliman (2013) further elaborated on earnings management methods and additionally, proposed a new method that been less researched. These methods include accruals manipulation, expectations management, real activities manipulation and lastly, defining non-GAAP earnings to achieve benchmark earnings per share (Doyle et al. 2013).

Accruals management (AM) refers to accounting choices used to represent the firm's operating activities within the bounds of GAAP that attempt to obscure true economic performance (Dechow & Skinner, 2000) in Gunny (2010).

Real activities manipulation (RM) refers to "actions undertaken by managers of firms that change the timing or structuring of an operation, investment, and / or financing transaction in an effort to influence the output of the accounting system" (Gunny, 2010, p.855). "Examples of RM include; overproduction to decrease cost of goods sold expenses and reducing desirable research and development investments to boost current period earnings" (Gunny, 2010, p 856). RM may be favoured over AM as the latter is subject to higher risk for scrutiny by the SEC, is constrained by the firms' operations and previous accruals manipulation and lastly AM can only take place at or after the fiscal year end and is subject to approval by the auditors (Gunny, 2010).

Expectations management refers to managers who achieve benchmarked expectations by guiding analysts' earnings forecasts downward to improve their firms' chances of meeting or beating the forecast when earnings are announced (Matsumoto, 2002). This is also known as forecast guidance (Matsumoto, 2002).

Bradshaw and Sloan (2002) were the first to document the practice of excluding expenses (also known as exclusions) from GAAP earnings and issuing non-GAAP earnings. The

rationale is that these exclusions are deemed to be non-recurring, non-cash or uninformative of the firm's core operating activities (Doyle et al. 2013). Interestingly, it was found that financial markets discount the earnings surprises by 10% to 14% if it is associated with income increasing exclusions (Doyle et al. 2013).

### **Motives and incentives associated with committing earnings management and manipulation**

One of the most important motivators for earnings management is the desire to attain external financing at a low cost (Dechow, Sloan & Sweeney, 1996). Two theories pertaining to the motivation to commit earnings management have received great support from academic research; these are: The bonus plan hypothesis and the debt/equity hypothesis (Watts & Zimmerman, 1990) in Dechow et al (1996).

The bonus plan hypothesis states that managers of firms with bonus plans are more likely to use accounting methods that will increase reported earnings for the current period (Watts & Zimmerman, 1990). By doing so, the present value of bonuses paid will increase provided that the compensation committee of the board of directors does not adjust for the method chosen (Watts & Zimmerman, 1990).

The debt/equity hypothesis states that the higher the firm's debt/equity ratio, the more likely managers are to use accounting methods that will increase earnings (Watts & Zimmerman, 1990). The tighter the covenants on the debt, the greater the probability of a violation and of incurring costs from default (Watts & Zimmerman, 1990). The use of income increasing accounting methods relaxes the constraints on debt and reduce the cost of default (Watts & Zimmerman, 1990, p.139). This hypothesis is in support of the view by Dechow *et al.* (1996) which stated that low cost, external financing is one of the primary motivators of earnings management.

Christie (1990) re-examined the work of Watts and Zimmerman (1990) and concluded that management compensation and debt contracts were statistically the most significant variables in explaining the accounting procedural choice (Dechow et al. 1996).

Kellogg and Kellogg (1991) stated that the two main reasons for fraud and earnings management were firstly, to encourage investors to buy an interest in a company's stock as owners or in bonds as creditors, and lastly, to increase the value of the stock of present shareholders (Kellogg & Kellogg, 1991) in Dechow et al (1996). The first reason is supported



by findings by the National Association of Certified Fraud Examiners (1993) in Dechow *et al* (1996). Thus the primary motivator for earnings management is to influence investor perceptions of firm value (Dechow *et al.* 1996). Additional motivators include the inside sale of stock and external financing (Dechow *et al.* 1996).

According to Dechow *et al* (1996) governance structures that contribute to an environment in which earnings management may occur are associated with the following characteristics: a firm with no audit committee, the CEO of the firm was a founder, the CEO also serves as chairman on the board of directors, the board of directors is dominated by insiders and there is usually no external monitoring management.

Findings by Strobl (2012) stated “the managers of firms whose earnings are more strongly correlated with the market during periods of economic expansion are more inclined to engage in manipulation during periods of recession, and vice versa” (Strobl, 2012, p.2). “The rationale for this finding is; when a firm's earnings exhibit a low correlation with the market, investors learn little about the firm's earnings from the reports issued, thus the reported earnings have a great impact on its stock price. A favourable report leads to a significantly higher price than an unfavourable one. Thus, this is exactly when the manager's incentive to issue an upwardly biased report are highest.” (Strobl, 2012, p.2).

Additional findings by Strobl (2012) revealed that forcing firms to disclose more information to the public does not reduce the incidence of manipulation but rather has the opposite effect. The rationale is that “more informative accounting disclosures increase the expected quality of a firm that reports high earnings thus leading to a higher stock price. This, in turn, increases the manager's incentives to engage in manipulation. Thus, our results suggest that stricter disclosure requirements can be counterproductive in terms of reducing the extent of manipulation. Unless disclosure laws make manipulation more costly for managers, more disclosure may actually lead to more manipulation” (Strobl, 2012, p.3). This finding by Strobl (2012) thus opposed the EMH as the increased availability of information has resulted in an upward movement of share price that does not fully reflect all the information. Whilst it is an unfortunate consequence of earnings manipulation, it represents an opportunity for a short seller who has picked up the trend (Gilson & Kraakman, 1984).

## **2.6 EARNINGS MANAGEMENT AND THE COST OF CAPITAL**

Arthur Levitt suggested; “that high quality accounting standards result in greater investor confidence, which ... reduces capital costs” (Levitt, 1998) in Strobl (2012). Findings by Strobl (2012) suggested that “earnings management can influence a firm's cost of capital despite the forces of diversification. This result is driven by the dependence of the manager's manipulation strategy on the state of the economy” (Strobl, 2012, p.2).

“Since earnings manipulation lowers firm value, differences in the extent of manipulation across the business cycle has an impact on the correlation structure of the firm's cash flow with the market. In particular, if managers are more likely to manage earnings in bad times, earnings manipulation leads to a larger reduction in firm value when the economy is performing poorly and the marginal utility of consumption is high. This increases the risk premium that investors require to hold the stock. Viewing this result from the perspective of the firm, a firm with a relatively stronger incentive to engage in manipulation during a recession, compared to its incentive during an expansion, thus faces a higher cost of equity capital. It is important to note that this result does not rely on the existence of naive investors who underestimate the extent of manipulation. Rather, it is derived under the assumption that all investors are perfectly rational and correctly anticipate the extent of manipulation in equilibrium.” (Strobl, 2012, p.2-3).

Dechow *et al* (1996) found that the stock prices drop by 9% at the initial announcement of alleged earnings manipulation. Companies found to be guilty of earnings manipulation suffer substantial costs imposed by capital markets, such as a decline in stock price, an increased bid-ask spread, decreased analyst following, increased short interest and increased dispersion in analysts' forecasts and increased cost of capital (Dechow et al. 1996). According to Strobl (2012) “it is this dependence on a market-wide factor that makes the reduction in the firm's cash flow due to earnings manipulation a systematic risk that cannot be diversified away in large economies” (p.5).

## **2.7 THE EFFECT OF CORPORATE FRAUD ON BUSINESS AND INVESTORS**

The financial crisis as defined by Mishkin (1996) was a disruption to the financial markets such that funds could not be channelled to those who have the most productive investment

opportunities (Dzikowska & Jankowska, 2012). The financial crisis of 2008 led to the deepest global recession since the 1930s (Dzikowska & Jankowska, 2012).

The study by Argo and Darke (2006) related the use of dual process theory by Chaiken and Trope (1999), who proposed that judgement occurs in two processes: Heuristic and systematic; the latter involving careful thought and consideration. The study also used trust literature based on the work of Rotter (1971); where specific versus general trust or distrust was combined to assess the impact of corporate fraud on investor behaviour (Argo & Darke, 2006). The results indicated that corporate fraud undermines investor behaviour in a general sense (Argo & Darke, 2006). Suspicion may also be exaggerated and maintained despite information from a reliable source; it also evokes a defensive bias in judgement as investors are more wary a second time around (Argo & Darke, 2006).

“Investment inefficiency” is a consequence of corporate fraud where investors had been misled by false financial performance and economic prospects, for example, Enron and Worldcom (Kumar & Langberg, 2009). To the detriment of efficient allocation of funds, “there is overinvestment in certain industries or sectors as uninformed investors direct capital flows to the firms manipulating their beliefs; however, there is underinvestment in other sectors, as the presence of fraud makes investors generally more cautious” (Kumar & Langberg, 2009, p.144).

“Fraudulent financial reporting imposes huge costs on financial markets. These accounting misrepresentations increase transaction costs by eroding investor confidence in the integrity of the capital markets. In recent years, we have seen how accounting misrepresentations have triggered action by regulators, who impose (often costly) regulation on companies and markets.” (Beneish et al. 2013, p.75).

Montier (2009) described five phases of a bubble: Displacement, Credit creation, Euphoria, Critical stage/ Financial distress and lastly Revulsion. Revulsion is characterised by investors not wanting to buy anything even though good opportunities are ripe for the picking, this is characterised by myopic human behaviour which serves to drive stocks lower (Montier, 2009). This behaviour is consistent with the generalised suspicion associated with corporate fraud and financial crises such as the; housing bubble of 2008 and 2009, or the *dot.com* bubble of late 1990s.

## 2.8 MONTIER'S C-SCORE

The C-score is a fundamental analysis tool with six components, each designed to capture an element of earnings manipulation (Montier, 2008). It is a binary scoring system that allocates a “1” or “0” (zero) to each component (Montier, 2008). The maximum score is six and minimum is zero (Montier, 2008).

**Component 1:** A growing difference between net income and cash flow from operations (Montier, 2008). A large or growing divergence indicates more aggressive capitalisation of costs (Montier, 2008). It is more difficult to alter cash flow figures as opposed to earnings (Montier, 2008).

**Component 2:** Increasing Days sales outstanding (DSO) (Montier, 2008). This indicates that accounts receivable is outgrowing sales and can indicate “channel stuffing” (Montier, 2008).

**Component 3:** Increasing Days sales of inventory (DSI) (Montier, 2008). It indicates reduced or slower sales (Montier, 2008).

**Component 4:** Increasing other current assets to revenue (Montier, 2008). “Canny CFO’s” could use this as a way to hide increasing DSO and DSI figures (Montier, 2008).

**Component 5:** A decline in depreciation relative to property, plant and equipment (Montier, 2008). Depreciation methods can be altered to improve quarterly earnings to beat estimates (Montier, 2008).

**Component 6:** High total asset growth (Montier, 2008). Some firms become “serial acquirers and acquire assets to distort their earnings” (Montier, 2008).

## 2.9 SUMMARY

The evidence from the above literature affirms that returns in excess of the market (abnormal) can be earned from short selling. Additionally, the link between earnings manipulation and short selling activity, due to the prediction of the share price declining, has been established. Short selling both challenges the EMH and yet also re-affirms it, as short sellers either advertently; through the use of fundamental analysis, or inadvertently; through the use of private information and short selling activity in itself, contribute valuable information to the markets such that market efficiency can be restored. The role of short

sellers as the accounting police contribute valuable information to the market and to investors; this ensures that funds are allocated to their most productive investment opportunities and helps to maintain efficiency.

# CHAPTER 3: RESEARCH QUESTION AND HYPOTHESIS

## 3.1 INTRODUCTION

The objective of this study is to determine the predictive ability of the C-Score to identify stocks that may be shorted for an abnormal return, the basis of which is the time to discovery of earnings manipulation with an anticipated decline in share price. Additionally, prior research has shown that a number of characteristics are correlated with subsequent returns, one of which is company size as is evidenced in Fama & French (1992) in Beneish *et al.* (2013). A study by Muller and Ward (2013) demonstrates that non-resource shares do somewhat better than resource shares. "Resource stocks out-perform over the period 1998 – 2002 and to a lesser extent over the period 2005 – mid 2008." (Muller & Ward, 2013, p.74). Based on the above, the following research hypothesis and sub-hypotheses have been developed.

## 3.2 HYPOTHESIS AND SUB-HYPOTHESES

### 1. The C-score is able to identify stocks that yield abnormal returns on the JSE:

H<sub>0</sub>: Returns of stocks with a high C-score under-performed in comparison to the index return.

H<sub>1</sub>: Returns of stocks with a high C-score did not under perform in comparison to the index return.

### 1.1 Sub-hypothesis 1: The C-score is able to identify shortable stocks in the resources sector:

H<sub>0</sub>: Returns of stocks with a high C-score under performed in comparison to the index return in the resources sector.

H<sub>1</sub>: Returns of stocks with a high C-score did not under perform in comparison to the index return in the resources sector.

**1.2 Sub-hypothesis 2: The C-score is able to identify shortable stocks in groups which were sorted by market capitalisation in the resources sector:**

$H_0$ : Returns of stocks with a high C-score under performed in comparison to the index return in the resources sector.

$H_1$ : Returns of stocks with a high C-score did not under perform in comparison to the index return in the resources sector.

**1.3 Sub-hypothesis 3: The C-score is able to identify shortable stocks in the manufacturing subset of the industrial sector:**

$H_0$ : Returns of stocks with a high C-score under performed in comparison to the index return in the manufacturing subset of the industrial sector.

$H_1$ : Returns of stocks with a high C-score did not under perform in comparison to the index return in the manufacturing subset of the industrial sector.

**1.4 Sub-hypothesis 4: The C-score is able to identify shortable stocks in the non-manufacturing subset of the industrials sector:**

$H_0$ : Returns of stocks with a high C-score under performed in comparison to the index return in the non-manufacturing subset of the industrial sector.

$H_1$ : Returns of stocks with a high C-score did not under perform in comparison to the index return in the non-manufacturing subset of the industrial sector.

**1.5 Sub-hypothesis 5: The C-score is able to identify shortable stocks in groups which were sorted by market capitalisation in the industrials sector:**

$H_0$ : Returns of stocks with a high C-score under performed in comparison to the index return in the manufacturing subset of the industrial sector.

$H_1$ : Returns of stocks with a high C-score did not under perform in comparison to the index return in the manufacturing subset of the industrial sector.

## CHAPTER 4: METHOD

### 4.1 RESEARCH DESIGN

The design of the research aims to mimic the study conducted by Montier (2008) but examines the C-score as a separate entity. It is a longitudinal, experimental study using secondary data from the Johannesburg Securities Exchange (JSE) from between 2002 and 2012 (Saunders, 2012). It is an experimental study because it serves to assess the causal relationships between the C-Score variable and the relative returns per sector (Saunders, 2012). This method was selected as it is consistent with Montier's method in his initial study, with the exception that no additional ratios were used to filter stocks for short selling, such as price to sales ratios (Montier, 2008).

### 4.2 POPULATION AND SAMPLING

**Unit of analysis:** All the stocks on the main board of the JSE during the sample period 2002 to 2012 were selected. Specific units of analysis include share price data, dividend data and various units of fundamental data which is described further in the research method. The indices that were used include the JSE/FTSE Resources 10 index, Industrial 25 index, Financial 15 index and SA Listed property index.

**Sampling Technique:** No sampling was done, the entire universe was explored.

**Universe:** All the public listed companies on the JSE's main board which comprised of 340 companies, listed in appendix 1.

**Time frame:** A historic period of 10 years was used from 2002 to 2012.

### 4.3 RESEARCH METHOD

#### Data collection

Secondary data as defined by Saunders (2012) is data used for a research project that were previously collected for a different purpose. This is representative of data published by



companies listed on the JSE. Secondary, quantitative data were downloaded via BFA McGregor's and applied using the McFAS function in Microsoft Excel 2010. Additional data pertaining to the days sales outstanding were obtained directly from Bloomberg's information terminal.

### **Data cleaning**

The availability of certain fundamentals such as cost of sales, other current assets and credit sales data posed a challenge and some companies from the initial list of 340 companies had to be excluded due to the lack of data. Companies that had less than two years of consecutive data were removed. Additionally, companies that could not form at least 1 C-score were removed from the dataset. This complication arose due to inconsistent availability of data over the 10 year time frame. The final dataset comprised of 43 companies in the resources sector, 178 in the industrials sector, nine in the financial sector and two in the property sector.

### **Data analysis**

The data from each company was used to calculate each element of the C-Score according to its specific year end; this method was used to ensure comparability between companies data sets. Additionally, a period of three months was added to the companies' year end dates, to compensate for the late release of annual data.

Survivorship bias as described by Brown, Goetzman, Ibbotson and Ross (1992) is the tendency to exclude companies that have failed and/ or delisted from fund performance, hence producing results that are positively skew. Therefore, to reduce the effect of survivorship bias in this study, companies that were either delisted or were acquired by another firm were included in the data set.

The data was categorised into four sectors, namely financial, industrial, property and resources to attain comparative advantage (Little, 2013). The categories of finance and property were removed due to an insufficient number of companies. It may also be noted that the C-Score was found to be an inappropriate scoring system for these categories due to its use of ratios such as days sales outstanding and days sales of inventory which was not representative of these sectors.

The C-Score for each company in the sample was determined using fundamental ratios with secondary data for each component of the scoring system.

**Table 1: C-score components and fundamental ratios**

C-Score Component	Fundamental ratios used in calculation
Days sales outstanding	<p>The ratio is calculated by the equation below:</p> $= \left( \frac{\text{Accounts receivable}}{\text{Total Credit Sales}} \right) \times \text{no. of days}$
Days sales of inventory	<p>The ratio is calculated by the equation below:</p> $= \left( \frac{\text{Inventory}}{\text{Cost of sales}} \right) \times 365 \text{ days}$
A decline in Depreciation relative to PPE	<p>The ratio is calculated by the equation below and expressed as a percentage:</p> $= \frac{\text{Depreciation}}{(\text{Gross: Plant \& Equip}) + (\text{Gross: Land \& build})}$ <p style="text-align: center;">or</p> $= \frac{\text{Depreciation}}{\text{Fixed assets}}$
High Total Asset Growth	<p>The ratio is calculated by the equation below and expressed as a percentage, this was then compared to the average growth across each category, namely property, financials, industrials and resources, if the percentage difference was higher (positive) a score of 1 was given.</p> $= \frac{\text{Total Assets}_{(\text{year}2)} - \text{Total Assets}_{(\text{year}1)}}{\text{Total Assets}_{(\text{year}1)}}$
Increasing other current assets to revenue	<p>The ratio is calculated by the equation below and expressed as a percentage:</p> $= \frac{\text{Other current assets}}{\text{Turnover}}$
Difference between Net Income & OPCF	<p>The ratio is calculated by:</p> $= (\text{Net profit/ loss}) - (\text{Operating cash flow})$

A C-Score was created for every two years of data which is consistent with Montier's method (Montier, 2008). The C-Score was calculated by assigning either a "1" or "0" (zero) for every two years of data, therefore each company would have a maximum of nine C-Scores and a minimum of one.

A company would receive a score of 1 if the data denoted an increase in the fundamental values, for example, increasing days of inventory. Conversely, a score of zero was given if the data denoted a decrease in the fundamental values.

An arithmetic mean was used to calculate the total return per company for year 1 and a geometric mean was used for years 3 and 5 (Murray State education campus, 2013). "The arithmetic mean adds a series of numbers and divides that sum by the amount of numbers added together" (Spizman & Weinstein, 2008, p.44). "By definition, the arithmetic mean is applicable when several observations are added together to produce a total; and to determine if all the quantities had the same value, what would those values have to be in order to achieve the same total?" (Spizman & Weinstein, 2008, p.44).

"Using the arithmetic mean to project future growth overstates the growth rate by not accounting for the compounding effect from year to year. This problem can be corrected by determining the geometric mean. The geometric mean is established when various observations are multiplied together to produce a product to determine if all the quantities had the same value, what would that value have to be in order to achieve the same product." (Spizman & Weinstein, 2008, p.45). To calculate the geometric mean return, a five-step process from the Murray State education campus was used (2013):

1. Determine the rate of return for each time period,
2. Add one to each of the returns (the result is called a holding period return),
3. Multiply each of the holding period returns together (this is called "chain-linking" the returns),
4. Take the root of the product in step 3. The root number is equal to the number of time periods.
5. Subtract one from the result.

**Table 2: Formulae for calculation of arithmetic and geometric mean returns**

Total Return (TR)	Equation:
Year 1 (yr1)	$(\text{Closing price}_t - \text{Closing price}_{(t-1)} + \text{Dividends paid}) / \text{Closing price}_{(t-1)}$
Year 3	$((\text{TR yr1} + 1) * (\text{TR yr } 1_{(t-1)} + 1) * (\text{TR yr } 1_{(t-2)} + 1))^{(1/3)} - 1$
Year 5	$((\text{TR yr1} + 1) * (\text{TR yr } 1_{(t-1)} + 1) * (\text{TR yr } 1_{(t-2)} + 1) * (\text{TR yr } 1_{(t-3)} + 1) * (\text{TR yr } 1_{(t-4)} + 1))^{(1/5)} - 1$

Above: (Murray state education campus, 2013)

Total returns for the indices; JSE/FTSE Resources 10, Financial 15, SA listed property and Industrial 25, were calculated using the same formulae for one year, three year and five year periods respectively.

The companies' total returns were then compared to the index returns for each sector, to yield the percentage difference (relative return). Relative returns are defined as returns compared to a benchmark index such as S&P 500 (Agarwal, 2010). The percentage differences (relative returns) were then listed according to the respective C-Scores of each company. Descriptive statistics was then performed and bar graphs using the mean returns were created.

Since the industrials category of this research comprised the largest number and greatest diversity of stocks, the category was further analysed by dividing it into two sectors; manufacturing and non-manufacturing sectors respectively. Descriptive statistics were performed and bar graphs using the mean percentage returns were created on both sub-sectors.

Diether *et al.* (2009) stated that short selling activity increased with high capitalisation stocks (growth) stocks and decreased with low capitalisation (value) stocks. Further analysis was conducted by binning (grouping) the relative return data for the resources and industrials sector separately by market cap into small, middle and large capitalisation bins (groups) such that there was an almost equal number of companies per group. The grouping by size also pertains to the size effect as motivated by Auret and Cline (2011).

**Table 3: Grouping criteria for market capitalisation**

Market Cap	Industrials	Resources
Large	= or > R4 billion	= or > R6 billion
Middle	< R4 billion but > R300 million	< R6 billion but > R350 million
Small	< R300 million	< R350 million

Descriptive statistics on each group for one year, three years and five years were conducted.

An alternative method for this study is the creation of winner and loser portfolios, winner portfolios being created using stocks with a C-Score of zero to 1 and loser portfolios consisting of stocks with C-Scores of 5 and 6. This would test the potential for the C-Score to predict winner stocks as well as loser stocks. The use of the style engine by Muller and Ward to create such portfolios would represent a tool that could facilitate this method (Muller & Ward, 2013). This method was not selected as the aim of this research was to investigate the efficiency of the C-score to predict shortable stocks (high C-scores) only.

### **Data management**

The data collection for this study was extensive and required the use of numerous Microsoft Excel folders. Microsoft Excel 2010 was the software of choice as it is user friendly and contained the McFAS add-in which enabled easy data retrieval from the Microsoft access database of secondary stock data. Online cloud storage and external hard drives were used store and back up data. This was done to ensure that no data was lost in any event, whatsoever.

## **4.4 RESEARCH LIMITATIONS**

This study had been impacted by various external influences that could not be explored within the time limitations and breadth of this thesis. These influences are:

- Strikes and social unrest within South Africa's mining, agricultural and manufacturing industries,
- The global financial crisis of 2008-2009,

- The recovery from the *dot.com* bubble burst of 2000,
- The Eurozone financial crisis,
- The Arab spring
- FIFA 2010 World Cup in South Africa.

All of these factors have greatly influenced the data but the effect and the extent to which cannot be accounted for within the scope of this research and is thus stated as a limitation.

Additionally, due to time constraints, the use of the price to sales ratio as an additional filter for shortable stocks could not be used. Therefore the results obtained in this study are only partially comparable to that obtained by Montier (2008) on the US and UK markets in 2008.

# CHAPTER 5: RESULTS

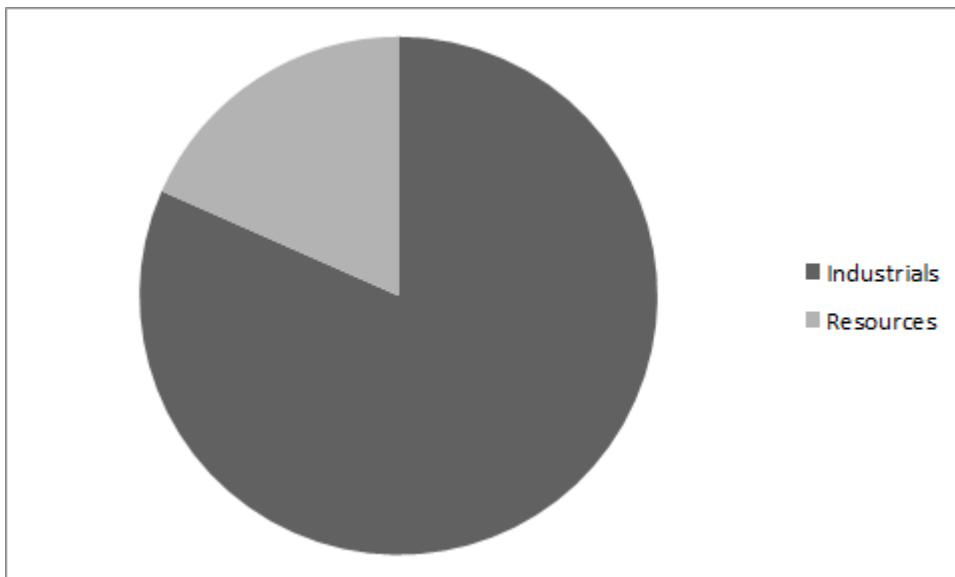
## 5.1 INTRODUCTION

The results below are presented in accordance with the stated hypothesis which serves to investigate the relationship between the C-Score and relative returns of the companies in the data set.

## 5.2 DESCRIPTIVE STATISTICS

The final data set was comprised of 224 companies, the majority of which formed part of the industrials sector which comprised of companies operating in retail, pharmaceuticals, technology, transportation, energy, media, clothing, textiles, agriculture, manufacturing, electronics, chemicals, telecommunications and entertainment. The resources sector comprised of companies operating in any form of mining.

**Figure 2: Industry composition:**



### 5.3 RESOURCES SECTOR:

Table 4: Year 1, Resources

SUMMARY: Resources 1 Year									
CSCORE	Mean	Median	Minimum	Maximum	Std Dev	Variance	Kurtosis	Skewness	Count
0	-11.39%	-40.07%	-97.32%	138.54%	0.91	0.83	-1.20	0.70	9.00
1	-16.52%	-21.85%	-105.82%	67.86%	0.45	0.20	-0.62	0.15	37.00
2	8.73%	3.12%	-150.86%	221.34%	0.58	0.34	3.64	1.07	60.00
3	5.30%	-7.04%	-85.11%	172.33%	0.58	0.33	0.67	1.05	55.00
4	-0.22%	-5.06%	-82.77%	151.44%	0.47	0.22	1.60	0.78	39
5	-7.43%	-20.33%	-59.70%	59.34%	0.40	0.16	-0.75	0.62	14
6	3.15%	3.15%	3.15%	3.15%					1

Figure 3: Mean return percentage resources 1 year

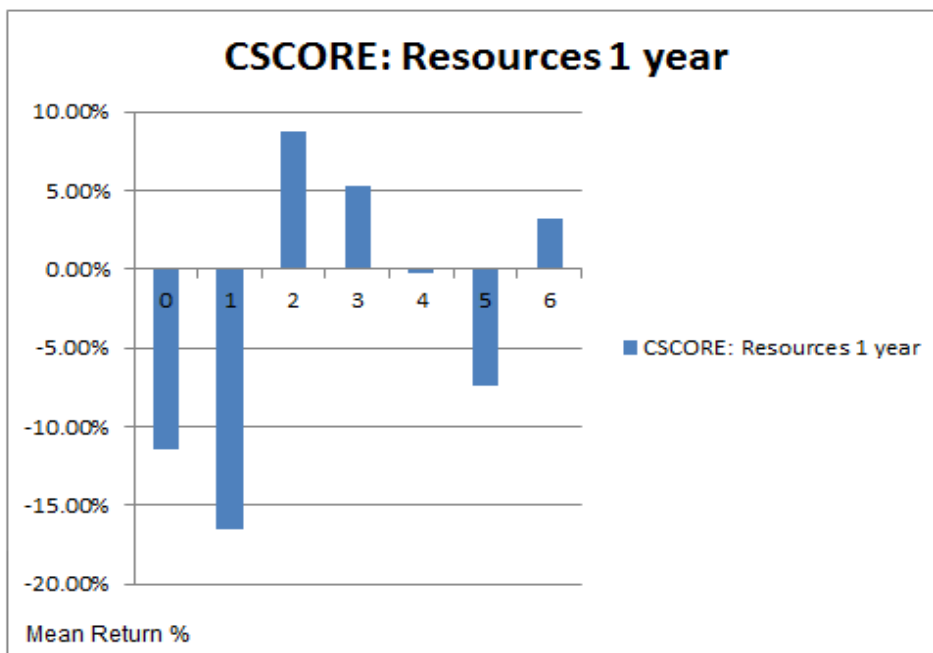


Table 4 is a summary of the descriptive statistics for the resources sector for a one year holding period. Figure 3 is a bar graph that indicates the percentage mean returns of the companies with their corresponding C-Score. According to Figure 3, the relative returns for companies in the resources sector in year 1 do under perform the index for a C-score of 4 and 5 but do not for a score of 6 with a positive return of 3.15%. It is important to note that there



was just 1 company with a C-Score of 6 in this portfolio, thus the positive return is not significant.

**Table 5: Year 3, Resources**

SUMMARY: Resources 3 Year									
CSCORE	Mean	Median	Minimum	Maximum	Std Dev	Variance	Kurtosis	Skewness	Count
0	-20.84%	-26.46%	-74.74%	41.70%	0.39	0.15	-0.51	0.53	8.00
1	-10.40%	-14.03%	-62.33%	73.71%	0.30	0.09	1.65	0.97	28.00
2	-0.86%	0.88%	-65.03%	58.78%	0.28	0.08	-0.06	-0.36	47.00
3	2.41%	0.85%	-80.07%	142.85%	0.34	0.12	5.26	1.21	48.00
4	3.44%	-2.25%	-49.75%	68.44%	0.33	0.11	-0.72	0.23	30
5	-2.72%	-6.55%	-58.06%	113.01%	0.50	0.25	3.68	1.56	9
6	-6.63%	-6.63%	-62.08%	48.82%	0.78	0.61			2

**Figure 4: Mean return percentage for resources 3 years**

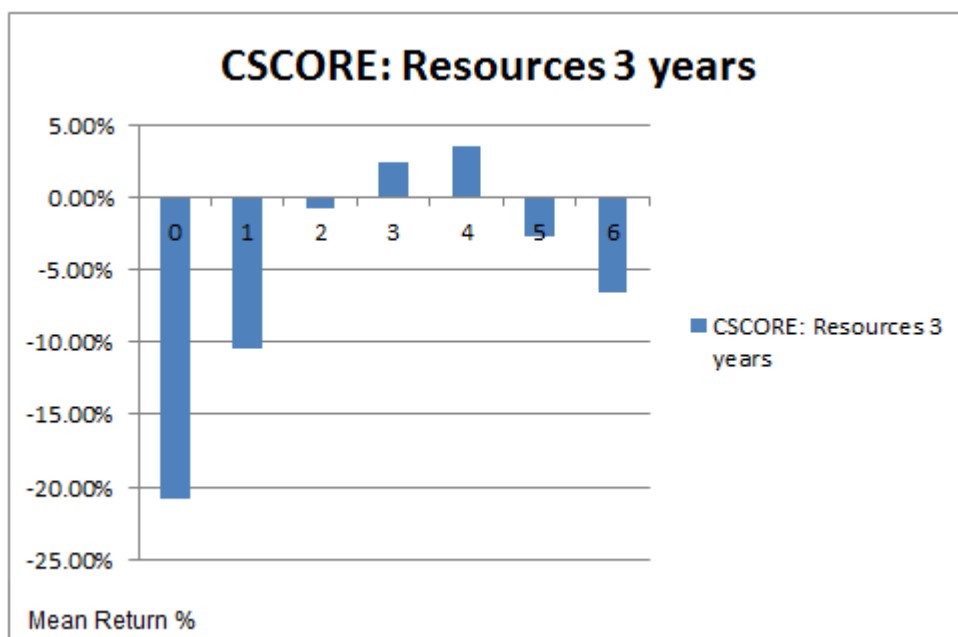


Table 5 is a summary of the descriptive statistics for the resources sector for a three year holding period. Figure 4 indicates the relative return for this holding period is negative for a C-score of 5 and 6 but a positive return of 0.45% for a C-score of 4. 30 data points were averaged to yield a return of 0.45% which is low positive return. However, two data points were averaged to yield a return of -6.63% for a C-score of 6, therefore it may not be considered significant.

**Table 6: Year 5, Resources**

SUMMARY: Resources 5 Year									
CSCORE	Mean	Median	Minimum	Maximum	Std Dev	Variance	Kurtosis	Skewness	Count
0	-16.9%	-20.24%	-61.91%	28.15%	0.36	0.13	-1.62	0.05	5
1	-7.1%	-5.45%	-51.89%	51.33%	0.24	0.06	0.61	0.25	22
2	2.5%	0.38%	-63.26%	85.89%	0.32	0.10	0.82	0.49	33
3	-3.6%	0.27%	-59.64%	65.38%	0.27	0.07	0.59	-0.08	35
4	-0.5%	-9.75%	-42.31%	56.88%	0.26	0.07	-0.18	0.56	19
5	-7.9%	-6.09%	-19.05%	-0.52%	0.08	0.01	-0.21	-0.97	4
6	28.3%	28.29%	28.29%	28.29%					1

**Figure 5: Mean return percentage for resources 5 years**

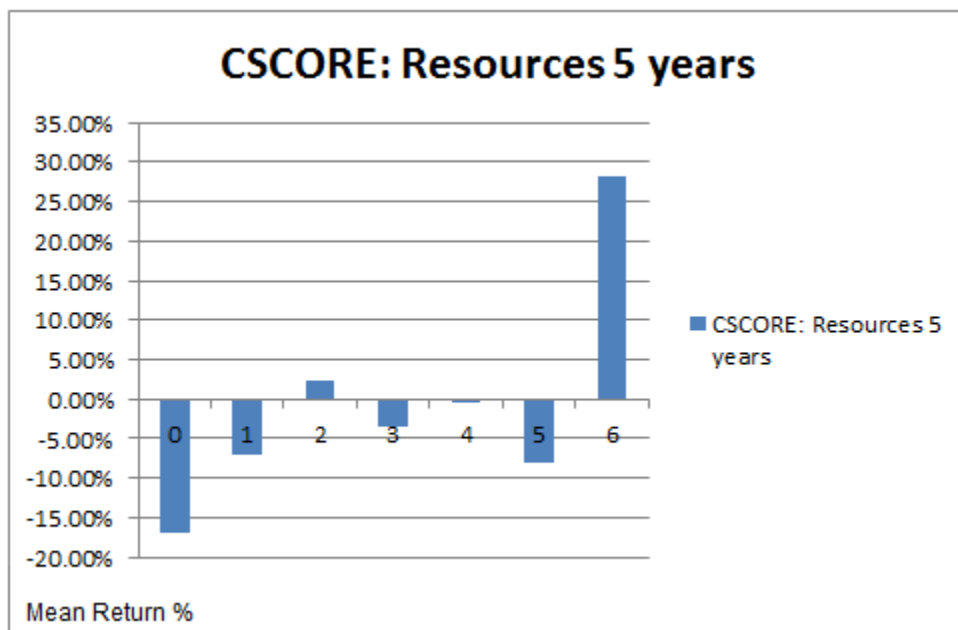


Table 6 is the summary of the descriptive statistics for the resources sector for a five year holding period. Figure 5 indicates that the relative return for this holding period is negative for C-scores of 4 and 5 but an abnormal positive return of 28% for a score of 6. It is important to note that there was just 1 data point for a C-score 6 for this holding period, therefore the 28% return may be viewed as an outlier and it cannot be inferred that the efficacy of the C-score declines at the 5 holding year period.

## 5.4 RESOURCES: LARGE CAP GROUP

Table 7: 1 Year, Resources – Large Capitalisation

SUMMARY: Resources - Large Cap Group : 1 Year									
CSCORE	Mean	Median	Minimum	Maximum	Std Dev	Variance	Kurtosis	Skewness	Count
0	101.23%	101.23%	63.91%	138.54%	0.53	0.28			2
1	4.25%	-0.87%	-40.49%	64.85%	0.30	0.09	-0.06	0.72	18
2	17.46%	11.86%	-39.43%	176.25%	0.42	0.18	6.14	1.96	30
3	4.52%	-6.96%	-85.11%	129.91%	0.51	0.26	0.30	0.78	32
4	3.71%	8.47%	-72.24%	46.22%	0.29	0.08	1.16	-0.72	20
5	1.47%	-11.58%	-27.68%	58.97%	0.36	0.13	1.45	1.37	5
6	3.15%	3.15%	3.15%	3.15%					1

Figure 6: Mean return percentage resources 1 year large cap

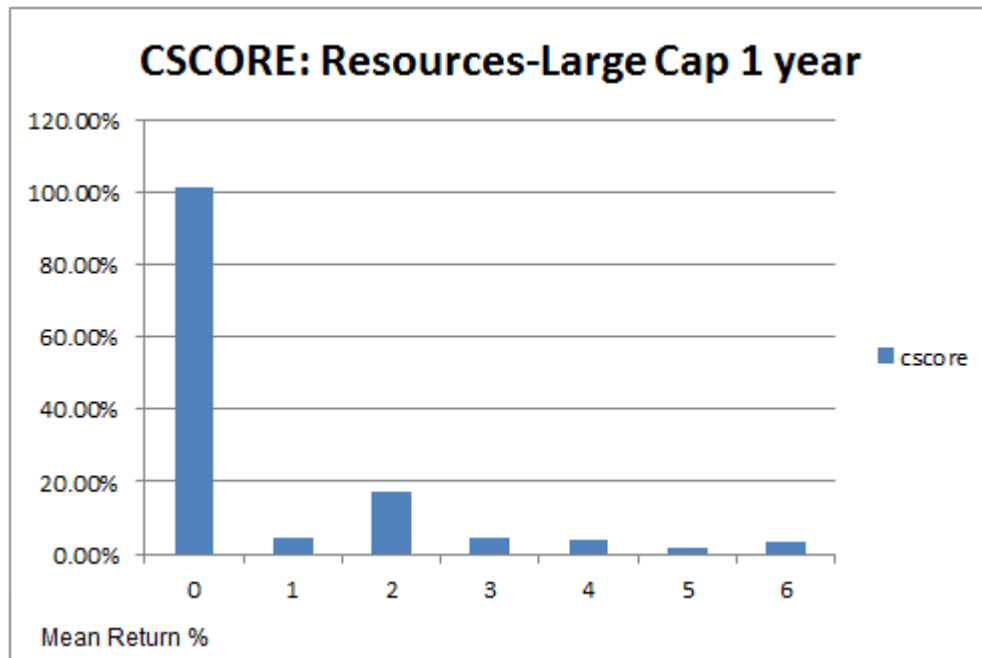


Table 7 is a summary of the descriptive statistics for the resources sector for a one year holding period pertaining specifically to companies with a large market capitalisation in the dataset. Figure 6 indicates a positive relative return for a C-score of 5 and 6; these C-score were averaged from five and one data points respectively. C-score appears ineffective for this category's holding period.

**Table 8: Year 3, Resources – Large Capitalisation**

SUMMARY: Resources - Large Cap Group : 3 Years									
CSCORE	Mean	Median	Minimum	Maximum	Std Dev	Variance	Kurtosis	Skewness	Count
0	28.24%	28.24%	28.24%	28.24%					1
1	2.75%	1.56%	-33.32%	49.82%	0.22	0.05	1.00	0.66	15
2	8.64%	3.46%	-36.60%	66.44%	0.27	0.07	-0.43	0.30	26
3	5.99%	1.24%	-33.34%	55.97%	0.24	0.06	-0.58	0.35	31
4	4.96%	-4.89%	-19.03%	54.75%	0.24	0.06	-0.48	0.87	15
5	-5.84%	-5.84%	-5.84%	-5.84%				0.00	1
6	48.82%	48.82%	48.82%	48.82%		0.00		0.49	1

**Figure 7: Mean return percentage resources 3 years large cap**

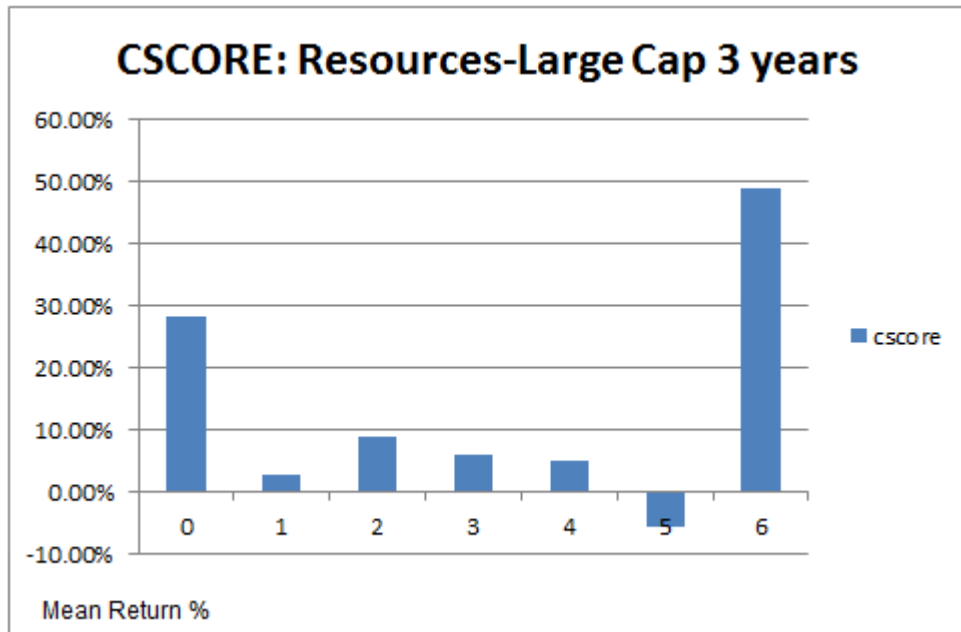


Table 8 is a summary of the descriptive statistics for the resources sector for a three year holding period pertaining to companies in the dataset with a large market capitalisation. Figure 7 indicates a negative return of 5.84% for a C-score of 5 but a positive return of 4.96% and 48.82% for a C-score of 4 and 6 respectively. It is important to note that there was only one data point available for the C-score of 5 and 6, therefore the results may not be deemed significant.

**Table 9: Year 5, Resources – Large Capitalisation**

SUMMARY: Resources - Large Cap Group : 5 Years									
CSCORE	Mean	Median	Minimum	Maximum	Std Dev	Variance	Kurtosis	Skewness	Count
0									0
1	2.87%	-0.84%	-24.84%	51.33%	0.21	0.04	1.60	1.10	12
2	6.82%	2.78%	-19.93%	59.84%	0.21	0.05	0.49	0.82	18
3	2.86%	4.62%	-37.97%	35.74%	0.19	0.03	0.04	-0.40	23
4	4.26%	-2.74%	-16.44%	39.07%	0.20	0.04	-0.54	0.87	11
5	-2.17%	-2.17%	-2.17%	-2.17%					1
6	28.29%	28.29%	28.29%	28.29%					1

**Figure 8: Mean return percentage resources 5 years large cap**

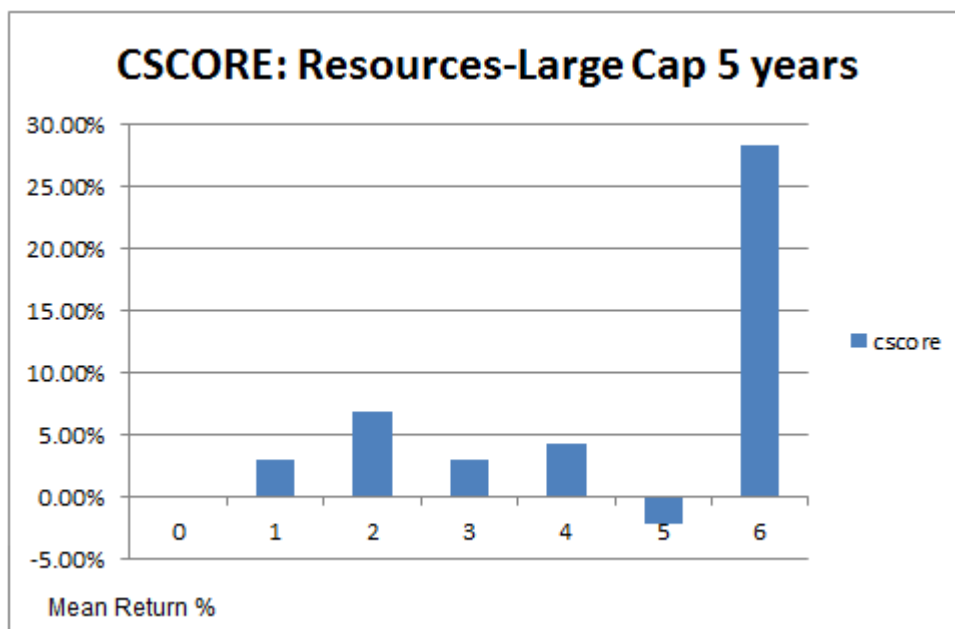


Table 9 is a summary of the descriptive statistics for the resources sector for a holding period of five years, pertaining to companies in the dataset with a large market capitalisation. Figure 8 indicates a positive return of 4.26% and 28.29% for C-score of 4 and 6 respectively. A negative return of 2.17 is indicated for a C-score of 5. For C-scores of 5 and 6, only one data point was used, the results therefore may not be significant.

## 5.5 RESOURCES: MIDDLE CAP GROUP

Table 10: Year 1, Resources – Middle Capitalisation

SUMMARY: Resources - Middle Cap Group : 1 Year									
CSCORE	Mean	Median	Minimum	Maximum	Std Dev	Variance	Kurtosis	Skewness	Count
0	-12.75%	-12.75%	-12.75%	-12.75%					1
1	-20.70%	-32.78%	-105.82%	67.86%	0.54	0.29	-1.14	0.11	15
2	18.49%	14.30%	-59.92%	221.34%	0.68	0.47	5.27	1.93	15
3	-4.00%	-17.29%	-73.60%	100.99%	0.53	0.28	0.48	1.03	12
4	1.25%	2.58%	-56.01%	63.24%	0.43	0.19	-1.82	0.00	10
5	-2.78%	1.59%	-59.70%	45.42%	0.44	0.20	0.11	-0.51	4
6	-20.41%	-20.41%	-20.41%	-20.41%					1

Figure 9: Mean return percentage resources 1 year middle cap

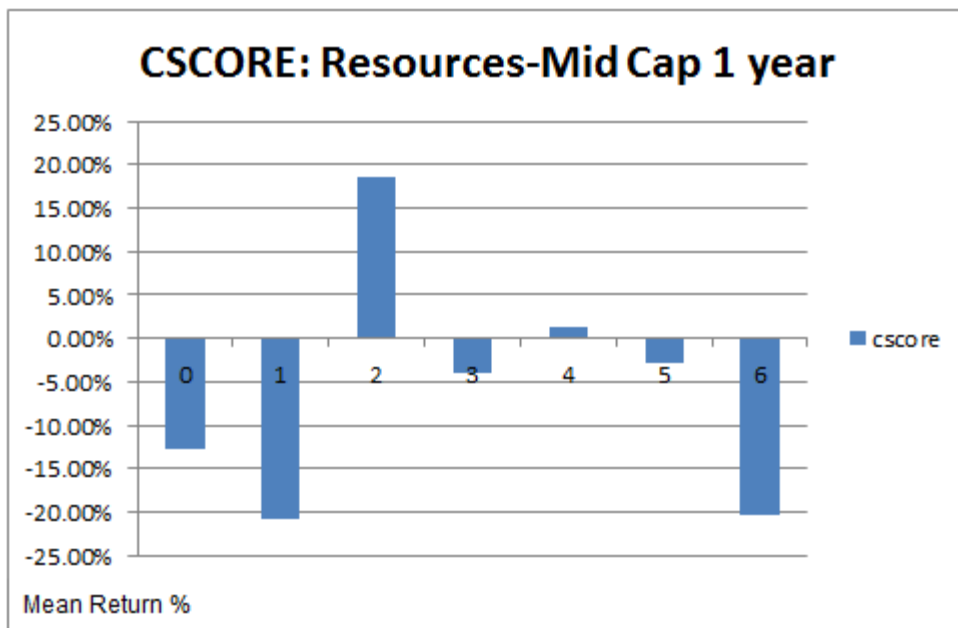


Table 10 is a summary of the descriptive statistics for the resources sector for a holding period of one year pertaining specifically to companies in the dataset with a middle market capitalisation. Figure 9 indicates a negative C-score of 2.78% and 20.41% for a C-score of 5 and 6 respectively. A small positive mean return of 1.25% is indicated for a C-score of 4. It is important to note that four data points were averaged to yield the mean return for C-score 5 and just one data point for C-score 6. The results may thus not be significant.

**Table 11: Year 3, Resources – Middle Capitalisation**

SUMMARY: Resources - Middle Cap Group : 3 Years									
CSCORE	Mean	Median	Minimum	Maximum	Std Dev	Variance	Kurtosis	Skewness	Count
0	-15.52%	-15.52%	-15.52%	-15.52%					1
1	-15.35%	-17.71%	-62.33%	73.71%	0.34	0.11	4.21	1.61	12
2	5.63%	0.29%	-22.11%	52.55%	0.24	0.06	0.41	1.17	12
3	-7.27%	4.28%	-80.07%	45.89%	0.36	0.13	0.49	-0.88	11
4	11.87%	15.01%	-49.75%	73.02%	0.45	0.20	-1.19	0.13	7
5	3.27%	2.11%	-11.36%	19.06%	0.15	0.02		0.34	3
6	-62.08%	-62.08%	-62.08%	-62.08%					1

**Figure 10: Mean return percentage resources 3 years middle cap**

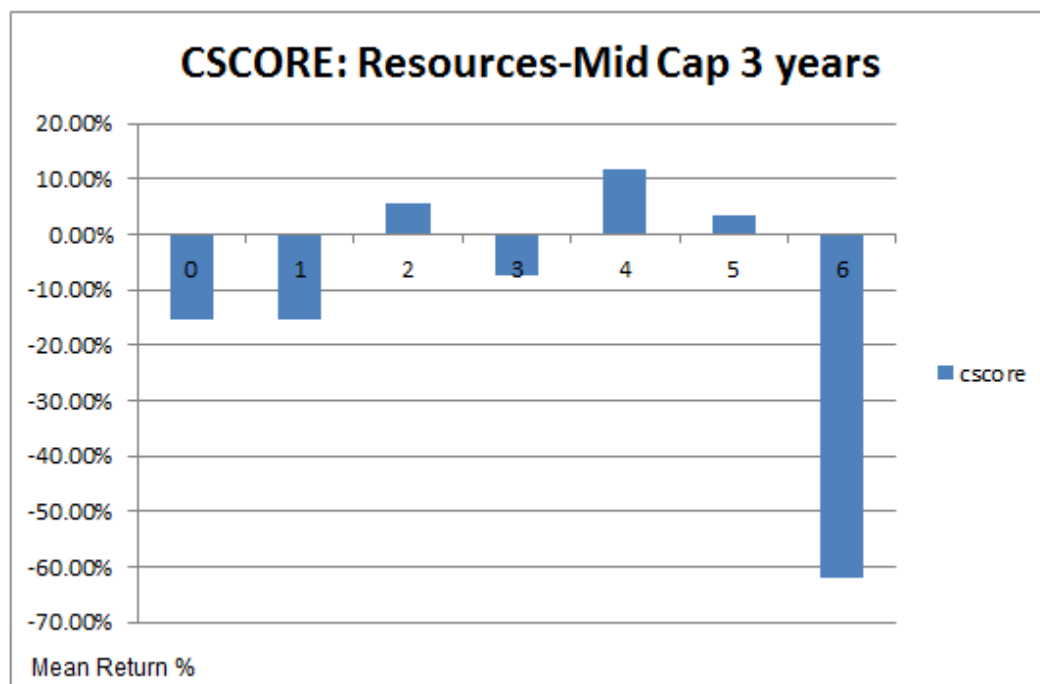


Table 11 is a summary of the descriptive statistics for the resources sector for a holding period of three years, pertaining specifically to companies in the dataset with a middle market capitalisation. Figure 10 indicates a mean positive return of 11.87% and 3.27% for C-score of 4 and 5 respectively. A negative mean return of 62.08% is indicated for a C-score of 6. Four data points were averaged to yield the mean return for C-score 5 and just one data point for C-score 6. The results may thus not be significant.

**Table 12: Year 5, Resources – Middle Capitalisation**

SUMMARY: Resources - Middle Cap Group : 5 Years									
CSCORE	Mean	Median	Minimum	Maximum	Std Dev	Variance	Kurtosis	Skewness	Count
0	28.15%	28.15%	28.15%	28.15%					1
1	-14.23%	-10.99%	-51.89%	14.11%	0.22	0.05	-0.93	-0.41	9
2	13.93%	8.75%	-26.12%	85.89%	0.37	0.14	0.26	1.02	11
3	-23.39%	-17.88%	-59.64%	2.67%	0.25	0.06	-1.17	-0.61	8
4	2.38%	2.71%	-24.28%	28.37%	0.25	0.06	-4.24	-0.04	4
5	-0.52%	-0.52%	-0.52%	-0.52%					1
6	0.00%	0.00%	0.00%	0.00%					0

**Figure 11: Mean return percentage resources 5 years middle cap**

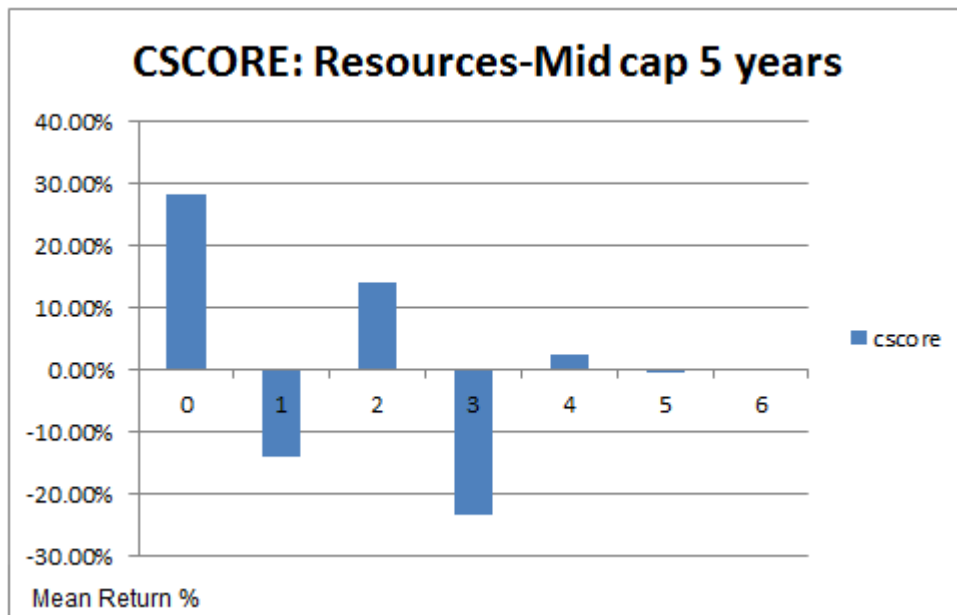


Table 12 is a summary of the descriptive statistics for the resources sector for a holding period of five years, pertaining specifically to companies in the dataset with a middle market capitalisation. Figure 11 indicates a negative mean return of 0.52% for a C-score of 5. Results may not be significant as only one data point is representative of the return for the C-score of 5. No data points were available for C-score zero.



## 5.6 RESOURCES: SMALL CAP GROUP

Table 13: Year 1, Resources – Small Capitalisation

SUMMARY: Resources - Small Cap Group : 1 Year									
CSCORE	Mean	Median	Minimum	Maximum	Std Dev	Variance	Kurtosis	Skewness	Count
0	-48.14%	-80.39%	-97.32%	102.96%	0.77	0.60	4.32	2.05	6
1	-45.81%	-44.91%	-59.87%	-28.77%	0.13	0.02	-1.74	0.05	6
2	-14.54%	-37.94%	-150.86%	159.67%	0.71	0.50	1.90	0.75	16
3	14.62%	-7.83%	-56.67%	172.33%	0.75	0.56	0.50	1.31	13
4	-1.61%	-42.78%	-82.77%	151.44%	0.80	0.63	-0.03	1.04	9
5	-16.13%	-35.11%	-53.66%	59.34%	0.52	0.27	2.84	1.69	4
6	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00	0.00	0

Figure 12: Mean return percentage resources 1 year small cap

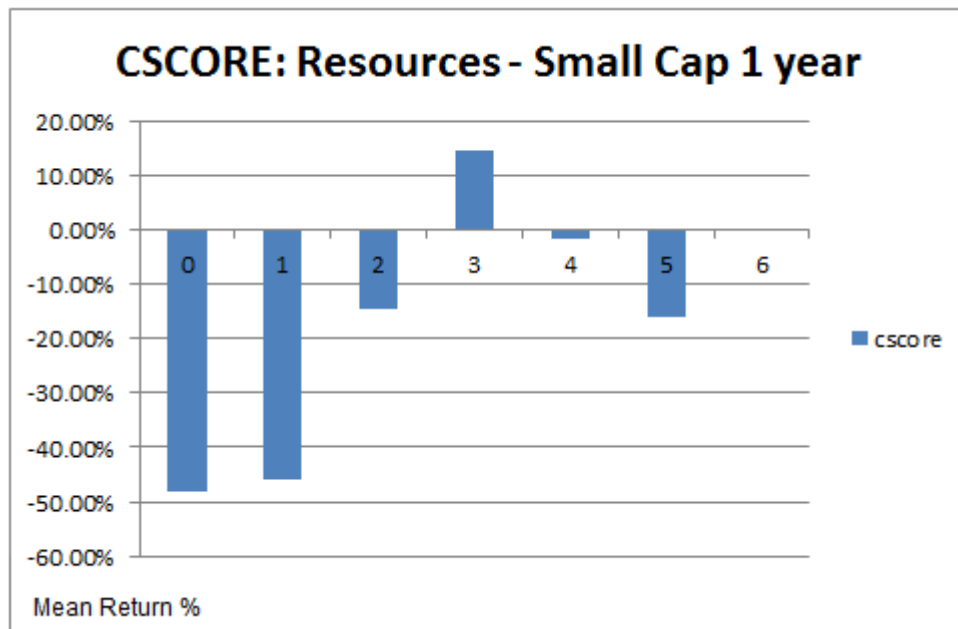


Table 13 is a summary of the descriptive statistics for the resources sector for a one year holding period, pertaining specifically to companies in the dataset with a low market capitalisation. Figure 12 indicates a negative return of 1.61% and 16.13% for C-score of 4 and 5 respectively. No data points were available for a C-score of 6.

**Table 14: Year 3, Resources – Small Capitalisation**

SUMMARY: Resources - Small Cap Group : 3 Years									
CSCORE	Mean	Median	Minimum	Maximum	Std Dev	Variance	Kurtosis	Skewness	Count
0	-31.15%	-40.59%	-74.74%	41.70%	0.44	0.19	3.00	1.49	5
1	-20.23%	-17.79%	-30.37%	-14.98%	0.07	0.00	2.58	-1.62	4
2	-23.55%	-14.26%	-62.42%	21.91%	0.32	0.10	-1.76	0.13	11
3	17.38%	2.54%	-39.60%	142.85%	0.59	0.35	2.60	1.53	8
4	-1.10%	11.16%	-48.85%	57.46%	0.46	0.21	-2.03	0.16	7
5	-32.56%	-35.60%	-55.97%	-3.08%	0.27	0.07	-4.83	0.20	4
6	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00	0.00	0

**Figure 13: Mean return percentage resources 3 years small cap**

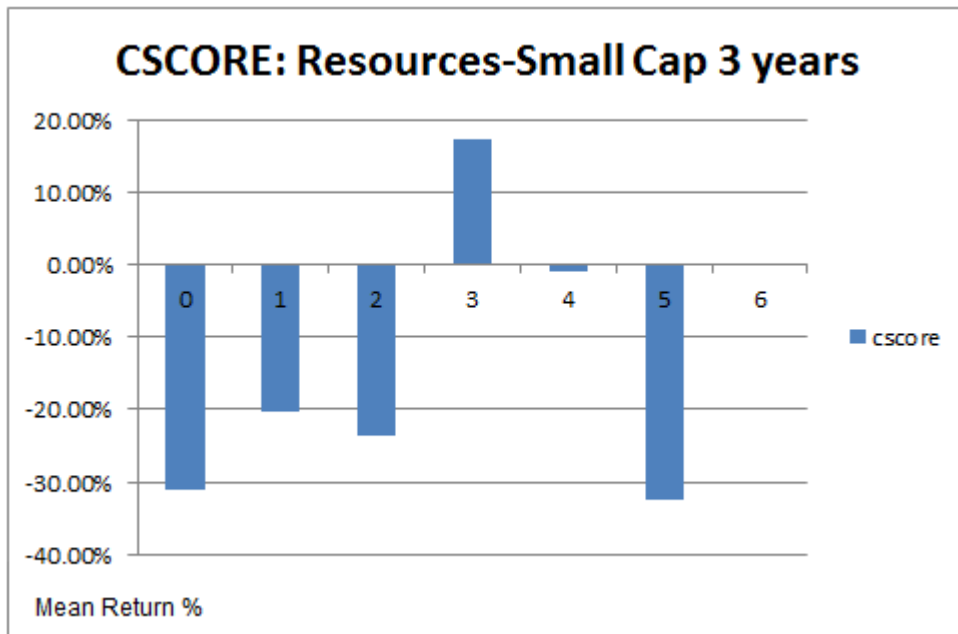


Table 14 is a summary of the descriptive statistics for the resources sector for a holding period of 3 years, pertaining specifically to companies in the dataset with a low market capitalisation. Figure 13 indicates a negative return of 1.10% and 32.56% for C-score of 4 and 5 respectively. No data points were available for a C-score of 6.

**Table 15: Year 5, Resources – Small Capitalisation**

SUMMARY: Resources - Small Cap Group : 5 Years									
CSCORE	Mean	Median	Minimum	Maximum	Std Dev	Variance	Kurtosis	Skewness	Count
0	-30.15%	-38.29%	-61.91%	9.76%	0.37	0.13		0.95	3
1	-14.38%	-14.38%	-26.52%	-2.23%	0.17	0.03			2
2	-25.57%	-35.76%	-60.93%	33.12%	0.34	0.12	0.70	1.09	6
3	-0.59%	-5.72%	-47.29%	65.38%	0.40	0.16	0.47	0.77	6
4	-10.00%	-27.29%	-42.31%	56.88%	0.46	0.21	2.95	1.72	4
5	-12.28%	-12.28%	-15.19%	-9.38%	0.04	0.00			2
6	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00	0.00	0

**Figure 14: Mean return percentage resources 5 years small cap**

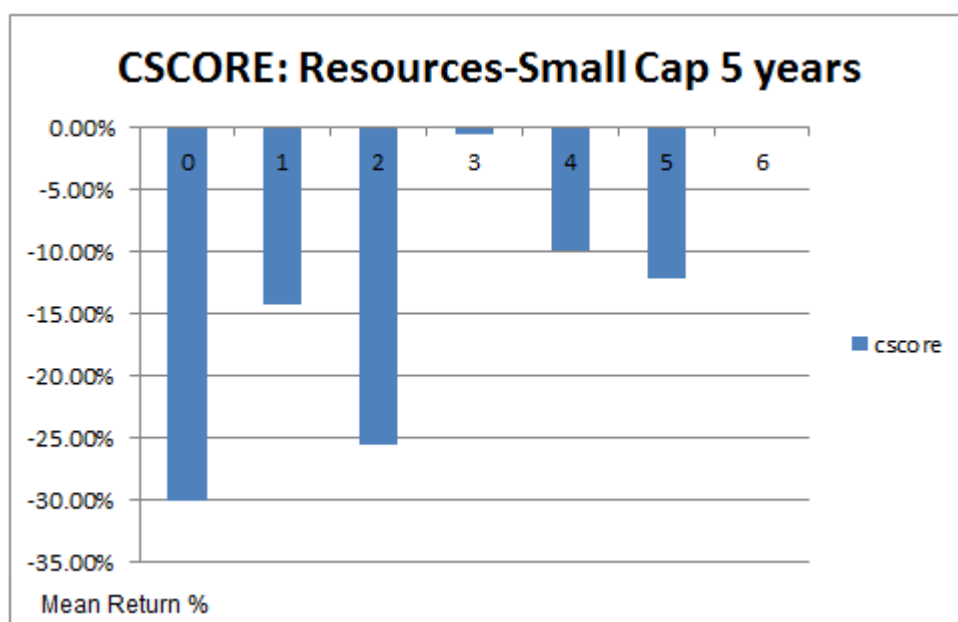


Table 15 is a summary of the descriptive statistics for the resources sector for a holding period of five years, pertaining specifically to companies in the dataset with a low market capitalisation. Figure 14 indicates a negative return of 10% and 12.28% for C-scores of 4 and 5 respectively. However just four and two data points were averaged to yield the returns for C-scores of 4 and 6 respectively. Therefore the results may not be significant. No data points were available for a C-score of 6.

## 5.7 INDUSTRIALS SECTOR

Table 16: Year 1, Industrials

SUMMARY: Industrials 1 Year									
CSCORE	Mean	Median	Minimum	Maximum	Std Dev	Variance	Kurtosis	Skewness	Count
0	-9.76%	-19.60%	-98.12%	219.55%	0.60	0.36	4.62	1.71	41
1	-1.22%	-15.03%	-120.69%	1531.33%	1.40	1.95	106.52	9.69	139
2	25.40%	-6.89%	-101.72%	4758.24%	3.28	10.75	203.50	14.05	217
3	1.73%	-8.72%	-108.40%	654.91%	0.69	0.47	39.54	4.84	247
4	1.34%	-5.44%	-103.59%	271.37%	0.49	0.24	6.18	1.70	195
5	12.41%	0.20%	-73.64%	540.53%	0.69	0.47	34.84	4.72	100
6	5.45%	1.10%	-67.81%	149.42%	0.55	0.30	2.17	1.31	20

Figure 15: Mean returns percentage industrials 1 year

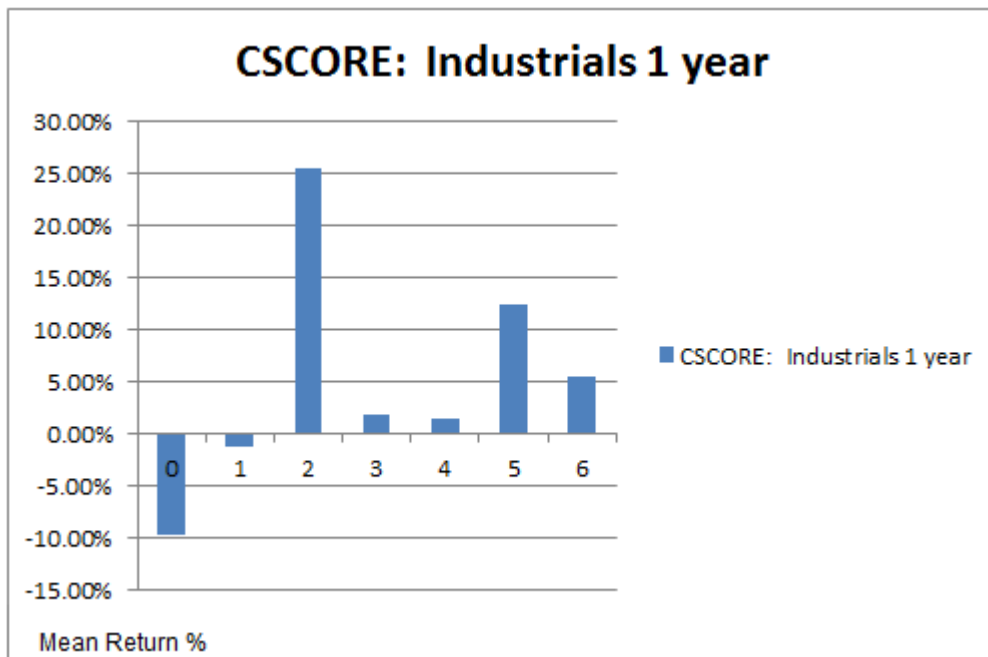


Table 16 is a summary of the descriptive statistics for the industrial sector for a one year holding period. Figure 15 indicates positive mean returns of 1.34%, 12.41% and 5.45% for the C-scores of 4, 5 and 6 respectively. The C-score thus appears ineffective for this holding period.

**Table 17: Year 3, Industrials**

SUMMARY: Industrials 3 Year									
CSCORE	Mean	Median	Minimum	Maximum	Std Dev	Variance	Kurtosis	Skewness	Count
0	-8.07%	-14.88%	-76.64%	159.60%	0.42	0.18	7.86	2.22	31
1	-13.95%	-14.33%	-72.36%	134.75%	0.34	0.12	2.85	1.06	99
2	-6.63%	-8.25%	-77.12%	253.96%	0.40	0.16	20.16	3.31	158
3	-3.17%	-6.19%	-81.36%	164.99%	0.35	0.12	4.72	1.49	197
4	4.64%	-3.39%	-59.98%	293.32%	0.45	0.20	16.38	3.28	142
5	10.56%	3.53%	-52.71%	185.52%	0.41	0.17	4.10	1.57	72
6	23.59%	15.25%	-32.27%	214.09%	0.59	0.35	7.62	2.56	16

**Figure 16: Mean return percentage industrials 3 years**

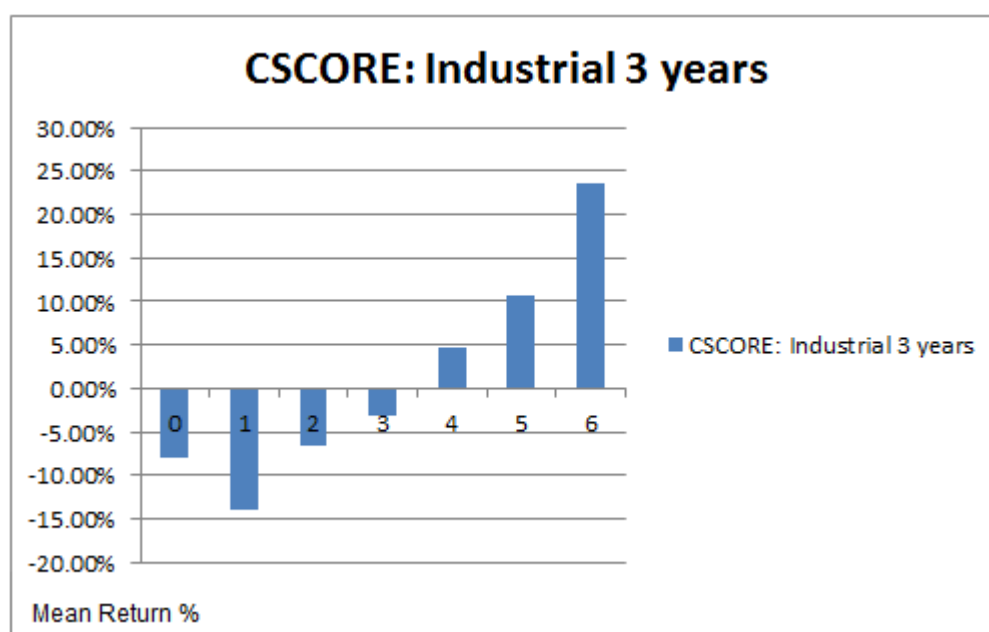


Table 17 is a summary of descriptive statistics for the industrials sector for a holding period of three years. Figure 16 indicates a positive mean return of 4.64%, 10.56% and 23.59% for the C-scores of 4, 5 and 6 respectively. The C-score thus also appears ineffective for this holding period.

**Table 18: Year 5, Industrials**

SUMMARY: Industrials 5 Year									
CSCORE	Mean	Median	Minimum	Maximum	Std Dev	Variance	Kurtosis	Skewness	Count
0	-9.06%	-12.53%	56.78%	98.89%	0.30	0.09	7.91	2.15	21.00
1	-13.35%	-6.46%	-117.29%	28.88%	0.25	0.06	3.32	-1.44	64.00
2	-4.70%	-3.36%	-234.40%	91.08%	0.32	0.10	22.59	-2.87	113.00
3	-3.75%	-6.18%	-118.82%	89.55%	0.26	0.07	3.44	0.07	139.00
4	0.17%	-1.65%	-48.49%	117.09%	0.28	0.08	5.34	1.68	85
5	6.26%	-2.59%	-50.60%	105.02%	0.31	0.10	4.41	1.87	40
6	-13.43%	-9.64%	-50.15%	39.67%	0.28	0.08	2.12	0.99	7

**Figure 17: Mean return percentage industrials 5 years**

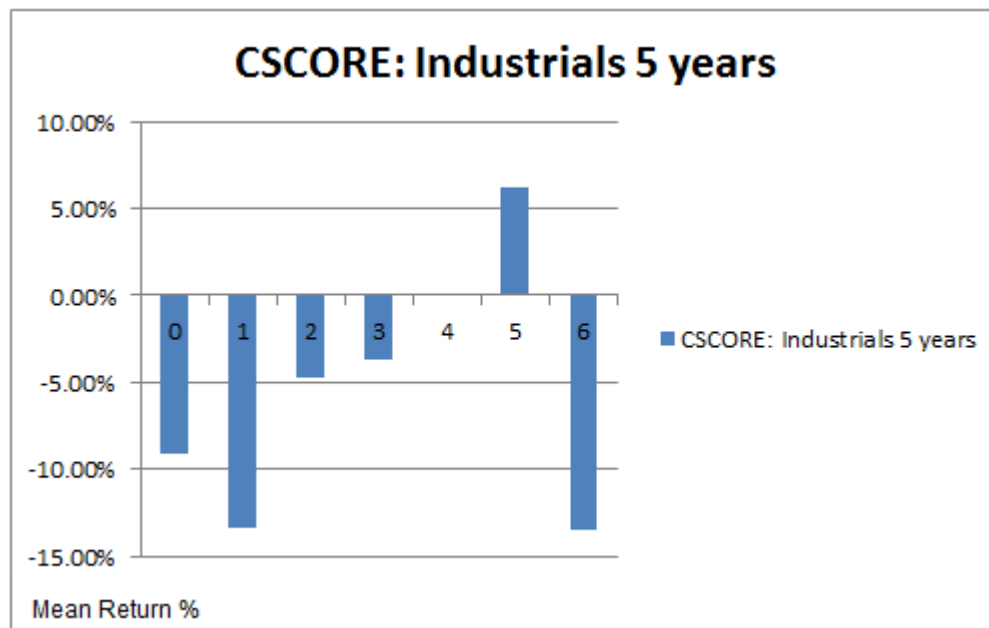


Table 18 is a summary of the descriptive statistics for the industrial sector for a five year holding period. Figure 17 indicates a negative mean return of 13.43% for a C-score of 6. The mean return for C-scores of 4 and 5 are positive at 0.17% and 6.26% respectively. Whilst it could be inferred that the five year holding period is moderately predictive for the industrial sector's C-scores, the influence of the 2008-2009 global financial crisis cannot be ignored.

## 5.8 INDUSTRIALS: MANUFACTURING SECTOR

Table 19: Year 1, Industrials – Manufacturing Sector

SUMMARY: Industrials - Manufacturing Sector: 1 Year									
CSCORE	Mean	Median	Minimum	Maximum	Std Dev	Variance	Kurtosis	Skewness	Count
0	-22.41%	-25.49%	-98.12%	134.29%	0.52	0.27	3.06	1.22	21
1	3.05%	-17.22%	-120.69%	1531.32%	1.82	3.30	68.42	8.04	77
2	3.09%	-11.49%	-101.72%	253.96%	0.67	0.45	4.25	1.87	96
3	-8.99%	-11.22%	-99.07%	166.55%	0.43	0.19	2.14	0.85	124
4	-8.26%	-11.78%	-91.44%	130.31%	0.37	0.13	2.33	0.97	101
5	-3.43%	-4.25%	-68.06%	88.31%	0.36	0.13	-0.23	0.41	45
6	-0.12%	-7.73%	-59.79%	126.80%	0.51	0.26	3.33	1.50	11

Figure 18: Mean return percentage manufacturing 1 year

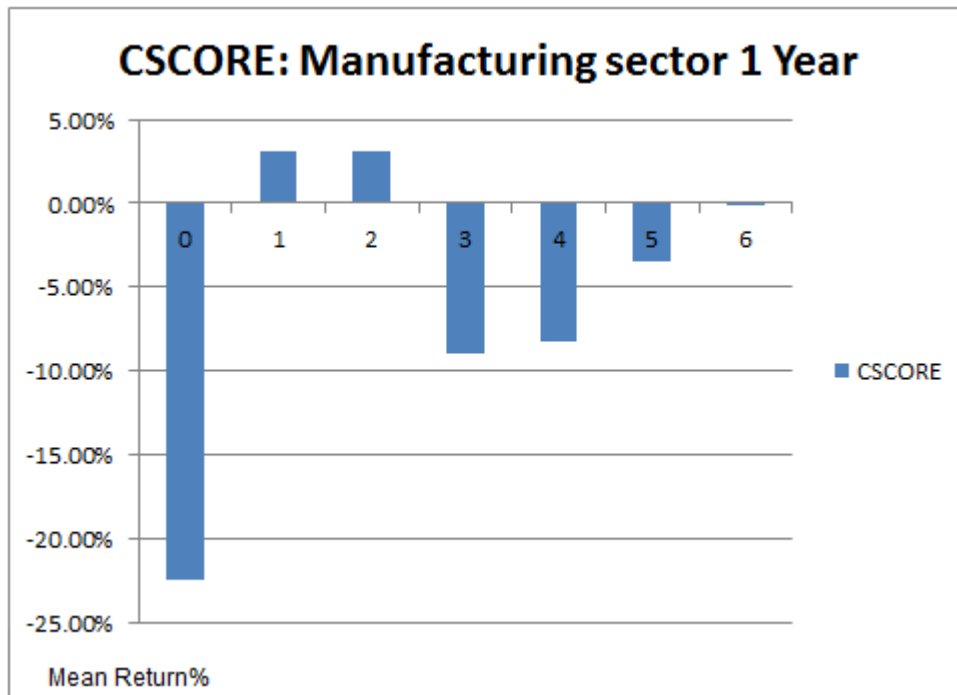


Table 19 is a summary of the descriptive statistics for the industrials sector for a one year holding period, pertaining specifically to companies in the dataset that are classified as being manufacturers. Figure 18 indicates a negative mean return of 8.26%, 3.43% and 0.12% for C-scores of 4, 5 and 6 respectively. The C-score appears to be more effective for this holding period.

**Table 20: Year 3, Industrials – Manufacturing Sector**

SUMMARY: Industrials - Manufacturing Sector: 3 Years									
CSCORE	Mean	Median	Minimum	Maximum	Std Dev	Variance	Kurtosis	Skewness	Count
0	-19.75%	-21.14%	-76.64%	72.61%	0.37	0.14	1.65	1.01	16
1	-17.79%	-19.28%	-72.36%	134.75%	0.35	0.12	5.44	1.64	57
2	-16.11%	-13.21%	-77.12%	21.80%	0.22	0.05	-0.10	-0.54	64
3	-9.95%	-13.96%	-61.04%	87.93%	0.27	0.07	2.21	1.14	102
4	-7.24%	-10.45%	-59.98%	111.04%	0.31	0.10	2.52	1.23	76
5	2.59%	-3.75%	-58.71%	125.82%	0.37	0.13	2.69	1.26	35
6	3.40%	10.65%	-34.59%	25.26%	0.20	0.04	-0.01	-0.84	9

**Figure 19: Mean return percentage manufacturing 3 years**

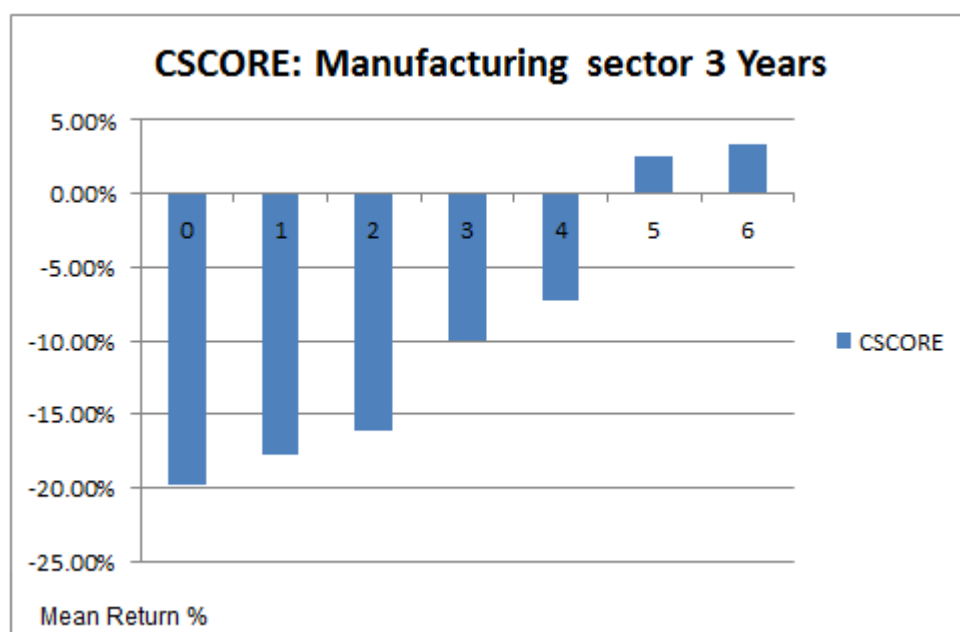


Table 20 is a summary of the descriptive statistics for the industrials sector for a holding period of 3 years, pertaining specifically to companies in the dataset which have been classified as being manufacturers. Figure 19 indicates a positive mean return of 2.59% and 3.40% for C-scores of 5 and 6 respectively. A negative mean return of 7.24% is indicated for a C-score of 4. The C-score thus appears less effective for this holding period.



**Table 21: Year 5, Industrials – Manufacturing Sector**

SUMMARY: Industrials - Manufacturing Sector: 5 Years									
CSCORE	Mean	Median	Minimum	Maximum	Std Dev	Variance	Kurtosis	Skewness	Count
0	-28.69%	-30.86%	-56.78%	-2.17%	0.17	0.03	-0.52	-0.09	10.00
1	-17.84%	-14.86%	-70.05%	10.94%	0.20	0.04	-0.22	-0.61	39.00
2	-10.86%	-12.39%	-51.07%	43.57%	0.18	0.03	1.06	0.33	47.00
3	-10.22%	-12.42%	-57.27%	86.56%	0.23	0.05	4.10	1.37	72.00
4	-7.83%	-7.97%	-51.82%	67.11%	0.22	0.05	1.63	0.73	45
5	-1.31%	-5.39%	-50.60%	89.84%	0.27	0.07	5.52	1.59	23
6	-7.75%	-28.34%	-31.50%	36.60%	0.38	0.15		1.72	3

**Figure 20: Mean return percentage manufacturing 5 years**

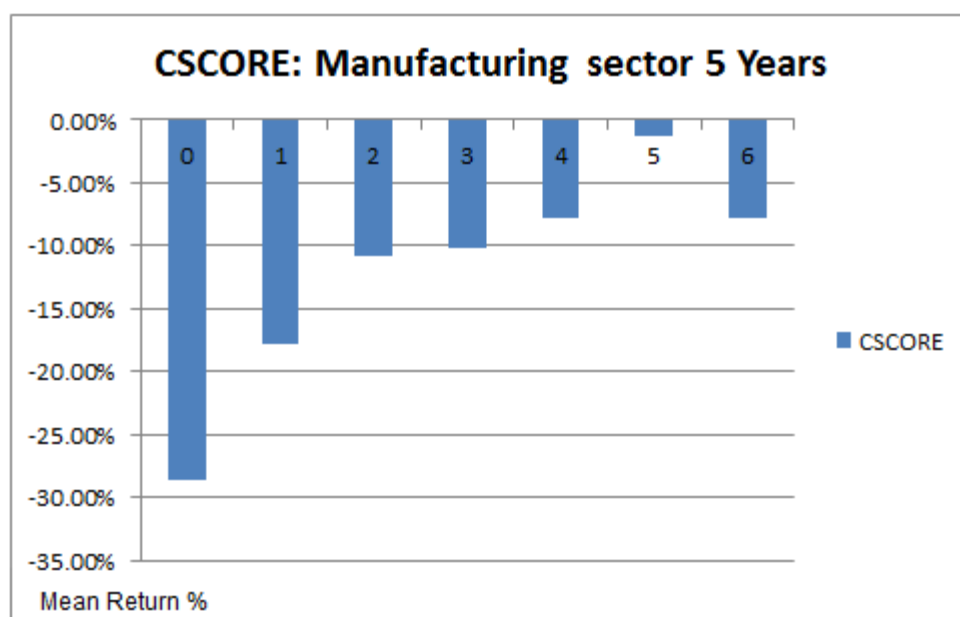


Table 21 is a summary of the descriptive statistics for the industrials sector for a holding period of five years, pertaining specifically to companies in the dataset which have been classified as being manufacturers. Figure 20 indicates a negative mean return of 7.83%, 1.31% and 7.75% for C-score of 4, 5 and 6 respectively. Whilst the C-score appears more effective for this holding period, the effect of the global financial crisis of 2008-2009 cannot be ignored especially since the returns for all the C-scores in this holding period are negative.

## 5.9 INDUSTRIALS: NON-MANUFACTURING SECTOR

Table 22: Year 1, Industrials – Non-manufacturing Sector

SUMMARY: Industrials - Non-manufacturing Sector: 1 Year									
CSCORE	Mean	Median	Minimum	Maximum	Std Dev	Variance	Kurtosis	Skewness	Count
0	-11.34%	-16.21%	-76.82%	96.73%	0.43	0.19	0.47	0.78	20
1	-13.00%	-9.52%	-117.91%	114.38%	0.45	0.21	0.22	0.04	59
2	34.44%	-8.83%	-92.09%	4758.24%	4.35	18.94	118.49	10.83	121
3	3.33%	-12.41%	-108.40%	654.91%	0.84	0.70	34.90	5.13	124
4	0.16%	-9.34%	-103.59%	255.28%	0.52	0.27	6.05	1.69	94
5	15.25%	2.74%	-73.64%	540.53%	0.84	0.70	28.78	4.67	55
6	6.71%	9.12%	-67.81%	127.66%	0.55	0.31	2.67	1.12	9

Figure 21: Mean return percentage non-manufacturing 1 year

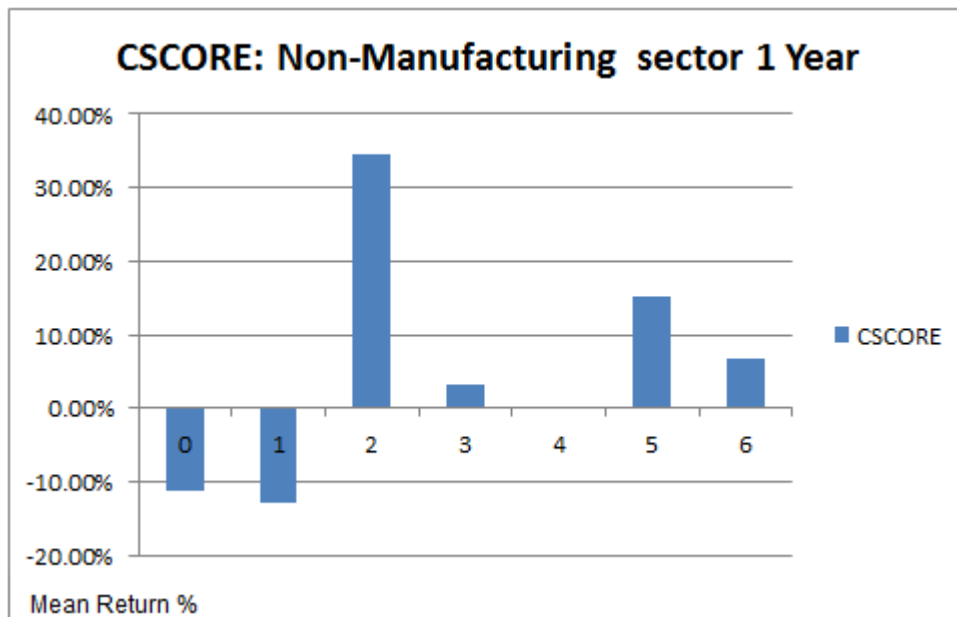


Table 22 is a summary of the descriptive statistics for the industrials sector for a holding period of one year, pertaining specifically to companies in the dataset which have been classified as being non-manufacturers. Figure 21 indicates a positive mean return of 0.16%, 15.25% and 6.71% for C-scores of 4, 5 and 6 respectively. The C-score thus appears less effective for this category's holding period.

**Table 23: Year 3, Industrials – Non-manufacturing Sector**

SUMMARY: Industrials - Non-manufacturing Sector: 3 Years									
CSCORE	Mean	Median	Minimum	Maximum	Std Dev	Variance	Kurtosis	Skewness	Count
0	-9.17%	-12.05%	-45.84%	26.31%	0.19	0.04	-0.01	0.26	15
1	-13.18%	-8.54%	-72.39%	75.94%	0.32	0.10	0.28	0.31	44
2	-8.71%	-8.23%	-77.65%	251.01%	0.38	0.15	21.20	3.14	97
3	-3.71%	-6.09%	-81.36%	164.99%	0.38	0.14	4.16	1.41	94
4	5.13%	-5.44%	-39.88%	268.69%	0.48	0.23	19.68	4.10	65
5	-0.41%	-8.18%	-52.71%	61.54%	0.29	0.08	0.09	0.70	39
6	41.14%	14.72%	-29.76%	214.09%	0.82	0.67	4.14	1.96	7

**Figure 22: Mean return percentage non-manufacturing 3 years**

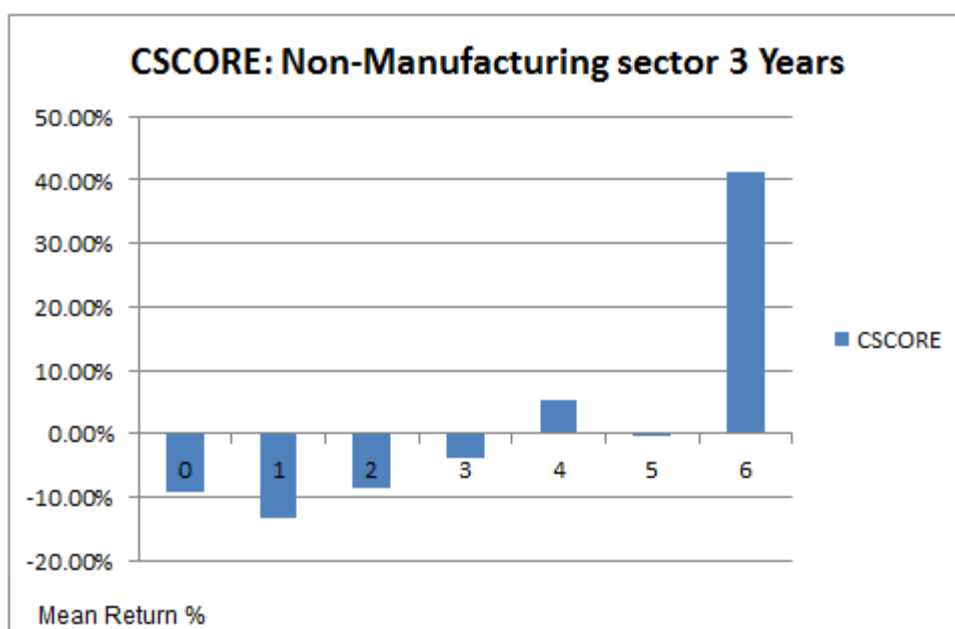


Table 23 is a summary of the descriptive statistics for the industrials sector for a holding period of three years, pertaining specifically to companies in the dataset which have been classified as being non-manufacturers. Figure 22 indicates a positive mean return of 5.13% and 41.14% for C-score of 4 and 6 respectively. A negative mean return of 0.41% is indicated for a C-score of 5. The large positive return for the C-score of 6 is attributable to a large increase in the share price of Metrofile Holdings Limited from June 2006 to June 2007. If the Metrofile Holdings Limited data point was removed a positive mean return of 19.66% would be shown.

**Table 24: Year 5, Industrials – Non-manufacturing Sector**

SUMMARY: Industrials - Non-manufacturing Sector: 5 Years										
CSCORE	Mean	Median	Minimum	Maximum	Std Dev	Variance	Kurtosis	Skewness	Count	
0	-0.64%	-6.95%	-22.52%	71.53%	0.25	0.06	7.84	2.65	11	
1	-11.56%	-8.09%	-64.53%	28.88%	0.22	0.05	0.89	-0.79	26	
2	-6.47%	-6.26%	-234.40%	70.23%	0.37	0.14	21.15	-3.39	69	
3	-7.57%	-8.63%	-51.22%	57.64%	0.20	0.04	0.62	0.33	69	
4	-0.39%	-5.30%	-35.32%	108.77%	0.26	0.07	7.11	1.97	39	
5	-6.51%	-8.43%	-37.81%	28.34%	0.15	0.02	1.30	0.47	19	
6	-19.60%	-9.94%	-50.15%	-8.37%	0.20	0.04	3.97	-1.99	4	

**Figure 23: Mean return percentage non-manufacturing 5 years**



Table 24 is a summary of the descriptive statistics for the industrials sector for a holding period of five years, pertaining specifically to companies in the dataset which have been classified as being non-manufacturers. Figure 23 indicates a negative mean return of 0.39%, 6.51% and 19.60% for C-scores of 4, 5 and 6 respectively. The C-score appears to be more predictive for this category’s holding period, however the effect of the global financial crisis must be considered as all the returns in this category are negative for this period.

## 5.10 INDUSTRIALS: LARGE CAP GROUP

Table 25: Year 1, Industrials – Large Capitalisation

SUMMARY: Industrials - Large Cap Group : 1 Year									
CSCORE	Mean	Median	Minimum	Maximum	Std Dev	Variance	Kurtosis	Skewness	Count
0	7.44%	-3.12%	-57.55%	219.55%	0.66	0.44	5.72	2.12	18
1	1.97%	-3.40%	-80.56%	193.76%	0.48	0.23	5.06	1.76	48
2	11.98%	0.94%	-77.57%	207.06%	0.46	0.21	4.10	1.72	90
3	5.89%	-0.96%	-75.40%	165.64%	0.40	0.16	3.40	1.46	106
4	6.04%	-1.40%	-47.85%	215.62%	0.41	0.17	7.63	2.07	79
5	24.10%	12.72%	-28.63%	138.28%	0.41	0.17	0.49	0.93	50
6	10.46%	11.31%	-13.97%	42.69%	0.18	0.03	-0.16	0.47	8

Figure 24: Mean return percentage industrials 1 year large cap

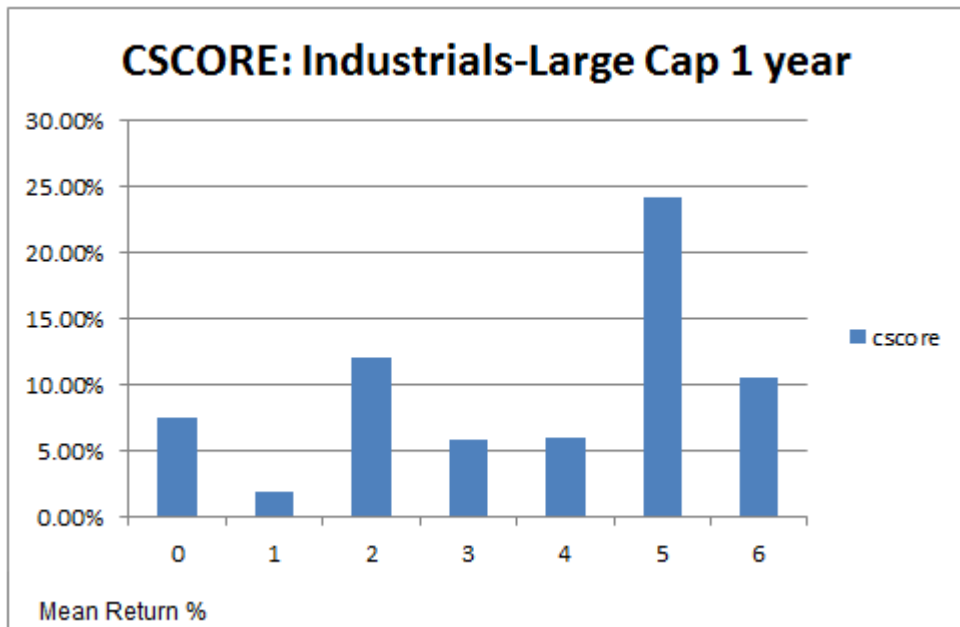


Table 25 is a summary of the descriptive statistics for the industrials sector for a holding period of one year, pertaining specifically to companies in the dataset that have a large market capitalisation. Figure 24 indicates a mean positive return for all the C-scores in this category and for this holding period. The C-score is thus not effective for this category's holding period.

**Table 26: Year 3, Industrials – Large Capitalisation**

SUMMARY: Industrials - Large Cap Group : 3 Years										
CSCORE	Mean	Median	Minimum	Maximum	Std Dev	Variance	Kurtosis	Skewness	Count	
0	4.91%	-4.09%	-45.84%	159.60%	0.48	0.23	7.54	2.45	16	
1	-6.14%	-5.30%	-72.26%	81.14%	0.27	0.07	2.92	0.40	33	
2	4.10%	2.44%	-69.47%	105.41%	0.26	0.07	4.01	0.65	71	
3	6.07%	1.66%	-45.96%	153.30%	0.29	0.08	9.35	2.41	86	
4	2.66%	-2.87%	-38.00%	171.22%	0.31	0.10	14.46	3.26	61	
5	19.79%	4.10%	-39.12%	185.52%	0.47	0.22	3.64	1.75	37	
6	12.04%	17.50%	-29.42%	64.91%	0.31	0.10	0.33	0.49	7	

**Figure 25: Mean return percentage industrials 3 years large cap**

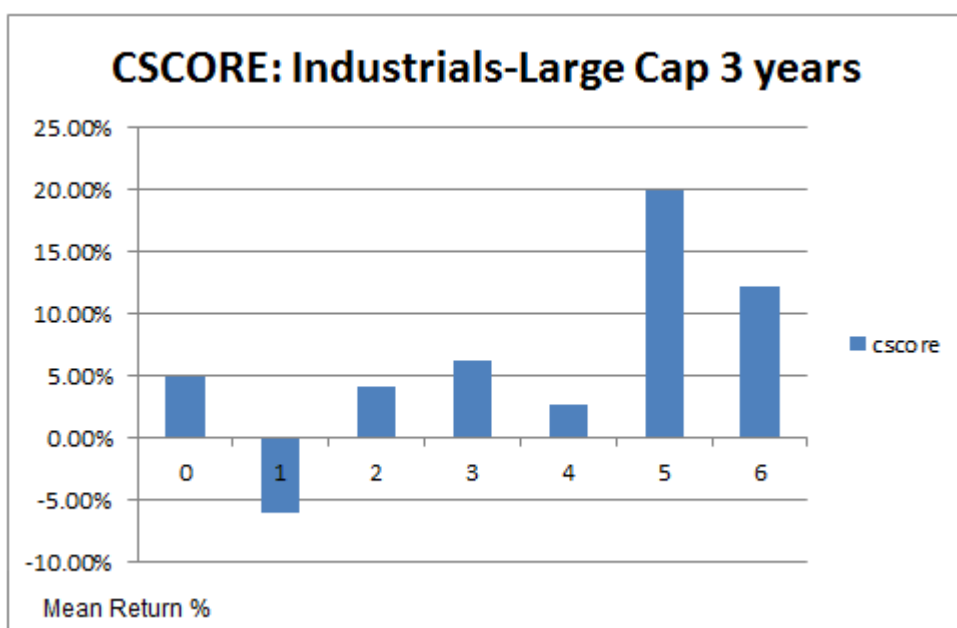


Table 26 is a summary of the descriptive statistics for the industrials sector for a holding period of three years, pertaining specifically to companies in the dataset that have a large market capitalisation. Figure 25 indicates a positive mean return of 2.66%, 19.79% and 12.04% for C-scores of 4, 5 and 6 respectively. The C-score is not effective for this category's holding period.

**Table 27: Year 5, Industrials – Large Capitalisation**

SUMMARY: Industrials - Large Cap Group : 5 Years									
CSCORE	Mean	Median	Minimum	Maximum	Std Dev	Variance	Kurtosis	Skewness	Count
0	-6.32%	-4.30%	-29.16%	14.78%	0.14	0.02	-0.70	-0.31	10
1	-4.02%	-3.49%	-64.34%	31.16%	0.20	0.04	2.89	-1.23	24
2	0.11%	4.95%	-229.84%	73.27%	0.37	0.14	24.45	-3.93	60
3	0.68%	-1.65%	-39.94%	56.75%	0.19	0.03	1.19	0.67	66
4	3.57%	2.00%	-39.85%	113.31%	0.26	0.07	7.86	1.98	38
5	8.20%	-2.50%	-20.69%	105.02%	0.33	0.11	5.38	2.43	21
6	-8.83%	-8.83%	-17.66%	200.00%	0.01	0.00	0.02	-0.10	2

**Figure 26: Mean return percentage industrials 5 years large cap**

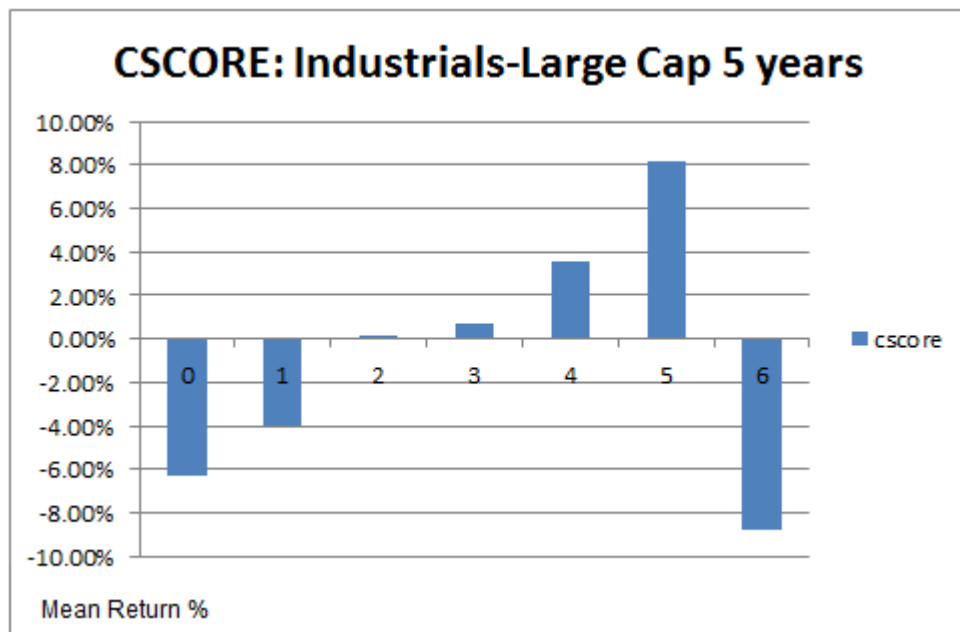


Table 27 is a summary of the descriptive statistics for the industrials sector for a holding period of five years, pertaining specifically to companies in the dataset that have a large market capitalisation. Figure 26 indicates a negative mean return of 8.83% for a C-score of 6, however just 2 data points were averaged to yield this return; therefore it may not be significant. A positive return of 3.57% and 8.20 is indicated for C-scores of 4 and 5 respectively. The C-score appears less effective for this category’s holding period.

The C-score appears ineffective for the category of large cap companies for all 3 holding periods.

## 5.11 INDUSTRIALS: MIDDLE CAP GROUP

Table 28: Year 1, Industrials - Middle Capitalisation

SUMMARY: Industrials - Middle Cap Group : 1 Year									
CSCORE	Mean	Median	Minimum	Maximum	Std Dev	Variance	Kurtosis	Skewness	Count
0	3.94%	-2.13%	-76.82%	134.3%	0.68	0.46	1.00	0.90	8
1	25.83%	-3.98%	-116.75%	1531.3%	2.29	5.25	43.05	6.43	47
2	6.14%	-6.12%	-87.91%	254.0%	0.54	0.29	6.62	1.91	62
3	9.07%	-9.96%	-108.40%	654.9%	1.11	1.22	22.30	4.35	62
4	12.03%	-1.95%	-83.44%	271.4%	0.56	0.32	7.51	2.10	54
5	16.19%	-9.47%	-64.45%	540.5%	1.05	1.11	21.79	4.34	31
6	19.55%	10.18%	-48.65%	149.4%	0.77	0.59	3.09	1.64	5

Figure 27: Mean return percentage industrials 1 year middle cap

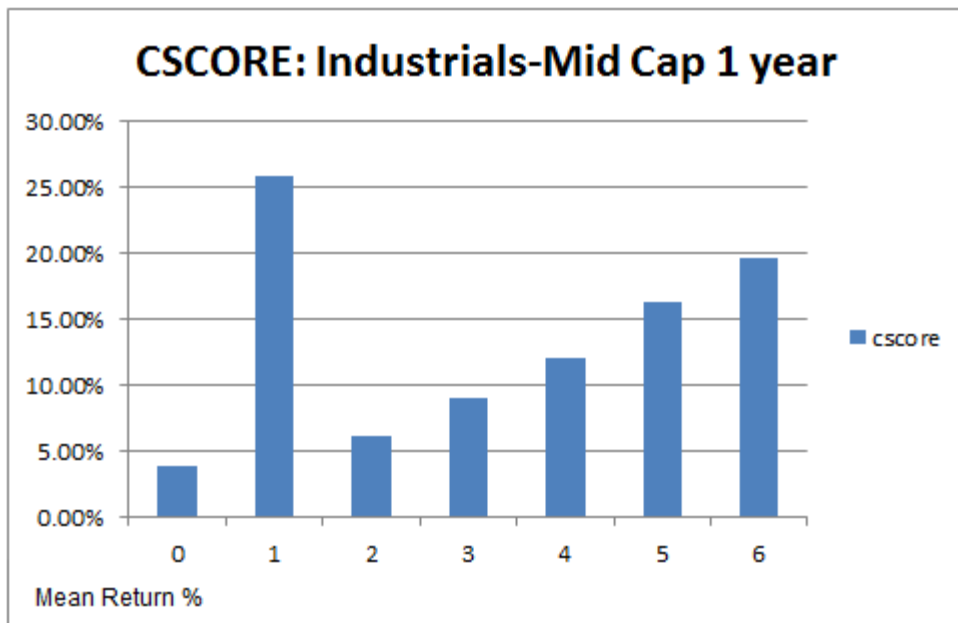


Table 28 is a summary of the descriptive statistics for the industrials sector for a holding period of one year, pertaining specifically to companies in the dataset that have a middle market capitalisation. Figure 27 indicates that all the returns for this category, for a one year holding period, are positive. The C-score is thus ineffective.



**Table 29: Year 3, Industrials – Middle Capitalisation**

SUMMARY: Industrials - Middle Cap Group : 3 Years									
CSCORE	Mean	Median	Minimum	Maximum	Std Dev	Variance	Kurtosis	Skewness	Count
0	-2.77%	-17.83%	-37.17%	72.61%	0.37	0.13	3.53	1.78	7
1	-4.29%	-9.00%	-71.97%	134.75%	0.44	0.20	1.62	0.93	33
2	-10.99%	-9.37%	-72.97%	35.59%	0.22	0.05	0.61	-0.34	42
3	-1.21%	-13.00%	-81.36%	114.99%	0.42	0.18	0.82	1.11	51
4	5.91%	0.60%	-46.61%	87.71%	0.33	0.11	0.24	0.68	38
5	3.87%	-5.53%	-50.89%	132.99%	0.41	0.17	3.24	1.55	24
6	69.53%	18.13%	5.67%	214.09%	0.89	0.80	1.26	1.43	5

**Figure 28: Mean return percentage industrials 3 years middle cap**

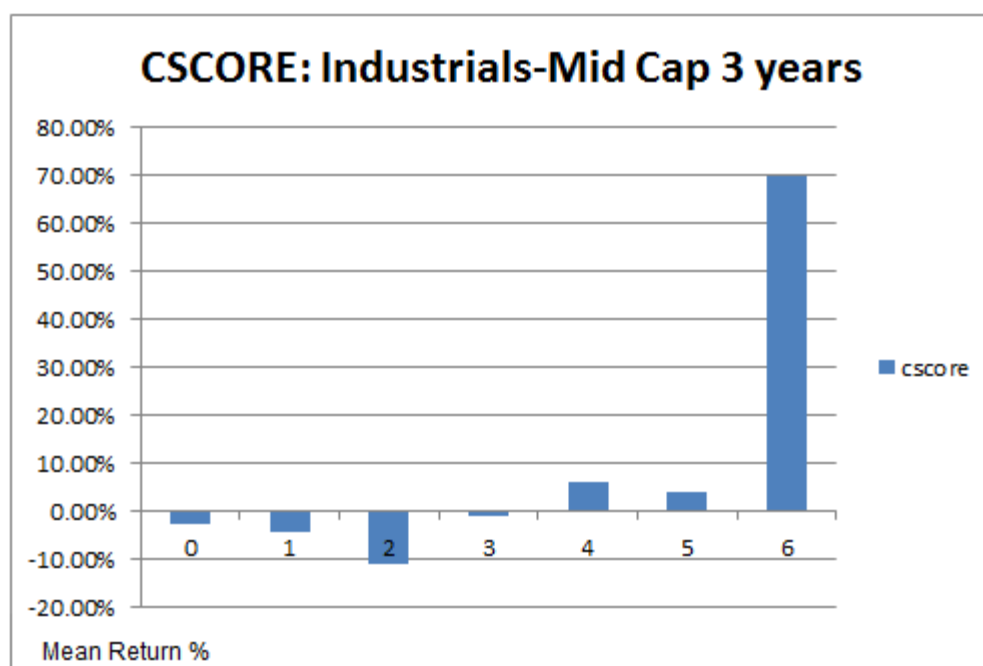


Table 29 is a summary of the descriptive statistics for the industrials sector for a holding period of three years, pertaining specifically to companies in the dataset that have a middle market capitalisation. Figure 28 indicates a positive mean return of 5.91%, 3.87% and 69.53% for C-scores of 4, 5 and 6 respectively. The large positive return for the C-score of 6 is attributed to a large increase in Metrofile Holdings Limited's share price during June 2006 and June 2007. The C-score however remains ineffective for this category's holding period.

**Table 30: Year 5, Industrials – Middle Capitalisation**

SUMMARY: Industrials - Middle Cap Group : 5 Years									
CSCORE	Mean	Median	Minimum	Maximum	Std Dev	Variance	Kurtosis	Skewness	Count
0	-17.47%	-17.51%	-38.62%	3.76%	0.19	0.04	-3.08	0.01	4
1	-6.22%	1.36%	-56.94%	21.15%	0.20	0.04	0.71	-1.10	24
2	-2.99%	-5.13%	-45.87%	51.42%	0.23	0.05	0.30	0.56	32
3	-6.78%	-13.17%	-57.27%	89.55%	0.29	0.08	3.86	1.74	35
4	5.19%	4.95%	-37.55%	71.94%	0.26	0.07	0.74	0.42	21
5	6.67%	0.79%	-34.94%	93.28%	0.28	0.08	6.12	2.07	17
6	-13.84%	-31.04%	-50.15%	39.67%	0.47	0.22		1.42	3

**Figure 29: Mean return percentage industrials 5 years middle cap**

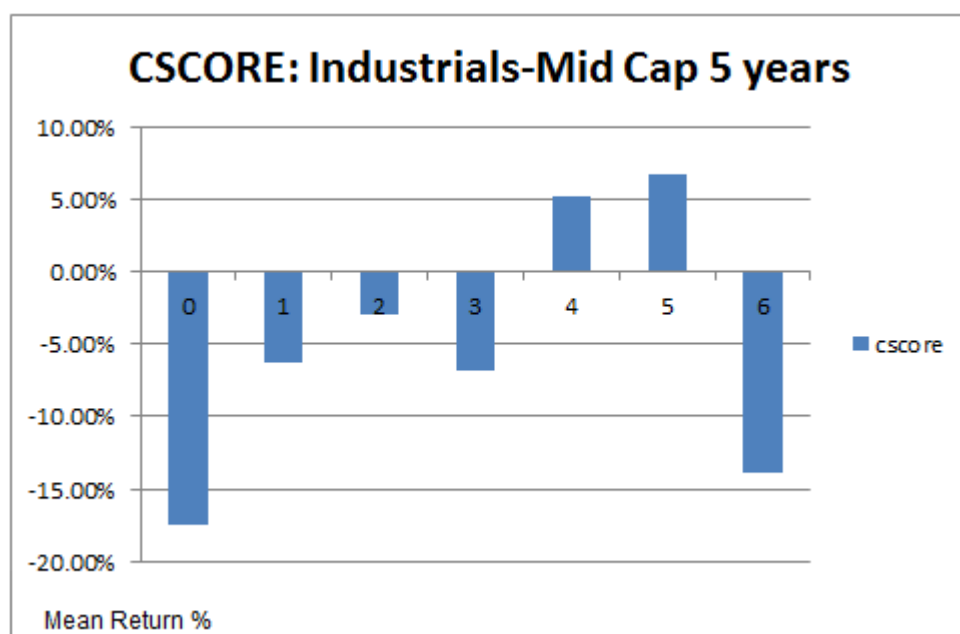


Table 30 is a summary of the descriptive statistics for the industrials sector for a holding period of five years, pertaining specifically to companies in the dataset that have a middle market capitalisation. Figure 29 indicates a negative mean return of 13.84% for a C-score of 6 and a positive return of 5.19% and 6.67% for C-score of 4 and 5 respectively. Only three data points were averaged to yield the return for C-score 6, the negative return may therefore be insignificant. The C-score is thus less effective for this category's holding period.

In general the C-score was ineffective for this category across all three holding periods.

## 5.12 INDUSTRIALS: SMALL CAP GROUP

Table 31: Year 1, Industrials – Small Capitalisation

SUMMARY: Industrials - Small Cap Group : 1 Year									
CSCORE	Mean	Median	Minimum	Maximum	Std Dev	Variance	Kurtosis	Skewness	Count
0	-37.48%	-43.06%	-98.12%	26.13%	0.40	0.16	-1.23	0.18	14
1	-28.95%	-25.46%	-120.69%	66.41%	0.48	0.23	-0.40	-0.02	48
2	65.10%	-28.97%	-101.72%	4758.24%	5.92	35.02	63.61	7.91	66
3	-6.00%	-20.17%	-99.07%	166.55%	0.54	0.30	0.88	0.84	80
4	-11.94%	-15.79%	-103.59%	172.59%	0.49	0.24	2.46	1.11	61
5	-22.11%	-27.62%	-73.64%	53.99%	0.37	0.13	-0.45	0.57	21
6	0.26%	-19.78%	-59.79%	126.80%	0.70	0.49	1.82	1.41	6

Figure 30: Mean return percentage industrials 1 year small cap

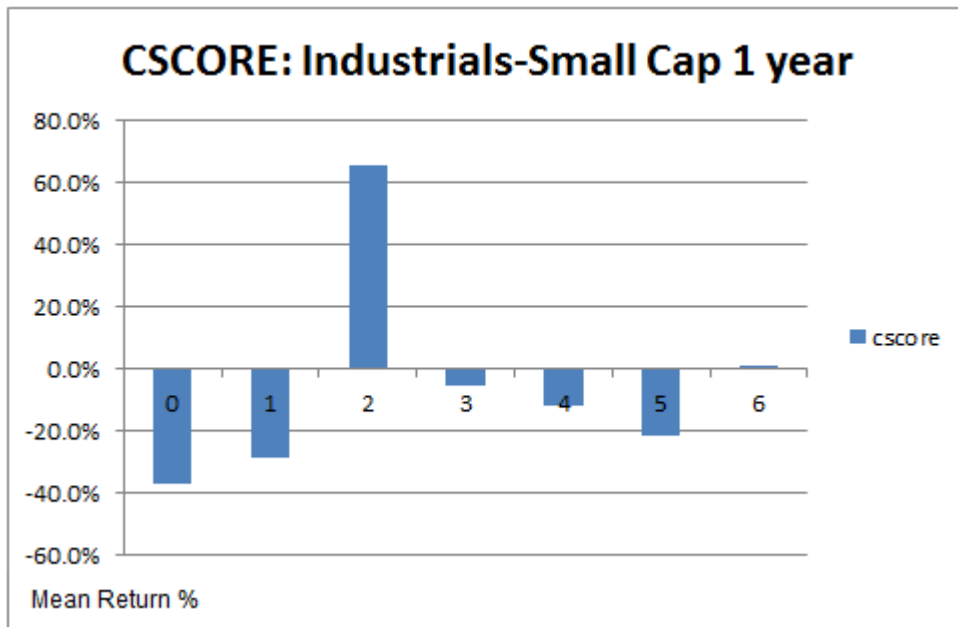


Table 31 is a summary of the descriptive statistics for the industrials sector for a holding period of one year, pertaining specifically to companies in the dataset that have a small (low) market capitalisation. Figure 30 indicates a negative mean return of 11.9% and 22.10% for C-score of 4 and 5 respectively. A positive mean return of 0.26% is noted for a C-score of 6. The C-score thus appears more effective for this category's holding period.

**Table 32: Year 3, Industrials – Small Capitalisation**

SUMMARY: Industrials - Small Cap Group : 3 Years									
CSCORE	Mean	Median	Minimum	Maximum	Std Dev	Variance	Kurtosis	Skewness	Count
0	-31.93%	-20.97%	-76.64%	-4.55%	0.28	0.08	-0.66	-1.08	7
1	-29.18%	-32.29%	-72.36%	19.97%	0.25	0.06	-0.54	0.46	36
2	-22.04%	-27.29%	-77.12%	251.01%	0.50	0.25	21.03	3.92	44
3	-11.07%	-15.52%	-67.52%	164.99%	0.36	0.13	7.91	1.96	62
4	9.14%	-7.79%	-59.98%	293.32%	0.67	0.44	9.26	2.75	42
5	-5.65%	-11.65%	-52.71%	38.25%	0.28	0.08	-0.46	-0.08	11
6	2.35%	13.01%	-34.59%	25.26%	0.25	0.06	-0.88	-0.89	5

**Figure 31: Mean return percentage industrials 3 years small cap**

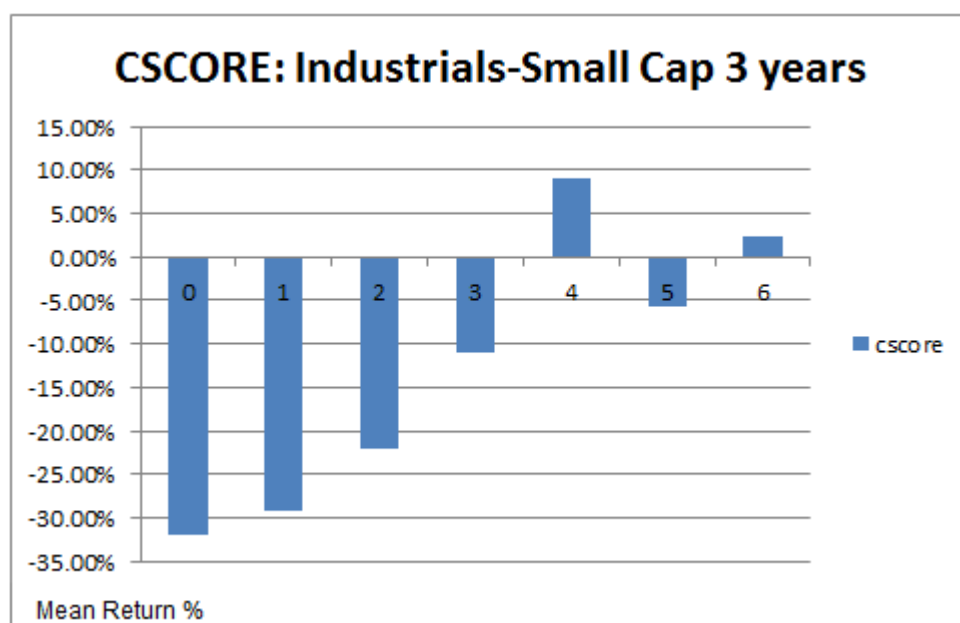


Table 32 is a summary of the descriptive statistics for the industrials sector for a holding period of 3 years, pertaining specifically to companies in the dataset that have a small (low) market capitalisation. Figure 31 indicates a negative mean return of 5.65% for a C-score of 5 and positive mean returns of 9.14% and 2.35% for C-scores of 4 and 6 respectively. The C-score appears less effective for this category's holding period.

**Table 33: Year 5, Industrials – Small Capitalisation**

SUMMARY: Industrials - Small Cap Group : 5 Years									
CSCORE	Mean	Median	Minimum	Maximum	Std Dev	Variance	Kurtosis	Skewness	Count
0	-6.36%	-15.80%	-56.78%	98.89%	0.55	0.30	3.68	1.76	6
1	-25.34%	-20.57%	-70.05%	0.02%	0.20	0.04	-0.55	-0.45	20
2	-11.63%	-13.57%	-53.89%	91.08%	0.31	0.09	5.50	1.93	22
3	-5.14%	-3.57%	-51.22%	57.64%	0.26	0.07	-0.21	0.20	39
4	-3.90%	-6.85%	-48.49%	117.09%	0.31	0.10	9.22	2.47	25
5	-12.64%	-13.99%	-50.60%	28.53%	0.32	0.10	-1.61	0.15	5
6	-18.58%	-18.58%	-28.34%	-8.81%	0.14	0.02			2

**Figure 32: Mean return percentage industrials 5 years small cap**

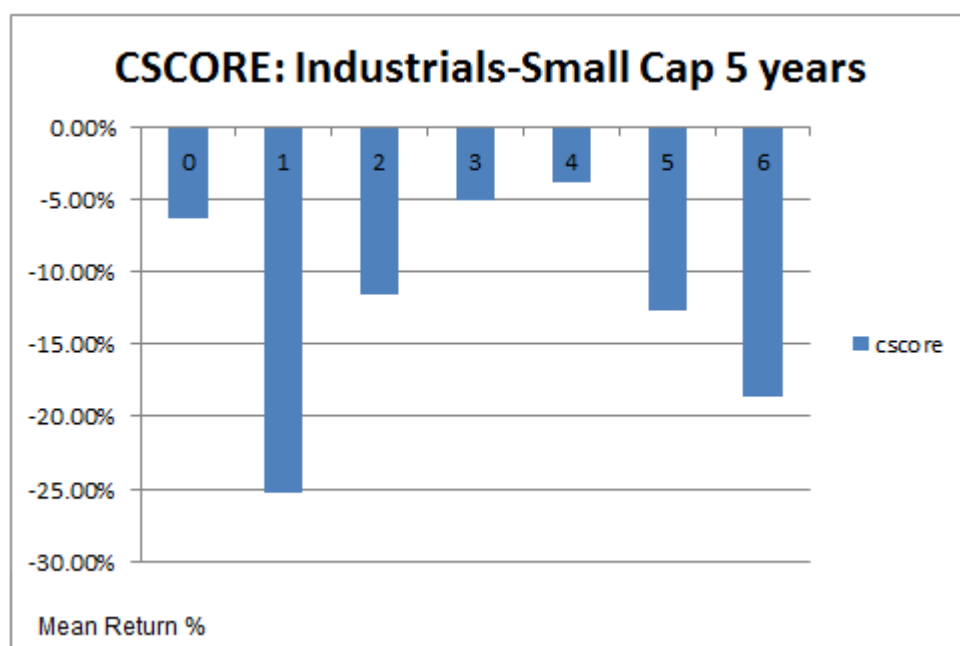


Table 33 is a summary of the descriptive statistics for the industrials sector for a holding period of five years, pertaining specifically to companies in the dataset that have a small (low) market capitalisation. Figure 32 indicates negative mean returns of 3.90%, 12.64% and 18.58% for C-score of 4, 5 and 6 respectively. The C-score appears more effective for this category's holding period, however just 2 data points were averaged to yield the negative return associated with C-score 6. Additionally all the returns for this category's holding period is negative, thus is effect of the global financial crisis cannot be ignored.

# CHAPTER 6: DISCUSSION OF RESULTS

## 6.1 INTRODUCTION

There is currently no research of the C-score on the South African market, thus the use of alternative studies such as the M-score by Beneish et al. (2013), the Z-score (Altman, 1968), the Zeta model (Altman et al. 1977) and the Z model (Altman, 2000) will be used as a comparative for the results obtained from this study. The results of Chapter 5 revealed the distribution of the returns of various C-scores for different sectors. The returns of the C-scores are representative of various influences occurring in the time frame of this study.

## 6.2 HYPOTHESIS ONE: THE C-SCORE CAN IDENTIFY SHORTABLE STOCKS ON THE JSE:

To attain greater depth into the efficacy of the C-score, 5 sub-hypotheses were formed pertaining to company size using market capitalisation, and sector division into resources and industrials. Further division of industrials into manufacturing and non-manufacturing sectors were conducted. Additionally, the use of different groups sorted by market capitalisation into large, middle and small was used to assess the size effect on the JSE.

### 6.2.1 SUB-HYPOTHESIS 1: THE C-SCORE IS ABLE TO IDENTIFY SHORTABLE STOCKS IN THE RESOURCES SECTOR

The results for the one year holding period demonstrated negative relative returns for C-scores of 4 and 5 with sufficient data points to affirm the predictive power of the C-score for this holding period (figure 3). The C-score of 6 for this holding period may be deemed insignificant as it is represented by only one data point. The insufficient number of data points represents a caveat in this research and shall be referred to as insignificant data from this point onward. This finding is in keeping with evidence from the Beneish *et al.*'s (2013)

study which “shows that a large proportion of the abnormal return is earned in the short three-day windows centred on the next four quarterly earnings releases, suggesting that our results are due to a delayed reaction to earnings-related news rather than risk-based factors” (p.58). Thus, the null hypothesis may be accepted for the holding period of one year.

In contrast, the results for the three year holding period demonstrated negative relative returns for C-scores of 5 and 6 (figure 4), however insufficient data for both C-scores presented weak evidence in support of the C-score. It cannot be inferred that the C-score was effective for the three year holding period, thus the null hypothesis is rejected.

The results for the five year holding period demonstrate negative relative returns for the C-scores of 4 and 5, but a positive return for a C-score of 6 (figure 5). However, the C-score of 4 is slightly negative at 0.54%. Insufficient data for both the C-scores of 5 and 6 present weak evidence in support of the C-score. The null hypothesis is thus rejected.

## **6.2.2 SUB-HYPOTHESIS 2: THE C-SCORE IS ABLE TO IDENTIFY SHORTABLE STOCKS FOR GROUPS WHICH WERE SORTED BY SIZE IN THE RESOURCES SECTOR**

Further analysis of the dataset was conducted by dividing the dataset into large, middle and small groups by market capitalisation. Evidence for this method is given by a study by Fama and French (1992) which demonstrated the “main result for the 1963-1990 period is; size and book-to-market equity capture the cross-sectional variation in average stock returns associated with size, E/P, book-to-market equity, and leverage” (p.450). Further evidence is provided through a study by Hoffman (2012) pertaining to the size effect on the JSE which states that; “Market cap has a consistent negative relationship with future returns, which is consistent with the earlier reports of Klerck and Maritz (1997), Van Rensburg and Robertson (2003) and of Basiewicz and Auret (2009) on the size effect” (p.28).

### **Resources: Large Capitalisation**

The results for the large capitalisation group for the one year holding period demonstrated positive relative returns for C-scores of 4, 5 and 6 (figure 6). The null hypothesis is thus rejected.

The results for the three year holding period demonstrated positive relative returns for C-score of 4 and 6 but a negative relative return for a C-score of 5 (figure 7). However due to insufficient data for C-scores of 5 and 6, it is difficult to infer the predictive power of the C-score. The null hypothesis is thus rejected.

The results for the five year holding period demonstrated positive relative returns for C-scores of 4 and 6 but a negative return for a C-score of 5 (figure 8). The null hypothesis is rejected for the five year holding period due to insufficient data points for a C-score of 5.

The results for this group is inconsistent with the findings of Beneish et al. (2013) which show that “a size based trading strategy that buys small companies (decile 1) and shorts large companies (decile 10) yields 2.5% a year. Combining M-score with size (e.g., buying small not-flagged companies and selling short large flagged companies), the strategy yields 15.2% a year” (p.65).

#### **Resources: Middle capitalisation**

The results for the one year holding period for the middle capitalisation group demonstrated negative relative returns for C-scores of 5 and 6 but a positive return for a C-score of 4 (figure 9). Whilst these are negative, little can be inferred from these results owing to insufficient data for C-scores of 5 and 6. The null hypothesis is thus rejected on the basis of insufficient evidence for the one year holding period.

The results for the three year holding period demonstrated positive relative returns for C-score of 4 and 5 but a negative return for a C-score of 6 (figure 10). The null hypothesis is rejected for the three year holding period on the basis of insufficient data.

The results for the five year holding period demonstrated a meagre negative return for a C-score of 5 but a positive relative return for a C-score of 4 (figure 11). No data was available for C-score 6. The null hypothesis is thus rejected for the five year holding period.

#### **Resources: Small capitalisation**

The results for the one year holding period for the small capitalisation group demonstrated a negative return for the C-score of 4 and 5 (figure 12). No data was available for a C-score of 6. Whilst the results of this holding period appear to validate the predictive power of the C-score, the null hypothesis is rejected due to insufficient data but the improved result should not be discounted entirely and may represent the possibility of the C-score being more effective for small capitalisation companies in the resources sector. The rationale for this



possibility is given by the results from a study by Auret and Cline (2011) on the JSE: “small shares tend to be growth shares and large shares tend to be value shares in both periods. This result corroborates Robins *et al.*’s (1999) findings” (p.33).

The results for the three year holding period demonstrated negative relative returns for C-scores of 4 and 5 (figure 13). The null hypothesis is accepted.

The results for the five year holding period demonstrate negative relative returns for C-scores of 4 and 5 (figure 14). The null hypothesis is accepted with caution, as all the returns in this group are negative.

The results pertaining to the resources sector proved that the C-score was ineffective for these market capitalisation groups. The conclusion inferred is that the returns yielded by the C-score is not affected (enhanced) by the size effect; however the number of data points in each group was insufficient to draw a conclusive answer for any of the holding periods studied. Further, there is no other study available on the use of an earnings manipulation detection model on a country’s resources sector. Thus there is little that this aspect of the research may be compared to or benchmarked against. A recommendation regarding the small capitalisation group is proposed in chapter seven.

### **6.2.3 SUB-HYPOTHESIS 3: THE C-SCORE IS ABLE TO IDENTIFY SHORTABLE STOCKS IN THE MANUFACTURING SUBSET OF THE INDUSTRIALS SECTOR**

The industrials sector comprised of 178 companies operating in both the services and manufacturing sectors. To analyse in greater detail the contribution of both sub-sectors to the overall results of the industrials category, the collection was divided into two groups, namely; manufacturing and non-manufacturing. The study of the Z-score (Altman, 1968) was conducted on a sample of manufacturing companies, which thus makes it comparable to the manufacturing subset of this research.

Results for the manufacturing sector for a one year holding period affirms that C-score was able to identify shortable stocks. C-scores of 4, 5 and 6 yielded negative relative returns with an adequate number of data points being averaged (figure 18). The null hypothesis for a holding period of one year is thus accepted.

The results for the three year holding period demonstrated positive relative returns for C-scores of 5 and 6 but a negative return for a C-score of 4 (figure 19). Although a C-score of 4 is considered high it is insufficient to affirm the C-score's predictive power. The null hypothesis is thus rejected for the three year holding period.

The results for the five year holding period demonstrated negative relative returns for C-scores 4, 5 and 6 (figure 20), whilst these findings are in support of the C-score's ability to identify shortable stocks, it must be noted that all the returns for this holding period were negative. The null hypothesis may be accepted but with caution.

Results of the Z-score by Altman (1968) revealed a model that could accurately forecast failure up to two years prior to bankruptcy thereafter the accuracy of the model diminished as lead time increased. A trend analysis was conducted to investigate the reasons for the reduced accuracy; the findings demonstrated that the observed ratios showed a deteriorating trend as bankruptcy approached (Altman, 1968, p.606). Additionally, the most severe change in the ratios occurred between two and three years prior to bankruptcy (Altman, 1968, p606).

The findings of this manufacturing subset are partially comparable to Altman's (1968) Z-score in that the results for the one year holding period are consistent with the findings of the Z-score, yet the results for the five year holding period is inconsistent and opposed by the findings of the Z-score.

#### **6.2.4 SUB-HYPOTHESIS 4: THE C-SCORE IS ABLE TO IDENTIFY SHORTABLE STOCKS IN THE NON-MANUFACTURING SUBSET OF THE INDUSTRIALS SECTOR**

The samples of both the Z model (Altman, 2000) and Zeta model by (Altman et al. 1977) utilise data from non-manufacturing companies, thus it is partially comparable to this subset of this research. Additionally, the latter studies focus mainly on the detection of bankruptcy thus there is no evidence pertaining to investor returns.

Results for the non-manufacturing sector for a one year holding period demonstrated positive relative returns for C-scores of 4, 5 and 6 (figure 21). The null hypothesis for the one year holding period is thus rejected. This finding is inconsistent with the Zeta model (Altman et al. 1977) and the Z model (Altman, 2000) from a time frame perspective.

Results for the three year holding period demonstrated positive relative returns for C-scores of 4 and 6 (figure 22), but a negative return of 0.41% for a C-score of 5. This result does not affirm the C-scores ability to identify shortable stocks, thus the null hypothesis is rejected for the three year holding period. This finding is inconsistent with the Zeta model (Altman et al. 1977) and the Z model (Altman, 2000) from a time frame perspective.

The results for the five year holding period appear better with negative relative returns being demonstrated for a C-score of 4, 5, and 6 (figure 23), however all the returns in the category were negative. Therefore, the null hypothesis may be accepted for this holding period but with caution. This finding is consistent with the Zeta model (Altman et al. 1977) and the Z model (Altman, 2000) from a time frame perspective.

#### **6.2.5 SUB-HYPOTHESIS 5: THE C-SCORE IS ABLE TO IDENTIFY SHORTABLE STOCKS IN DIFFERENT MARKET CAPITALISATION GROUPS OF THE INDUSTRIAL SECTOR**

##### **Industrials: Large capitalisation**

The results for the one year holding period demonstrated positive relative returns for C-scores of 4, 5 and 6 (figure 24), the null hypothesis is therefore rejected. This finding is inconsistent with the findings of a study by Beneish et al. (2013) which shows that “a large proportion of the abnormal return is earned in the short three-day windows centred on the next four quarterly earnings releases” (p.58).

The results for the three year holding period demonstrated positive relative returns for C-scores of 4, 5 and 6 (figure 25), the null hypothesis is thus rejected.

The results for the five year holding period demonstrated positive relative returns for C-scores of 4 and 5 (figure 26), but a negative return for a C-score of 6. Two data points were used to average the returns for C-score 6, thus it may be deemed insignificant. The null hypothesis is therefore rejected.

The findings for this group is inconsistent with the findings of a study by Diether et al. (2009) which demonstrated that greater short selling activity is observed in high capitalisation stocks and growth stocks. Additionally, the results for this group are inconsistent with the findings of a study by Beneish et al. (2013) which show that “combining M-score with size (for example; buying small not-flagged companies and selling short large flagged companies), the strategy yields 15.2% a year” (p.65).

### **Industrials: Middle capitalisation**

The results for the one year holding period demonstrated positive relative returns for C-scores of 4, 5 and 6 (figure 27), the null hypothesis is therefore rejected.

The results for the three year holding period demonstrated positive relative returns for the C-scores of 4, 5, and 6 (figure 28), the null hypothesis is thus rejected.

The results for the five year holding period demonstrated positive relative returns for C-scores of 4 and 5, but a negative return for a C-score of 6 (figure 29). Three data points were used to average the return for C-score 6, this result is therefore deemed insignificant. The null hypothesis is thus rejected.

### **Industrials: Small capitalisation**

The results for the small capitalisation groups for the one year holding period did demonstrate negative returns for C-scores of 4 and 5, but positive returns for a C-score of 6 (figure 30). This result is consistent with evidence from a study by Muller and Ward (2013) which states; “In fact, we find some indication that shares with market capitalisation rank greater than 230 (fledgling) under-perform the larger capitalisation shares” (p.81). The null hypothesis is therefore accepted for the holding period of one year for this group.

The results for the three year holding period demonstrated positive relative returns for C-scores of 4 and 6 but a negative return for a C-score of 5 (figure 31). The null hypothesis is thus rejected.

The results for the five year holding period demonstrated negative relative returns for C-scores of 4, 5 and 6 (figure 32). Whilst this result affirms the C-score’s ability to identify shortable stocks, all the returns in this group for this holding period were negative. Thus, the null hypothesis is accepted with caution.

Hence, hypothesis 1: The C-score is able identify shortable stocks on the JSE

The null hypothesis is rejected based on eight of the holding periods of the sub-hypotheses being accepted out of a total of 27 (appendix 2). The C-score is effective at only 29.6%. This finding is consistent with Montier’s statement that the C-score is just the first step in analysing whether a company is cooking its books (Montier, 2008).

## **CHAPTER 7: CONCLUSION**

### **7.1 CONCLUSION**

This study sought to demonstrate the C-score's ability to identify shortable stocks as a stand-alone scoring system, designed to identify and quantify vital aspects of earnings manipulation. The author sought to demonstrate a relationship between stocks with a high C-score and negative relative returns. Whilst negative returns were yielded for eight out of the 27 holding periods of the sub-hypotheses, positive returns and inconclusive results plagued the other holding periods (appendix 2). The most notable contribution of this study is that it represents a starting point and a point of comparison for future research into earnings manipulation and bankruptcy on the JSE.

### **7.2 RECOMMENDATION FOR INVESTORS**

The findings of this paper have laid a path to further explore earnings manipulation in the South African market. Whilst the results obtained in this research may not be significant for the C-score as a separate entity, scope is available to test the C-score's efficacy at isolating shortable stocks in conjunction with a measure of evaluation such as the price to earnings ratio as utilised by Montier (2008). As is evidenced in Beneish *et al.* (2013), "combining M-score with size (for example; buying small not-flagged companies and selling short large flagged companies), the strategy yields 15.2% a year" (p.65).

### **7.3 RECOMMENDATIONS FOR ACADEMICS**

Small capitalisation stocks in the resources and industrials sector displayed improved results in contrast to the large and middle capitalisation groups. The possibility that the C-score may be more effective at predicting negative returns for small capitalization stocks should be further investigated. The rationale for this suggestion is evidenced by a study by Muller and Ward (2013) on style based effects on the JSE that demonstrate that "in contrast to other

studies we find no evidence of a small size effect. In fact, we find some indication that shares with market capitalisation rank greater than 230 (fledgling) under-perform the larger capitalisation shares” (p.81).

In contrast, a study by Diether *et al.* (2009) demonstrated that greater short selling activity is observed in high capitalisation stocks and growth stocks, which are stocks with low book to market ratio, when compared to value stocks and low capitalisation stocks. Whilst the research of Diether *et al.* (2009) is in contradiction to the possibility proposed, the JSE does not behave in the same manner as the NYSE or NASDAQ upon which the Diether *et al.* (2009) study was based. Further research would be required to adequately assess the possibility of this relationship existing.

It would be of value to calibrate the grey area of the C-score, namely; C-score from 2 to 4 in a manner similar to that of Altman (1968); “By observing those firms which have been misclassified by the discriminant model in the initial sample, it is concluded that all firms having a Z score of greater than 2.99 clearly fall into the ‘non-bankrupt’ sector, while those firms having a Z below 1.81 are all bankrupt. The area between 1.81 and 2.99 will be defined as the ‘zone of ignorance’ or ‘gray area’ because of the susceptibility to error classification... Since errors are observed in this range of values, we will be uncertain about a new firm whose Z value falls within the ‘zone of ignorance.’ Hence, it is desirable to establish a guideline for classifying firms in the ‘gray area.’”(p.606). Similarly, value may be gained by analysing and classifying C-scores ranging from 2 to 4, thus enhancing the efficacy of the C-score.

## **7.4 FUTURE RESEARCH**

It would be of value to assess the influence of additional filters on the efficiency of predicting shortable stocks by using the C-score in tandem with other ratios, such as the price to sales ratio or price to earnings ratio.

Also, the use of the C-score to predict possible winner stocks can also be investigated using winner (low C-scores) and loser (high C-scores) portfolios.

An event study that investigates the effect of the global financial crisis and the Eurozone crisis on the efficacy of the C-score and the results ascertained would also be an avenue for

further research, especially pertaining to the five year holding periods as evidenced in this paper.

## REFERENCES

- Agarwal, M. (2010) *Relative returns versus Absolute returns*. Retrieved on 05 November 2013 from: <http://www.traderslog.com/relative-returns-vs-absolute-returns/>
- Allen, D. E., Powell, R. J., & Singh, A. K. (2011). *Short Selling Consistency in South Africa: Handbook of Short Selling*, (1<sup>st</sup> ed.), England, Elsevier Publishing. 382-385.
- Altman, E. I. (1968). Financial ratios, Discriminant analysis, and the Prediction of corporate bankruptcy. *Journal of Finance*, 23(4), 589-609.
- Altman, E. I., Haldeman, R., & Narayanan, P. (1977). ZETA Analysis: A New Model to Identify Bankruptcy Risk of Corporations. *Journal of Banking and Finance*, 1(1), 29-54.
- Altman, E. I. (2000). Predicting financial distress of companies: Revisiting the Z-score and ZETA models. *Stern School of Business, New York University*, July issue, 1-54.
- Argo, J. J., Darke, & Peter. R. (2006). When You Can't Count On the Numbers: Corporate Fraud, Generalized Suspicion and Investment Behaviour. *Advances in Consumer Research*, 33, 147-148.
- Auret, C., & Basiewicz, P. G. (2010). Feasibility of the Fama and French three factor model in explaining returns on the JSE. *Investment Analysts Journal*, 71, 13-25.
- Auret, C., & Cline, R. (2011). Do the value, size and January effect exist on the JSE? *Investment Analysts Journal*, 74, 29-37.
- Avramov, D., & Chordia, T. (2006). Assets pricing models and financial market anomalies. *Review of Financial studies*, 19(3), 1001-1040.
- Beber, A., & Pagano, M. (2013). Short-selling bans around the world: Evidence from the 2007-09 crisis. *Journal of Finance*, 68(1), 343-380.
- Beneish, M. D. (1999). The Detection of Earnings Manipulation. *Financial Analysts Journal*, 55 (5), 24-36.
- Beneish, M. D., Lee, C. M., & Nichols, D. C. (2013). Earnings Manipulation and Expected Returns. *Financial Analysts Journal*, 69(2), 57-82.



- Bodie, Z., Kane, A., & Marcus, A. J. (2007). *Essentials of Investments* (6<sup>th</sup> ed.) McGraw- Hill Irwin, New York, USA.
- Bradshaw, M. T., & Sloan, R. G. (2002). GAAP versus the street: An empirical assessment of two alternative definitions of earnings. *Journal of Accounting Research*, 40(1), 41-66.
- Brown, S. J., Goetzmann, W., Ibbotson, R. G., & Ross, S. A. (1992). Survivorship bias in performance studies. *Review of Financial Studies*, 5(4), 553-580.
- Chaiken, S., & Trope, Y. (1999), *Dual Process Theories in Social Psychology*, New York: Guilford Press.
- Christie, A. A (1990) Aggregation of test statistics: An evaluation of the evidence on contracting and size hypotheses. *Journal of accounting economics*, 12, 15-13.
- Dechow, P. M., Hutton, A. P., Meulbroek, L., & Sloan, R. G. (2001). Short-Sellers, Fundamental Analysis, and Stock Returns. *Journal of Financial Economics*, 61(1), 77-106.
- Dechow, P. M., & Skinner, D. J (2000). Earnings management: Reconciling the views of accounting academics, practitioners, and regulators. *Accounting Horizons*, 14 (2), 235–50.
- Dechow, P. M., Sloan, R. G., & Sweeney, A. P (1996). Causes and consequences of earnings manipulation: An analysis of firms subject to enforcement actions by the SEC, *Contemporary Accounting Research*, 13 (1), 1-36.
- Dempsey, M. (2013). The Capital Asset Pricing Model (CAPM): The history of a failed revolutionary idea in finance? *ABACUS: A Journal of Accounting, Finance and Business studies*, 49(supplement), 7-23.
- Desai, H., Krishnamurthy, S., & Venkataraman, K. (2006). Do short sellers target firms with poor earnings quality? Evidence from Earnings Restatements. *Review of Accounting Studies*, 11 (1), 71-90.
- Diether, K. B., Lee, K-H., & Werner, I. M. (2009). Short-sale Strategies and Return Predictability. *The Review of Financial Studies*. 22(2), 575-607.
- Doyle, J. T, Jennings, J. N, & Soliman, M. T (2013). Do managers define non-GAAP earnings to meet or beat analysts' forecasts? *Journal of Accounting and Economics*, 56, 40-56.

- Dzikowska, M., & Jankowska, B. (2012). The global financial crisis of 2008-2009 and the Fortune Global 500 corporations, looking for losers among the biggest - exploratory study. *Poznan University of Economics Review*, 12(3), 99-124.
- Fabozzi, F. J., Gupta, F., & Markowitz, H. M. (2002). The Legacy of modern portfolio theory, *The Journal of Investing*, 11 (3), 7- 22.
- Fama, E. F. (1970) Efficient Capital Markets: A review of theory and empirical work. *The Journal of Finance*, 25 (2), 383-417.
- Fama, E. F.; & French, K. R. (1992) The Cross section of Expected stock returns. *Journal of Finance*, 47(2), 427-465.
- Fama, E. F., & French, K. R. (1993) Common risk factor in the returns of stocks and bonds. *Journal of Financial economics*, 33, 3-56.
- Fama, E. F. (1998). Market efficiency, long-term returns, and behavioural finance. *Journal of Financial Economics*, 49(3), 283-306.
- Fama, E. F., & French, K. R. (2004). The Capital asset pricing model: Theory and evidence. *The Journal of Economic Perspectives*, 18(3), 25-46.
- Gary, G. (2008). What went wrong? Accounting fraud and lessons from the recent scandals. *Social Research*, 75(4), 1205-1238.
- Gilbert, E., & Strugnell, D (2010) Does survivorship bias really matter? An empirical investigation into its effects on the mean reversion of share returns on the JSE. *Investment Analysts Journal*, 72, 31-42.
- Gilson, R. J., & Kraakman, R. H. (1984). The Mechanisms of Market efficiency. *Virginia Law Review*, 70 (4), 549-644.
- Giroux, G. (2008). What went wrong? Accounting fraud and lessons from the recent scandals. *Social research*, 75(4), 1205-1238.
- Gunny, K. A (2010). The Relation between Earnings Management using Real activities manipulation and Future performance: Evidence from meeting Earnings Benchmarks. *Contemporary Accounting Research*, 27 (3), 855-888.
- Hancock, J. R., & Seng, D. (2012) Fundamental analysis and prediction of earnings. *International Journal of Business and management*, 7(3), 32-46.

- Hon, M. T., & Tonks, I. (2003). Momentum in the UK stock market. *Journal of Multinational Financial Management*, 13 (1), 43-70.
- Hung Wan, K. (2007). What determines the level of Short-selling Activity? *Financial Management*. 36 (4), 123-141.
- Jegadeesh, N., & Titman, S. (1993). Returns to Buying Winners and Selling Losers: Implications for Stock Market Efficiency. *The Journal of Finance*, 48, 65-91.
- Kellogg, I., & Kellogg, L. B. (1991) *Fraud, Window dressing and Negligence in financial statements*. Commercial law series, McGraw-Hill.
- Kumar, P. & Langberg, N. (2009). Corporate Fraud and Investment: Distortions in Efficient Capital Markets. *The RAND Journal of Economics*, 40(1), 144 -172.
- Lamont, O. A. (2004). Go down fighting: Short sellers vs. Firms, *Yale ICF Working paper*, 4(20), 1-47.
- Latif, M., Arshad, S., Fatima, M. & Farooq, S. (2011). Market Efficiency, Market Anomalies, Causes, Evidences, and Some Behavioural Aspects of Market Anomalies, *Research Journal of Finance and Accounting*, 2(9) & (10).
- Levitt, A. (1998) *The Numbers Game*. NYU center for Law and Business, New York, USA, 28 September 1998. Retrieved 23 October 2013 from: <http://www.sec.gov/news/speech/speecharchive/1998/spch220.txt>
- Lintner, J. (1965). The valuation of risk assets and the selection of risky investments in stock portfolios and capital budgets. *The review of economics and statistics*, 47(1), 13-37.
- Little, K. (2013) *Stock sectors – How to classify stocks*. Retrieved 05 November 2013 from: <http://stocks.about.com/od/understandingstocks/a/stocksectors.htm>
- Mangram, M. E. (2013). A Simplified Perspective of the Markowitz Portfolio Theory. *Global Journal of Business Research*, 7(1), 59-70.
- Matsumoto, D. A (2002). Management's incentive to avoid negative earnings surprises. *The accounting review*, 77(3), 483-514.
- Mishkin, F. S. (1996). Anatomy of a Financial Crisis. *Journal of Evolutionary Economics*, 2(2), 115–130.

- Mohanram, P. S. (2005). Separating Winners from Losers among low Book-to-Market stocks using Financial Statement analysis. *Review of Accounting Studies*, 10 (2-3), 133-170.
- Montier, J. (2008). Cooking the books, or, more sailing under the black flag. *Societe Generale Mind Matters*. June 2008, 1-8.
- Montier, J. (2009). Applied behavioural finance: White swans, Revulsion & Value. *CFA Institute Conference Proceedings Quarterly*, 26(1), 40-52.
- Muller, C., & Ward, M. (2012). Empirical testing of CAPM on the JSE. *Investment Analysts Journal*, 76, 1-12.
- Muller, C., & Ward, M. (2013). Style-based effects on the Johannesburg Stock Exchange: a graphical time-series approach. *Investment analysts Journal*, 77, 67-82.
- Murray State Education Campus (2013). *Geometric mean return*, Retrieved 25 September 2013 from:  
<http://campus.murraystate.edu/academic/faculty/lquin/FIN333/Geometric%20Mean%20Return.htm>
- Nelson, M. W., Elliott, J. A., & Tarpley, R. L. (2002). Evidence from auditors about managers' and auditors' earnings management decisions. *The Accounting Review*, 77(s-1), 175-202.
- Piotroski, J. D. (2000). Value Investing: The Use of Financial Statement Information to Separate Winners from Losers, *Journal of Accounting Research*, 38(3), 1-41.
- Saffi, P. A., & Sigurdsson, K. (2011). Price efficiency and short selling. *Review of Financial Studies*, 24(3), 821-852.
- Saunders, M., & Phillips. L. (2012). *Doing Research in Business & Management* (1<sup>st</sup> ed.), England, Pearson Education Limited, 109-123.
- Sharpe, W. F. (1964). Capital Asset Prices: A Theory of Market Equilibrium under conditions of risk. *The Journal of Finance*, 19(3), 425-442.
- Shiller, R. (2013) *Lecture7: Efficient Markets*. Retrieved 24 May 2013 from:  
<http://www.intellivestor.org/lecture-6-efficient-markets-financial-markets-by-prof-robert-shiller/>

- Spizman, L., & Weinstein, M. A. (2008) A Note on Utilizing the Geometric Mean: When, Why and How the Forensic Economist Should Employ the Geometric Mean, *Journal of Legal Economics*, 15 (1), 43-55.
- Strobl, G. (2013). Earnings manipulation and the Cost of Capital, *Journal of Accounting Research*, 51, 449-473.
- Rosner, R. L (2003). Earnings Manipulation in Failing Firms, *Contemporary accounting research*, 20 (2), 361-408.
- Rotter, J. B. (1971). Generalized Expectancies for Interpersonal Trust, *American Psychologist*, 26, 443-52.
- Watts, R. L & Zimmerman, J. L (1990). Positive accounting theory: A ten year perspective, *The Accounting Review*, 65 (1), 131-156.

# APPENDIX

## 1. LIST OF COMPANIES IN THE UNIVERSE: 2002 – 2010

1TIME HOLDINGS LTD  
AFRICAN BRICK CENTRE LTD  
AFRICAN BANK INVESTMENTS LTD  
ACCENTUATE LTD  
ARCELORMITTAL SA LTD  
ADVTECH LIMITED  
AFRICAN DAWN CAPITAL LIMITED  
AVENG LTD  
AMALGAMATED ELECTRONIC CORPORATION LIMITED  
ALERT STEEL HOLDINGS LIMITED  
A E C I LIMITED  
AFGRI LIMITED  
AFRIMAT LIMITED  
AFRICAN OXYGEN LIMITED  
AG INDUSTRIES LIMITED  
ANGLO AMERICAN PLC  
AH-VEST LIMITED  
ADCOCK INGRAM HOLDINGS LTD  
ALLIANCE MINING CORP LIMITED  
ALLIED TECHNOLOGIES LIMITED  
AMALGAMATED APPLIANCE HOLDINGS LD  
AFRICAN MEDIA ENTERTAINMENT LIMITED  
ANGLO AMERICAN PLAT LTD  
ADRENNA PROP GROUP LTD  
ANDULELA INVESTMENT HOLDINGS LTD  
ANGLOGOLD ASHANTI LIMITED  
ANSYS LIMITED  
AFRICAN AND OVERSEAS ENTERPRISES LD  
APEXHI PROPERTIES LIMITED  
ASTRAPAK LIMITED  
ASPEN PHARMACARE HOLDINGS LIMITED  
AQUARIUS PLATINUM LIMITED  
ARB HOLDINGS LIMITED  
AFRICAN RAINBOW MINERALS LIMITED  
ASTRAL FOODS LIMITED  
ANOORAQ RESOURCES CORPORATION  
ARGENT INDUSTRIAL LIMITED  
ABSA GROUP LIMITED  
AUSTRO GROUP LTD  
ASSORE LIMITED  
ATLATSA RESOURCES CORP  
KAP INDUSTRIAL HLDGS LTD  
KAYDAV GROUP LIMITED  
KEATON ENERGY HOLDINGS LIMITED  
KELLY GROUP LIMITED  
KAGISO MEDIA LIMITED  
KUMBA IRON ORE LIMITED  
KAIROS INDUSTRIAL HOLDINGS LIMITED  
KWIKSPACE MODULAR BUILDINGS LTD  
LABAT AFRICA LIMITED  
LONRHO PLC  
LEWIS GROUP LIMITED  
LIFE HEALTHCARE GROUP HOLDINGS LTD  
LITHA HEALTHCARE GROUP LTD  
LONMIN PLC  
MASONITE (AFRICA) LIMITED  
MEDICLINIC INTERNATIONAL  
METROFILE HOLDINGS LIMITED  
MIX TELEMATICS LTD  
MICROMEGA HOLDINGS LIMITED  
MIRANDA MINERAL HOLDINGS LTD  
METMAR LIMITED  
MARSHALL MONTEAGLE PLC  
MONDI Limited  
MONDI PLC  
MORVEST BUS GROUP LTD  
MR PRICE GROUP LIMITED  
MPACT LIMITED  
MERAPE RESOURCES LIMITED  
M&S HOLDINGS LTD  
MASSMART HOLDINGS LIMITED  
MUSTEK LIMITED  
METAIR INVESTMENTS LIMITED  
MUVONI TECH GROUP LTD  
MTN GROUP LIMITED  
METOREX LIMITED  
MURRAY AND ROBERTS HOLDINGS LIMITED  
MVELAPHANDA GROUP LIMITED  
MVELAPHANDA RESOURCES LIMITED  
MVELASERVE LTD  
MAZOR GROUP LIMITED  
NEW AFRICA INVESTMENTS LIMITED

ALLIED ELECTRONICS CORPORATION LTD	NEW BOND CAPITAL LTD
AFRICA CELLULAR TOWERS LIMITED	NICTUS BEPERK
AVI LIMITED	NANDOS GROUP HOLDINGS LTD
AVUSA LTD	NORTHAM PLATINUM LIMITED
AWETHU BREWERIES LIMITED	NAMPAK LIMITED
BAUBA PLATINUM LIMITED	NASPERS LIMITED
BARLOWORLD LIMITED	NET 1 UEPS TECHNOLOGIES INC
BOWLER METCALF LIMITED	NETCARE LIMITED
BLACKSTAR GROUP SE	NUTRITIONAL HOLDINGS LTD
BUSINESS CONNEXION GROUP LIMITED	NU-WORLD HOLDINGS LIMITED
BUILDMAX LIMITED	OANDO PLC
BEIGE HOLDINGS LIMITED	OCEANA GROUP LIMITED
BELL EQUIPMENT LIMITED	ONELOGIX GROUP LIMITED
BLUE FINANCIAL SERVICES LIMITED	O-LINE HOLDINGS LIMITED
BRIKOR LTD	OMNIA HOLDINGS LIMITED
BHP BILLITON PLC	OPTIMUM COAL HOLDINGS LIMITED
BIOSCIENCE BRANDS LTD	PALABORA MINING COMPANY LIMITED
BLUE LABEL TELECOMS LIMITED	PAN AFRICAN RESOURCES PLC
BONATLA PROPERTY HOLDINGS LIMITED	PBT GROUP LIMITED
BARPLATS INVESTMENTS LIMITED	PETMIN LIMITED
BRIMSTONE INVESTMENT CORPORATION LD	PIONEER FOOD GROUP LIMITED
BASIL READ HOLDINGS LIMITED	PHUMELELA GAMING AND LEISURE LTD
BSI STEEL LTD	PICK N PAY STORES LIMITED
BYTES TECHNOLOGY LIMITED	PROTECH KHUTHELE HOLDINGS LTD
BRITISH AMERICAN TOBACCO PLC	PLATMIN LIMITED
THE BIDVEST GROUP LIMITED	PRIMEDIA LIMITED
B & W INSTRUMENTATION AND ELECTRICAL LTD	PRIMESERV GROUP LIMITED
CAFCA LTD	PINNACLE TECHNOLOGY HOLDINGS LTD
CAPE EMPOWERMENT LTD	PINNACLE POINT GROUP LIMITED
CAXTON CTP PUBLISHERS AND PRINTERS	POYNTING HOLDINGS LIMITED
COUNTRY BIRD HOLDINGS LTD	PPC LIMITED
CIC HOLDINGS LTD	PUTPROP LIMITED
COMPU-CLEARING OUTSOURCING LIMITED	PSG GROUP LIMITED
COMPAGNIE FIN RICHEMONT	PSV HOLDINGS LIMITED
CALGRO M3 HOLDINGS LIMITED	PEERMONT GLOBAL LIMITED
CONSOLIDATED INFRASTRUCTURE GROUP	PICK N PAY HOLDINGS LIMITED
CROOKES BROTHERS LIMITED	PAMODZI GOLD LIMITED
CLIENTELE LIFE ASSURANCE COMPANY LD	QUEENSGATE HOTEL & LEISURE LTD
CITY LODGE HOTELS LIMITED	QUANTUM PROPERTY GROUP LIMITED
CLIENTELE LIMITED	RACEC GROUP LTD
CLOVER INDUSTRIES LTD	RARE HOLDINGS LIMITED
CLICKS GROUP LIMITED	RBA HOLDINGS LTD
COMMAND HOLDINGS LIMITED	ROYAL BAFOKENG PLATINUM LTD
COMBINED MOTOR HOLDINGS LIMITED	RAINBOW CHICKEN LIMITED
CHROMETCO LIMITED	RAUBEX GROUP LIMITED
CIPLA MEDPRO SA LTD	ROCKWELL DIAMONDS INCORPORATED
CONTROL INSTRUMENTS GROUP LIMITED	REMGRO LIMITED
COLLIERS S A HOLDINGS LTD	ROLFES HOLDINGS LTD
COMAIR LIMITED	REUNERT LIMITED

CAPITEC BANK HOLDINGS LIMITED	REX TRUEFORM CLOTHING COMPANY LTD
CAPRICORN INV HLDGS LTD	SABMILLER PLC
CENTRAL RAND GOLD LIMITED	SOUTH AFRICAN COAL MINING HOLDINGS LTD
CARGO CARRIERS LIMITED	SALLIES LIMITED
CERAMIC INDUSTRIES LIMITED	SANYATI HOLDINGS LIMITED
CASHBUILD LIMITED	SAPPI LIMITED
CONSOL LIMITED	SABLE HOLDINGS LIMITED
CHEMICAL SPECIALITIES LIMITED	SACOIL HOLDINGS LTD
CULLINAN HOLDINGS LIMITED	SECUREDATA HOLDINGS LIMITED
CONVERGENET HOLDINGS LTD	SEARDEL INVESTMENT CORPORATION LTD
COAL OF AFRICA LTD	S A FRENCH LIMITED
DISTRIBUTION AND WAREHOUSING NETWORK LTD	SHERBOURNE CAPITAL LTD
DATACENTRIX HOLDINGS LIMITED	STEINHOFF INTERNATIONAL HOLDINGS LTD
DIMENSION DATA HOLDINGS PLC	SHOPRITE HOLDINGS LIMITED
DIGICORE HOLDINGS LIMITED	SIMMER AND JACK MINES LIMITED
DIALOGUE GROUP HOLDINGS LIMITED	SEKUNJALO INVESTMENTS LIMITED
DORBYL LIMITED	SKINWELL HOLDINGS LTD
DIAMONDCORP PLC	SEA KAY HOLDINGS LTD
THE DON GROUP LIMITED	STELLA VISTA TECHNOLOGIES LIMITED
DRDGOLD LIMITED	SOUTHERN ELECTRICITY COMPANY LD
DELRAND RESOURCES LTD	SENTULA MINING LTD
DISTELL GROUP LIMITED	SOUTH OCEAN HOLDINGS LIMITED
DELTA EMD LTD	SASOL LIMITED
DATATEC LIMITED	SOVEREIGN FOOD INVESTMENTS LIMITED
EVRAZ HIGHVELD STEEL AND VANADIUM LIMITED	SPANJAARD LIMITED
ELAND PLATINUM HOLDINGS LIMITED	SUPER GROUP LIMITED
ELEMENTONE LTD	THE SPAR GROUP LIMITED
ELLERINE HOLDINGS LIMITED	SQUARE ONE SOLUTIONS GROUP LIMITED
ELLIES HOLDINGS LIMITED	STEFANUTTI STOCKS HOLDINGS LTD
ELB GROUP LIMITED	STRATCORP LIMITED
ENVIROSERV HOLDINGS LIMITED	SUN INTERNATIONAL LIMITED
EOH HOLDINGS LTD	SPUR CORPORATION LTD
EASTERN PLATINUM LIMITED	SILVERBRIDGE HOLDINGS LTD
EQSTRA HOLDINGS LIMITED	TIGER AUTOMOTIVE LTD
ERBACON INVESTMENT HOLDINGS LIMITED	TASTE HOLDINGS LIMITED
ESORFRANKI LTD	TAWANA RESOURCES NL
EXCELLERATE HOLDINGS LIMITED	TIGER BRANDS LIMITED
EXXARO RESOURCES LIMITED	THABEX LIMITED
FAMOUS BRANDS LIMITED	Transaction Capital Ltd
FARITEC HOLDINGS LIMITED	TOTAL CLIENT SERVICES LIMITED
FIRST URANIUM CORPORATION	TRADEHOLD LIMITED
FIRST URANIUM CORPORATION	THE FOSCHINI GROUP LTD
FREEWORLD COATINGS LIMITED	TOP-FIX HOLDINGS LTD
FONEWORX HOLDINGS LTD	TIGER WHEELS LIMITED
GREAT BASIN GOLD LIMITED	TELKOM SA SOC LTD
GOOD HOPE DIAMONDS (KIMBERLEY) LTD	TREMATON CAPITAL INVESTMENTS LTD
GOODERSON LEISURE CORPORATION LTD	TONGAAT HULETT LIMITED
GOLD ONE INTERNATIONAL LTD	TRANSPACO LIMITED



GOLD FIELDS LIMITED  
GOLIATH GOLD MINING LTD  
GIJIMA GROUP LTD  
GRINDROD LIMITED  
GRAND PARADE INVESTMENTS LIMITED  
GROUP FIVE LIMITED  
HARMONY GOLD MINING COMPANY LIMITED  
HOSKEN CONSOLIDATED INVESTMENTS LD  
HUDACO INDUSTRIES LIMITED  
HULAMIN LIMITED  
HOLDSPORT LIMITED  
HUGE GROUP LTD  
HWANGE COLLIERY COMPANY LIMITED  
HOWDEN AFRICA HOLDINGS LIMITED  
HARDWARE WAREHOUSE LTD  
IDECO GROUP LIMITED  
INDEQUITY GROUP LIMITED  
IFCA TECHNOLOGIES LIMITED  
IFA HOTELS AND RESORTS LIMITED  
ILIAD AFRICA LIMITED  
IMBALIE BEAUTY LIMITED  
ILLOVO SUGAR LIMITED  
IMPALA PLATINUM HOLDINGS LIMITED  
IMPERIAL HOLDINGS LIMITED  
INFRASORS HOLDINGS LTD  
ISA HOLDINGS LTD  
INSIMBI REFRACTORY & ALLOY SUPPLIES LTD  
ITALTILE LIMITED  
INTERTRADING LIMITED  
INVICTA HOLDINGS LIMITED  
INTERWASTE HOLDINGS LTD  
JUBILEE PLATINUM PLC  
JCI LIMITED  
JD GROUP LIMITED  
JOHN DANIEL HOLDINGS LIMITED  
JOHNNIC HOLDINGS LIMITED  
JASCO ELECTRONICS HOLDINGS LIMITED  
TRENCOR LIMITED  
TOURISM INVESTMENT CORPORATION LD  
TRUWORTHS INTERNATIONAL LIMITED  
TSOGO SUN HOLDINGS LTD  
TRANS HEX GROUP LIMITED  
TRUSTCO GROUP HOLDINGS LIMITED  
TWP HOLDINGS LIMITED  
UBUBELE HOLDINGS LIMITED  
UCS GROUP LIMITED  
URANIUM ONE INC  
VILLAGE MAIN REEF LIMITED  
VALUE GROUP LIMITED  
VERIMARK HOLDINGS LTD  
VENFIN LIMITED  
VODACOM GROUP LTD  
VOX TELECOM LTD  
VUNANI LIMITED  
WILSON BAYLY HOLMES-OVCON LIMITED  
W G WEARNE LIMITED  
WOOLWORTHS HOLDINGS LIMITED  
WILDERNESS HOLDINGS LIMITED  
WORKFORCE HOLDINGS LIMITED  
WINHOLD LIMITED  
WESCOAL HOLDINGS LIMITED  
WILLIAM TELL HOLDINGS LTD  
YORK TIMBER HOLDINGS LIMITED  
ZCI LIMITED  
ZAPTRONIX LIMITED

## 2. RESULTS: HOLDING PERIODS FOR THE SUB-HYPOTHESES

Resources	Industrials
Year 1 Resources: hypothesis (H) accepted	Year 1 Industrials Manufacturing (M): H accepted
Year 3 Resources: H rejected	Year 3 Industrials (Ind) M: H rejected
Year 5 Resources: H rejected	Year 5 Ind M: H accepted
Large cap Year 1: H rejected	Year 1 Ind non-manufacturing (NM): H rejected
Large cap Year 3: H rejected	Year 3 Ind NM: H rejected
Large cap Year 5: H rejected	Year 5 Ind NM: H accepted
Middle cap Year 1: H rejected	Large cap Year 1: H Rejected
Middle cap Year 3: H rejected	Large cap Year 3: H rejected
Middle cap Year 5: H rejected	Large cap Year 5: H rejected
Small cap Year 1: H rejected	Middle cap Year 1: H rejected
Small cap Year 3: H accepted	Middle cap Year 3: H rejected
Small cap Year 5: H accepted	Middle cap Year 5: H rejected
	Small cap Year 1: H accepted
	Small cap Year 3: H rejected
	Small cap Year 5: H accepted