

Predicting Corporate Failure:
an application of Altman's Z-
Score and Altman's EMS
models to the JSE Alternative
Exchange from 2008 to 2012

by

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Research dissertation presented for the approval of Senate in fulfilment of part of the requirements for the degree of Master of Commerce in Finance (Financial and Risk Management) in approved courses and a minor dissertation. The other part of the requirement for this qualification was the completion of a programme of courses.

I hereby declare that I have read and understood the regulations governing the submission of Master of Commerce dissertations, including those relating to length and plagiarism, as contained in the rules of the University, and that this dissertation conforms to those regulations.

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Abstract

The JSE Alternative Exchange (Alt-X) experienced a dramatic decline in equity values from 2008 to 2009 as part of the global economic crisis of approximately 60%, and has subsequently experienced a decline of a further 50% from 2009 to 2012. By way of comparison, the JSE Main Board declined approximately 33% in 2008 and 2009, and has subsequently experienced a 100% increase in equity values from 2009 to 2012.

The extent of the decline in equity values of companies listed on the Alt-X has raised the issue as to whether companies listed on the Alt-X have a higher likelihood of corporate failure. This study applies the Altman Z-Score and the Altman Z'EM score in order to identify trends in corporate solvency of Alt-X listed companies. Thereafter bond equivalent ratios are calculated for further analysis.

The study found a marginal increase in corporate failure likelihood amongst Alt-X listed companies according to the Altman Z-Score and the Altman Z-EM score over the period tested, but nonetheless found that the corporate failure likelihood of those companies remains low and that the dramatic decline in equity values is not matched by a dramatic decline in corporate solvency rates from 2008 to 2012.

The study further found that low levels of financial leverage is the greatest contributor to the solvency of companies listed on the Alt-X and that over the period capital structures had become more conservative, contributing to the low likelihood of corporate failure.

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1 Introduction

The financial crisis of 2008 and 2009 had a dramatic effect on financial markets globally. Over that two year period the equity values of companies listed on the Johannesburg Stock Exchange (JSE) had dramatically fallen by approximately 30%, however the Alt-X, being the secondary board of the JSE and the subject of this study, had experienced a decline in equity values of approximately 60% (JSE). The Alt-X is the secondary exchange to the JSE Main Board and consists primarily of smaller companies over diversified sectors.

Subsequent to the financial crises of 2008 and 2009, the JSE Main Board has made a steady recovery and the index had increased by approximately 100% to the end of 2012. The Alt-X index on the other hand incurred further losses of approximately 50% from its position at the end of 2009 to the position at the end of 2012 (JSE).

Following such a dramatic fall in equity values in 2008 and 2009, the question posed and address by Correia (2009) was whether the companies listed on the Alt-X had a high risk of corporate failure. Correia (2009) calculated the Altman Z-Score and the Altman Emerging Market Z Score (Z-EM Score) and found that companies listed on the Alt-X were not subject to a high likelihood of corporate failure. Correia (2009) found that only 7% of companies listed on the Alt-X had a high likelihood of corporate failure according to the Altman Z-Score and 11% according to the Altman Z'EM Score. Correia (2009) further attributed the low levels of corporate failure likelihood to low levels of financial leverage on the Alt-X.

Correia (2009) further converted the Altman (1995) Z-EM Scores to bond equivalent ratings as performed by Altman (2005). Correia (2009) found that 63% of companies listed on the Alt-X would be classified as investment grade and 37% of companies listed on the Alt-X would be classified as junk high yielding according to the bond equivalent ratings.

Subsequent to 2009, the Alt-X has underperformed relative to the JSE Main Board by approximately 200% and the Alt-X has seen seven corporate failures and nine delistings, these making up 21% of the companies listed on the exchange. Therefore, subsequent to the 2008-2009 financial crisis, the question is what has happened to the corporate solvency of these smaller cap companies? Have the effects of the 2008-2009 financial crisis perhaps only been realised by smaller companies years after the event occurred? Although it may not have been apparent at the time of the crisis, according to the Altman Z-Score and the Altman Z-EM Score,

could a trend be identified thereafter that may give insight into how corporate solvency has been effected in periods after a financial crises event?

Therefore, the objective of this study it to calculate the Altman Z-Score and Altman Z-EM Score on companies listed on the Alt-X for period 2008 to 2012 in order to assess the corporate solvency of these companies and gain insight into the financial components that make up the respective corporate failure prediction models when applied to these companies.

In applying the financial prediction models, the average scores over the entire index as well as the mean and the standard deviations of those scores are analysed. The financial components that form the variables of the Altman Z-Score and the Altman Z-EM score shall further be analysed to gain insight into what factors are having the greatest effect on the corporate solvency of Alt-X listed companies.

Thereafter, bond equivalent ratings of the Alt-X listed companies shall be calculated as described by Altman (2005) and analysed to identify trends over the period and to gain an understanding of the corporate failure risk profile of Alt-X listed companies.

Additionally, the Altman Z-Scores and Altman Z'EM Scores of companies that had entered into corporate failure during the period shall be analysed in order to assess how accurate the corporate failure predictors have been in predicting these corporate failures. Furthermore, given the number of delistings on the exchange during the period, the Altman Z-Scores and Altman Z'EM Scores shall be calculated for these companies in order to identify whether there have been any indicators that these companies had delisted owing to corporate solvency difficulties.

2 Review of prior studies

The core focus of this study is to apply accounting based corporate failure prediction models, with influences of market based variables, to companies listed on the AltX and to determine whether such companies are subject to increased risk of financial distress given the performance of the exchange since the global economic crisis of 2009. To contextualise the methods used, the review of prior studies is extended beyond that of the Altman (1968) Z-Score and the Altman (1995) EMS Score. Alternate methods are briefly discussed as well as studies performed over other exchanges.

Corporate failure may result in significant losses for investors and other stakeholders in a business. Corporate failure is inherent in business and it is likely to always be a factor to be considered by prospective investors. Therefore, a model for predicting corporate failure would be useful in giving investors an early warning that such events may occur. This motivated the first corporate failure prediction models to be developed by Beaver (1966) and Altman (1968), predicting how likely corporate failure would be based on publically available financial data publically available (Deakin, 1972).

The Altman Z-Score was developed in 1968 to demonstrate that ratio analysis could be used as an analytical tool (Altman, 1968). At the time of the study, Altman (1968) believed that academics were disregarding financial ratio analysis as an analytical technique in favour of more advanced statistical tools. To demonstrate that financial ratio analysis could be used as an analytical tool, Altman (1968) applied a multiple discriminant analysis statistical technique using financial ratios to predict corporate failure. Altman (1968) considered financial distress suitable for financial ratio analysis as it was often used as the basis for credit rating agencies.

Univariate accounting based modelling techniques had been the most widely used of the modelling techniques at the time of Altman's 1968 study. This involves analysing financial ratios against a comparative or a benchmark in order to identify the most relevant ratio (Altman, 1968). However this method would derive a model that only considers a single variable which may be limited in the sense that it may not fully consider compensation circumstances. Correia (2009) provides a good example in that the univariate model cannot evaluate a company that has weak profitability but strong liquidity. Subsequent to Altman's (1968) study, four methods have

been used, namely the linear probability approach, the logit model, the probit model and the multiple discriminate analysis. Of these methods, the multiple discriminate analysis has been the most widely used followed by the logit model (Altman & Saunders, 1997).

The multiple discriminate analysis technique used by Altman (1968) evaluates a set of ratios against two possible outcomes, being either failure or survival in the case of the Altman Z-Score (1968) and the Altman Z-EM Score (1995) derivation. Multiple discriminant analysis models allow for multiple variables to be considered by a single model, addressing the issue raised by Correia (2009) on univariate models.

In developing the Z-Score, Altman (1968) calculated 22 financial ratios which were thought to be useful in the context of predicting corporate failure based on previous studies (Altman, 2000). These 22 financial ratios were then classified in five different categories being liquidity, profitability, leverage, solvency and activity (Altman, 2000). Using a multiple discriminant analysis statistical technique, the five most significant contributors to corporate failure were then determined, one for each category mentioned above.

Altman (1968) sampled thirty-three bankrupted manufacturing companies and thirty-three manufacturing companies that had not been bankrupt over a twenty year period from 1946 to 1965. The sample was selected at random from firms that had been stratified by size and industry.

The Altman Z-Score applied five ratios representing liquidity, profitability, leverage, solvency and activity (Altman, 1968). After applying the multiple discriminant analysis the following formula was derived:

$$Z = 1.2X_1 + 1.4X_2 + 3.3X_3 + 0.6X_4 + 1.0X_5$$

X_1 = Working capital / total assets

X_2 = Retained earnings / total assets

X_3 = Earnings before interest and taxes / total assets

X_4 = Market value of equity / book value of debt

X_5 = Sales / total assets

Altman (2005) later developed the Z-EMS (Emerging market Z-score) model as a method for evaluating corporate bonds in emerging markets. The Z-EMS model was developed as an enhancement on the original Z-Score developed by Altman in 1968 having applications for companies that are not publically traded irrespective of sector, unlike the Z-Score (Altman, 1968) which was restricted to publically trade manufacturing companies. The Z-EMS model was first applied to companies in Mexico, particular prior to and after the Mexican Peso crisis of 1994 (Altman, 2005). The Z-EMS model has also been applied in other emerging economies such as Brazil, Argentina and South East Asian countries (Altman, 2005).

The premise for Altman's 2005 study was that majority of the corporate failure and credit scoring academic literature had been based on data from the United States and a model that could be used in other countries was needed (Altman, 2005). As Altman (2005) suggested, the model may be applied to emerging markets, and this study shall consider the application of the model in South Africa. Altman's (2005) EMS score was however derived using Mexican data and as discuss by Altman (2005), differences in legislation among countries need to be considered.

Altman (2005) calculated the Z-EM Scores for 30 Mexican companies that had corporate bonds issued on the Eurobond exchange. Of these 30 bonds, only 13 had received ratings from an official rating agency as at the time of the study. Altman (2005) found the Z-'EM Score to be particularly accurate in predicting corporate failure both before and after the Mexican Peso crisis of 1994, where market related indicators differed significantly before and after the crisis, accounting based variables remained consistent and provided a more relevant basis for prediction. Furthermore, the Z-EM Score was found to be accurate and useful for predicting corporate failure in Brazil and Argentina (Altman, 2005).

The objective of the original Z-Score was to demonstrate the financial statement data was relevant and useful for analysis of companies (Altman, 1968). Financial reporting standards have been continuously changing subsequent to 1968 when the original Z-Score was derived and therefore the applicability of the Z-Score and Z-EM score to data from financial statements subsequent to 1968 is brought into question by academics. Notable changes in financial reporting are the establishment of the Financial Accounting Standards Board (FASB) in the

United States and the establishment of the International Accounting Standards Board (IASB) outside of the United States, who have favoured the move to fair value accounting as opposed to historic cost accounting, an increasing use of derivative financial instruments and the acquisition of intangible assets, and an increasing extent to which preparers of financial statements are required to make estimates and assumptions that may be subject to scrutiny (Beaver et al., 2005).

Studies performed over the relevance of financial statement information in explaining market movements have reached differing conclusions with Dechow et al (2004) concluding that over time information contained in financial statement has been less useful in explaining market movements whereas Brown et al (1999) concluded that the information contained in financial statements has not been less useful in explaining market returns over time.

Beaver (1966) performed a study on the usefulness of financial ratios in the prediction of corporate failure. Although Beaver (1966) indicates the study primarily focuses on predicting corporate failure, there are a range of uses for financial ratios in predicting any sort of corporate event, and therefore accounting ratios are useful.

Beaver (1966) selected a sample of 79 failed and surviving publicly traded industrial companies in the United States for the period 1954 to 1964 and collected financial data for these firms one year before failure. Beaver selected the sample of surviving companies on the basis of matching each failed firm with a surviving firm in terms of asset size and industry.

Beaver (1966) concluded that financial ratios are useful in predicting corporate failure and further found that cash generated from operating activities over total debt to be the most useful ratio. Furthermore, Beaver (1966) found that financial ratios can be useful in identifying corporate failure up to five years before the event occurs.

Beaver (1968) extended the initial study performed on financial ratios and corporate failure by further considering changes in market prices and the extent to which investors use financial ratios in assessing a company's solvency position using the same sample of companies used in the 1966 study. Beaver (1968) found that investors forecast corporate failure before the financial ratios do, likely due to investors using financial ratios in assessing a company's

solvency. This is likely due to investors additionally using non-financial ratio information to base their decisions upon which is consistent with the view that financial ratios is not the only source of information on a company's solvency (Beaver, 1968).

Following numerous corporate failures in the latter part of the 1960s and the early 1970s, Altman and Loris (1976) created a 'financial early warning system', particularly due to significant changes in the regulatory environment in the United States with the establishment of the Securities Investor Protection Act, established to provide protection to investors who had invested through brokers experiencing corporate failure. Subsequent to the implementation of the Security Investor Protection Act, the Security Protection Corporation had been established to compensate investors for losses in the event that a broker or dealer had entered into corporate failure.

However, subsequently large sums had been paid out by this corporation in the wake of numerous failures between 1970 and 1976 (Altman & Loris, 1976). To address this issue, Altman and Loris (1976) developed a model using a multivariate discriminant analysis similar to that of the original Z-Score on 40 failed and 113 surviving broker and dealer companies using six financial ratios, with an accuracy of 90.1% in correctly classifying a company as expected to fail or expected to survive.

In an application of the Altman Z-Score to demonstrate its usefulness, Altman and McGough (1974) performed a study applying the Altman Z-Score to 34 failed companies from the period 1971 to 1973. Of the 34 failed companies, 46% of these companies had qualified audit opinions on the basis that the company was not longer a going concern. Whereas, the Altman Z-Score had correctly classified 82% of the companies sampled as likely to fail. Altman and McGough (1974) further concluded that corporate failure predictive techniques such as the Altman Z-Score could be useful for auditors in assessment whether a company has correctly or incorrectly prepared their financial statements on the going concern basis (Altman & McGough, 1974).

Deakin (1972) re-performed the study performed by Beaver (1972) on a sample of 32 failed and surviving companies for the period 1964 to 1970 using the same methodology. Deakin (1972) found that indicators of corporate failure in the form of adverse ratios accelerated three and two years before corporate failure occurred. Furthermore Deakin (1972) found that these failures

often occurred subsequent to the companies issuing debt instruments and investing funds into fixed assets. Thereafter, it was likely that these companies were unable to generate sufficient cash from their investments in fixed assets in order to meet their debt obligations. Another factor considered by Deakin (1972) is the effect of interest rates over the period tested in that certain ratios such as the sales to cash equivalent ratios had at times been unusually high for the companies tested likely due to interest rates being high at the time in the United States. Deakin (1972) concluded that financial ratios could be used to predict corporate failure three years prior to the event occurring.

Edmister (1972) performed a study attempting to use financial ratios as a means to predict corporate failure specifically for smaller companies. The previous research performed by Altman (1968) and Beaver (1966) had focused greatly on medium and large size companies whereas the work performed by Edmister (1972) applied to smaller companies. This study is of particular interest in the context of the AltX as the companies used by Edmister (1972) may be more representative of the size of the companies listed on the AltX.

Edmister (1972) selected a sample of 42 companies for the period 1954 to 1969. Edmister derived a seven variable model using multiple discriminant analysis based on financial statement data for three years preceding corporate failure. Edmister (1972) found that the operating cash flow over current liabilities ratio, the net working capital over sales ratio and the equity over total sales ratios of a company to be most significant ratios respectively in predicting corporate failure for smaller companies.

Wilcox (1973) constructed an accounting based corporate failure prediction model using a mean adjusted cash flow over adjusted cash position ratio. Wilcox (1973) tested the model on 53 failed and non-failed firms selecting the non-failed firms on a paired basis concluding that an adjusted cash flow over adjusted cash position ratio was a more powerful predictor of corporate failure than the cash flows from operating activities over total debt ratio as found by Beaver (1966).

Corporate failure prediction also has its roots in the legislature. The United States Supreme Court formulated the Failing Company Doctrine in a case between International Shoe and F.T.C (Blum, 1974) on the premise that a failed firm causes significant harm to its stakeholders and

should rather be allowed to merge with a competitor in order to survive. This is irrespective that the other competitors would be somewhat disadvantaged should such a merger occur (Blum, 1974).

Blum (1974) derived the Failing Company Model as envisaged in *International Shoes v FTC* using a multiple discriminant analysis on 115 failed and 115 surviving companies from 1954 to 1968 that predicted 94% of corporate failures one year before occurrence, 80% of corporate failures two years before occurrence, and approximately 70% of corporate failures three to five years before occurrence. The Failing Company Model consisted of variables representing liquidity, profitability and variability. With respect to variability, the Failing Company Model considered the standard deviation of net income, trend breaks in net income, slope for net income, and the standard deviation, trend breaks and the slope of the quick assets to inventory ratio (Blum, 1974).

Altman et al (1977) extended the research performed by Altman (1968) by calculating Z-Scores for periods 1969 to 1975 on a sample size of 53 failed and 53 surviving firms, deriving the ZETA model using both accounting based and market based variables. The model achieved a 90% and 70% accuracy one year and two years prior to corporate failure occurring.

Altman et al (1977) noted that although the models in existence at the time of the study had achieved relative success and had been reliable in predicting corporate failure, changing circumstances had necessitated the need for the creation of a new model. Amongst the factors considered are the increase in the average size of failed companies; where historically a larger company was less likely to fail, at the time of the study there was an increase in the number of corporate failures amongst large companies. Previous models had not distinguished between sectors but were blanketly applied among all sectors, or had been specifically designed for a standalone sector. There was a need to have a single model that took into account the sector a company operated in. Furthermore, there had been significant changes in accounting practices leading up to the time of the study which necessitated a new model (Altman et al., 1977).

The ZETA model was derived using a multiple discriminant analysis in a similar manner to that of the original Altman (1968) model. However the ZETA model comprised seven input variables and made adjustments such as the capitalising of operating leases, the exclusion of

contingent equity reserves from the equity balance, the netting off of minority interests against the assets of the company, consolidation of non-consolidated subsidiaries, the deduction of intangible assets and goodwill from the total assets of the business, and the expensing as opposed to capitalisation of research and development costs (Altman et al., 1977). Altman et al (1977) found the Z-Score model to be accurate in predicting corporate failure, but the more advanced ZETA model to achieve a higher accuracy rate when extended to five years over that of the original Altman (1968) Z-Score.

Ohlson (1980) used a conditional logit analysis as opposed to Altman's (1968) multivariate discriminant analysis on data for the period 1970 to 1979, using a sample of one hundred and five failed companies and two thousand and fifty eight surviving companies. The sample selected was from companies traded on a formal exchange in the industrial sector. Ohlson (1980) used data from financial statements at the date of publication of the financial statements to the public as opposed to the financial statement date or any other date. This adjustment had not been considered in previous studies.

Ohlson (1980) found four factors that were statistically significant in predicting corporate failure within a year of occurrence; a company's size, capital structure, financial performance and liquidity.

Ohlson's 1980 study states that previous studies had not adjusted for the event that a company enters into bankruptcy between the reporting date of the financial statements and the date that financial statements are published and thereby concluded that the accuracy of financial distress predictors is overstated accordingly, as it had been originally applied in Altman's 1968 study (Ohlson, 1980). Furthermore, companies that are experiencing financial distress could expect to have significant delays in the publication of their financial statements due to the audit process requiring additional time (Ohlson, 1980). Ohlson (1980) found the average time between the financial statements reporting date and the date of publication to be thirteen months for companies that had entered into bankruptcy.

Ohlson (1980) further concludes that the strength of a corporate failure prediction model is dependent on the accuracy and appropriateness of the information inputted into the model, and

that financial ratios are useful in predicting financial distress when derived from large samples of data.

Charitou et al (2004) selected a sample of 51 publically traded industrial companies in the United Kingdom that had failed between 1988 and 1997 and that had published financial statements in the three years preceding corporate failure. In applying Altman's Z-Score, Charitou et al (2004) found the Z-Score to be 83% accurate one year before corporate failure, 63% accurate two years before corporate failure, and 68% accurate three years before corporate failure. Charitou et al (2004) further found that the market value of equity over total debt and the retained earnings over total assets ratio to be the most statistically significant of the five ratios used in the Altman Z-Score.

Beaver et al (2005) used a sample of five hundred and forty one bankrupt companies and a sample of four thousand two hundred and thirty seven surviving companies for the period 1962 to 2002 from the NYSE and the AMEX to analyse whether information contained in financial statements could be used to predict corporate failure and over time with changes in accounting standards whether the predictive ability of information contained in financial statements had diminished. Beaver et al (2005) notes that bankruptcies have been prevalent in certain periods such as 1990-1992 and 1999-2002 where economically challenging conditions had been experienced. Beaver et al (2005) concluded that over time the predictive power of financial information in predicting financial distress remained consistently strong over the period 1962 to 2002 with a slight decline in the usefulness of financial ratios being mitigated by a slight increase in the usefulness of market variables.

During the early 2000s, there had been a renewed interest in credit risk assessment tools greatly due to increased regulation as a result of the Basel II and Basel III requirements (Altman, 2002), the increased use of financial derivatives and complex financial securitisation structures (Agarwal & Taffler, 2007). As a result, in time contingent claims valuation methods such as the KMV model had increased in popularity and the accounting based valuation techniques such as the Altman (1968) Z-Score and the Altman (1995) ZEM-Score had declined in popularity (Agarwal & Taffler, 2007). Contingent claims valuation methods appear to have been favoured over that of accounting based methods as in efficient markets, corporate failure considerations would likely be reflected in the share price, it is free from the influence of accounting policies,

market based measures would be more representative of future cash flows whereas accounting based measures use historical data, and from the financial theory perspective the models are sound (Agarwal & Taffler, 2007). However, these market based valuation techniques are not free from scrutinise as many assumptions are made in their architecture (Agarwal & Taffler, 2007).

To address this trend, Agarwal and Taffler (2007) tested an accounting based corporate failure prediction technique (Taffler Z-Score) against market based corporate failure prediction techniques. Agarwal and Taffler (2007) found that neither model necessary outperformed the other, and both methods are useful for predicting corporate failure.

With respect to South African studies, Court and Radloff (1994) developed a two phase model for predicting corporate failure using both financial and non-financial variables. Court (1994) using a discriminant analysis further found six variables to be useful in predicting corporate failure. Court and Radloff found that the number of board appointments and resignations, the amount of directors' shareholding two years prior to corporate failure, and delays experienced in publishing of financial statements could be used as predictors of corporate failures (Court & Radloff, 1994). Other variables used by Court and Radloff (1994) in the model are profit before interest and tax over total assets ratio, the current assets over total debt ratio, and the equity over assets ratio. These financial variables are consistent with those found by Altman (1968 and 1995) to be significant. Interest in corporate failure prediction models have developed significantly since the first multiple discriminant analysis models were first developed by Altman (1968). Altman and Saunders (1997) attribute the interest to a global increase in bankruptcies over time, usage of complex financial derivative instruments and declining value of property.

Accordingly financial institutions have over time adopted more advanced methods for evaluating the recoverability of financial instruments. Historically these assessments may have made solely by the management of institutions by looking at the characteristics of the borrower as opposed analysing the empirical evidence (Altman & Saunders, 1997). Interesting and contrary to the current trend mentioned by Altman and Saunders (1997), Libby (1975) performed a study of the usefulness of accounting ratios from the perspective of loan holders by giving a sample of loan officers accounting ratios from failed and non-failed firms in order for

them to make an assessment as to whether the company would fail or not based on the ratios. Libby (1975) found that the loan officers were able predict whether the companies would fail or survive by reviewing the ratios and applying their judgement.

Nevertheless, corporate failure prediction models have been used widely by many institutions and investors to assess corporate solvency (Altman & Saunders, 1997). Altman et al (1994) further notes how the Centrale die Bilanci (an organisation established by the Italian Central Bank) has used neural networks and logit analysis as an early warning system for Italian banks to use in identifying industrial companies that run an increased risk of corporate failure (Altman et al., 1994).

2.1 Background to the AltX

The Alternative Exchange (AltX) is the secondary securities exchange to the Johannesburg Securities Exchange (JSE). The AltX consists of smaller cap companies compared to the main board which are characterised as growth stocks. The primary objective of the AltX provides these smaller cap companies with access to additional capital (Johannesburg Securities Exchange, n.d.) in order to facilitate this growth.

Although the listing requirements of the Alt-X are not as extensive as that of the Johannesburg Securities Exchange main board, companies listed on the exchange are still subject to onerous compliance requirements. In terms of the Alt-X listing a requirements, a company listing on the Alt-X is required to obtain a designated advisor who performs a due diligence on the company to determine whether the company is suitable to be listed on the exchange. Furthermore, the company is required, with the assistance of the designated advisor, to submit a business plan to the JSE Issuer Services. Thereafter the board of the directors of the company are to make a presentation to the Alt-X advisory committee. (Johannesburg Securities Exchange, n.d.)

With respect to listing requirements, a company wishing to list on the Alt-X is required have an issued share capital in excess of R2 million and have at least 100 shareholders. There are no requirements for the company in terms of pre-tax profit or profit history for companies wishing to list on the Alt-X, whereas the JSE Main Board requires at least 3 years profit history and for pretax profit to exceed R8 million (Johannesburg Securities Exchange, n.d.).

The Alt-X is made up of a broad range of sectors, but it is dominated by the consumer services sector which makes up approximately 41% of the board over the period studied, followed by basic resources, industrials and healthcare.

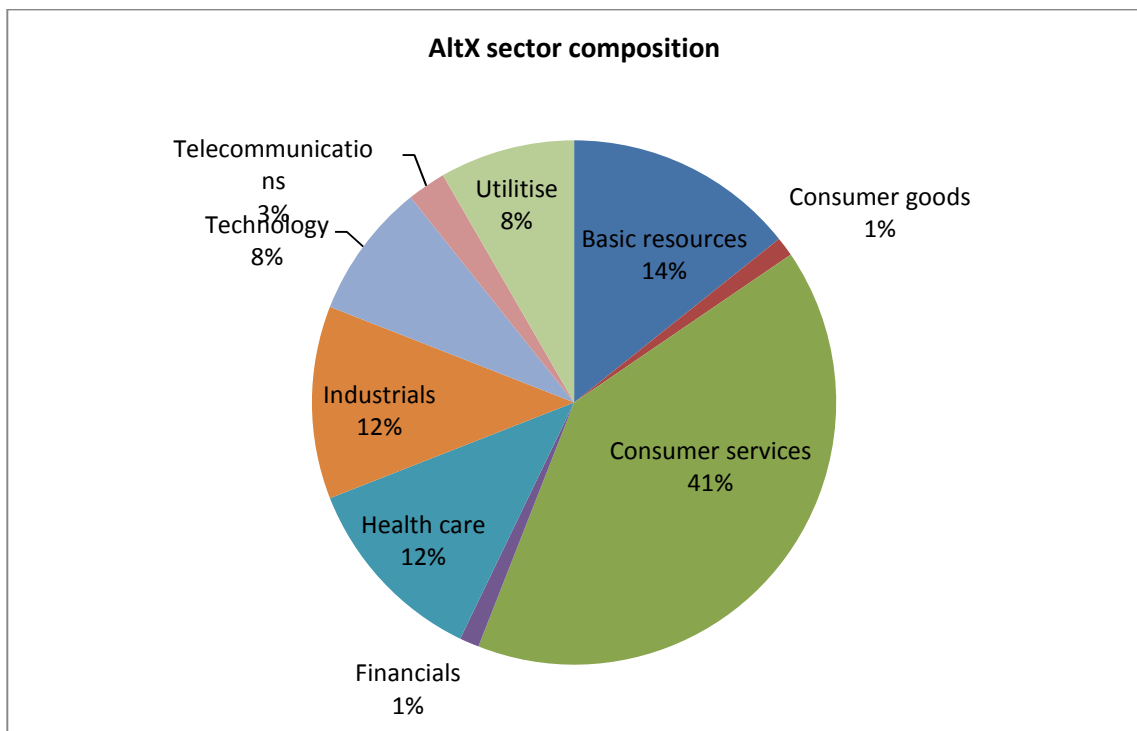


Figure 1

Since its establishment in 2006, the Alt-X grew considerably leading up to 2008 and 2009 where it sharply declined by approximately 80% (refer to figure 2). Subsequently, the JSE has seen significant growth whereas the Alt X had experienced a steady decline. In 2009, the dramatic fall in the equity values raised the question as to whether the companies listed had not fully recovered from the financial crisis experienced in 2009 and accordingly are still subjected to higher levels of risk of corporate failure.

Correia (2009) suggests that the reason for the dramatic fall in 2008 and 2009 in equity prices is that the companies traded on the Alt-X were overvalued at that time and that part of the fall in the prices can be attributed to a correction. However, Correia (2009) further addresses this matter by reviewing the price earnings ratios of companies listed on the Alt-X and the first day listing returns and finds that the price earnings ratios of Alt-X companies in 2008 were on average less than 5 and the first day returns was significantly lower than that of other

comparable exchanges. Using data from the same period, Correia found that price earnings ratios for companies listed on the JSE Main Board were on average 11.5 and accordingly concluded that it was unlikely that the companies listed on the Alt-X were overvalued leading up to the financial crisis of 2008/2009 (Correia, 2009).

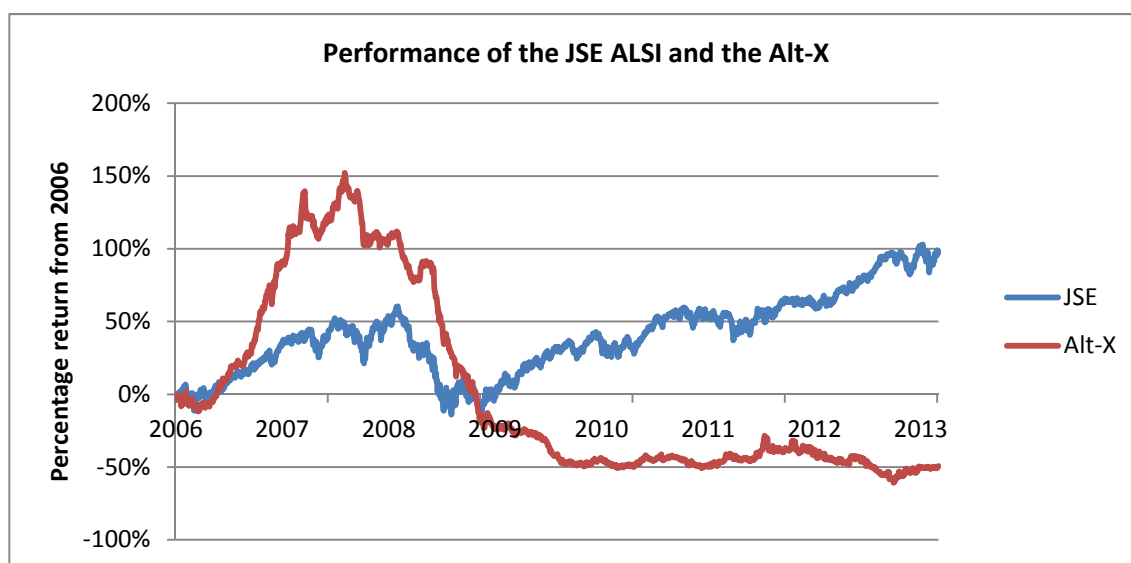


Figure 2

Correia (2009) further demonstrates that 60% of companies trading on the Alt-X were trading at market values below their equity book value. As at the end of 2012, there are still numerous companies listed on the Alt-X that remain in such a position, although the average price to book ratio has increased over the period tested from 2008 to 2012, indicating a recovery from 2009 to 2011 and thereafter a stabilisation of the price to book ratios. Nevertheless, the number of companies trading on with market prices below their book value is on average 44% based on the midyear share prices over the period tested.

Notably, differences in the number of companies trading below their market value are expected between Correia's (2009) study and this study as Correia's study used the market value at the financial year end of the company and this study uses the midyear market value in the calendar year of the financial year end.

To extent the analysis performed by Correia (2009) and to gain insight into why the AltX has not seen the strong recovery as the JSE Main board has, the market to book values and the price earnings multiples were calculated.

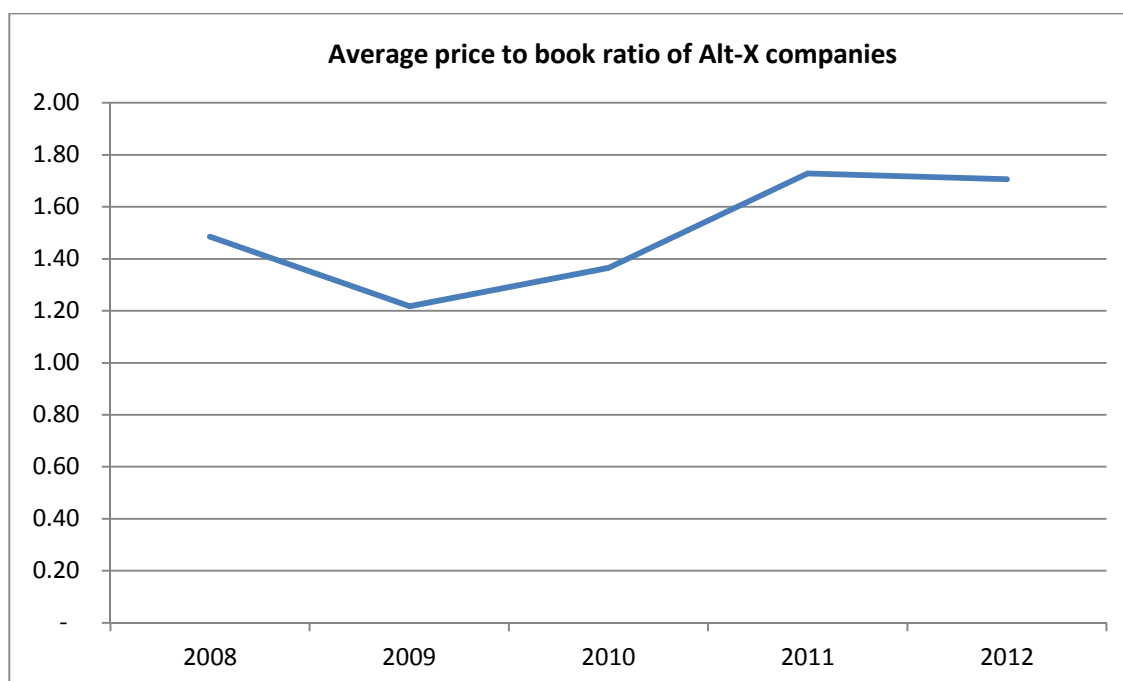


Figure 3

Despite the relative poor performance of the Alt-X to that of the JSE main board, the price to book value of Alt-X companies does not seem to indicate any dramatic movements or trends. Although the average price to book ratio has increased over the period tested there have been movements in the number of companies with price to book ratios of less than one over the period. In 2008 the 35% of companies listed on the Alt-X traded with a market value less than that of the book value. Subsequently, this increased to 48%, 54% and 52% in 2009, 2010 and 2011 respectively. In 2012, the percentage improved substantially to 30%. This may be due to three bankruptcies occurring in 2011 and one bankruptcy occurring in 2012, improving the averages.

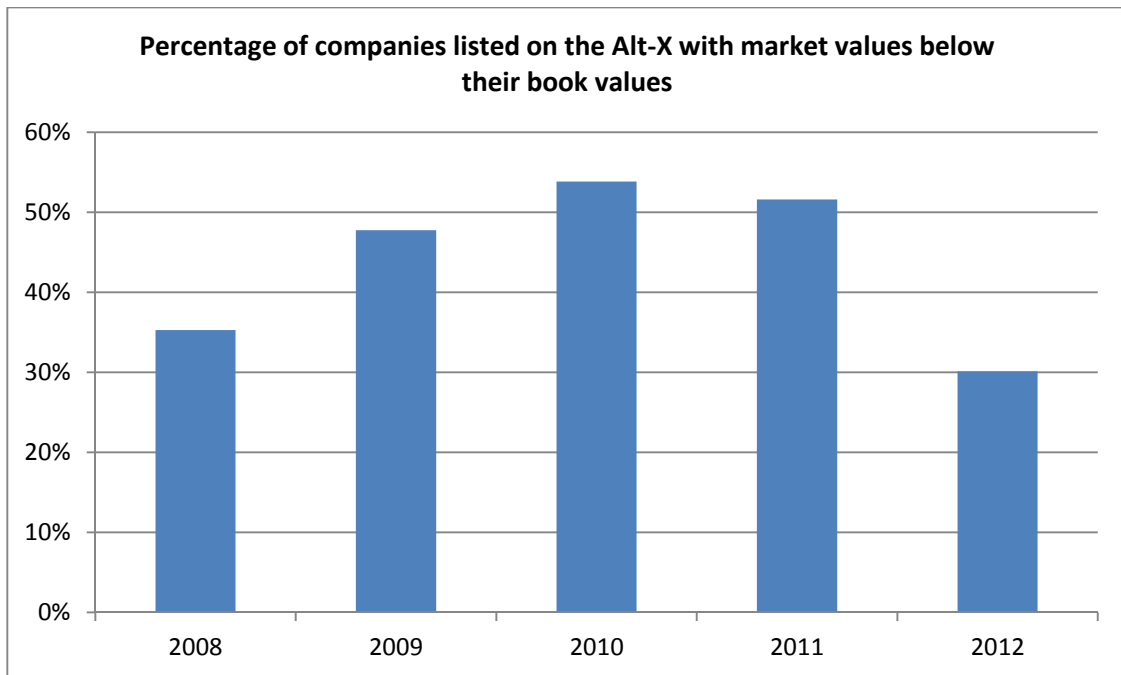


Figure 4

As a further analysis measure, the price to earnings ratio was calculated over the period to identify any additional trends. In calculating the price earnings ratios, for four of the five periods tested the average price earnings ratio was negative driven by the losses incurred on the Alt-X. The median of price earnings ratios over the period on average is 2.82 which may be a better comparable than that of the average.

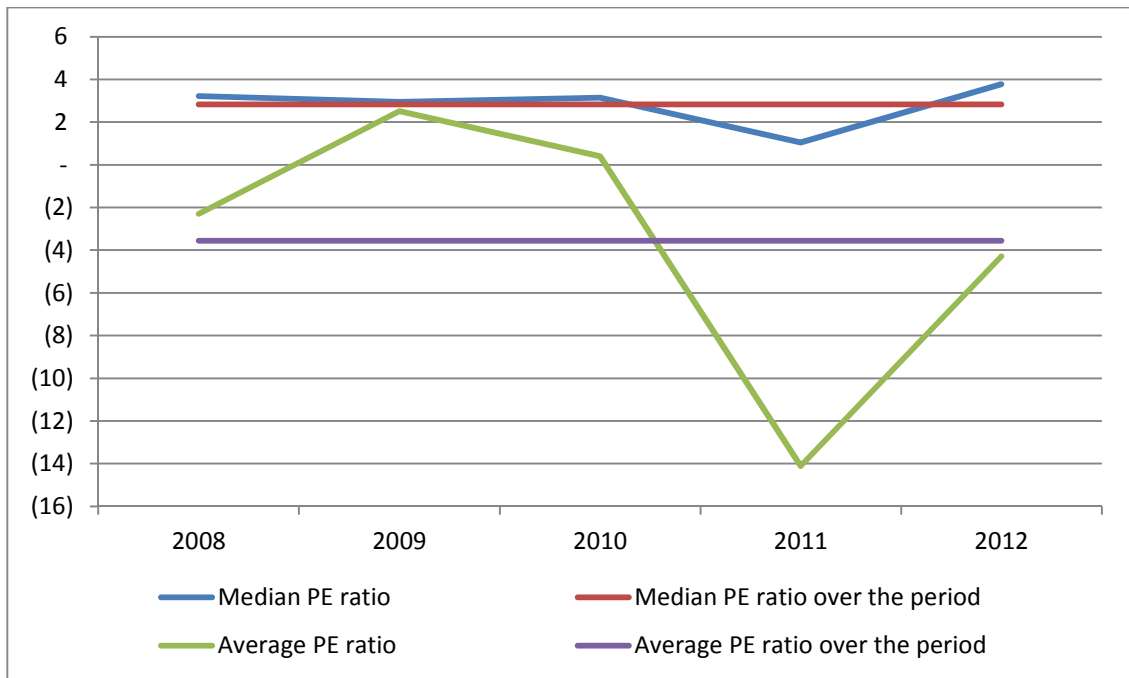


Figure 5

The low price to earnings ratio may be more indicative of low earnings as opposed to stock pricing errors. From 2008 to 2011 the Alt-X saw a significant increase in the number of companies that were in loss making positions. In 2008, approximately 19% of Alt-X companies were in loss making positions. This sharply rose to 50% of companies listed in 2011, and has substantially declined in 2012 to 30%.

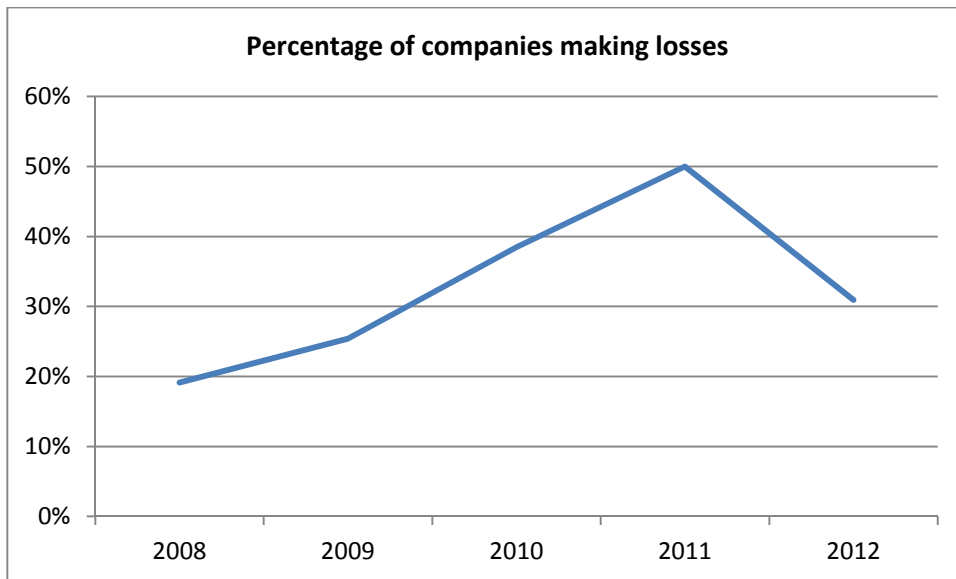


Figure 6

Based on the above factors, it appears that the companies listed on the Alt-X over this period have struggled to achieve profitability following the financial crisis of 2009 and accordingly from a corporate failure predictability perspective, the Alt-X is of particular interest.

Correia (2009) concluded that companies listed on the Alt-X in 2008 were not subject to an unusual likelihood of corporate failure on the basis of the Z-Score and Z-EM scores calculated. Correia (2009) found using the Altman Z-Score and the Altman Z-EM Score that only 11% and 6% of companies respectively were expected to fail. A large contributor to this result was that companies listed on the Alt-X had relatively low levels of financial leverage.

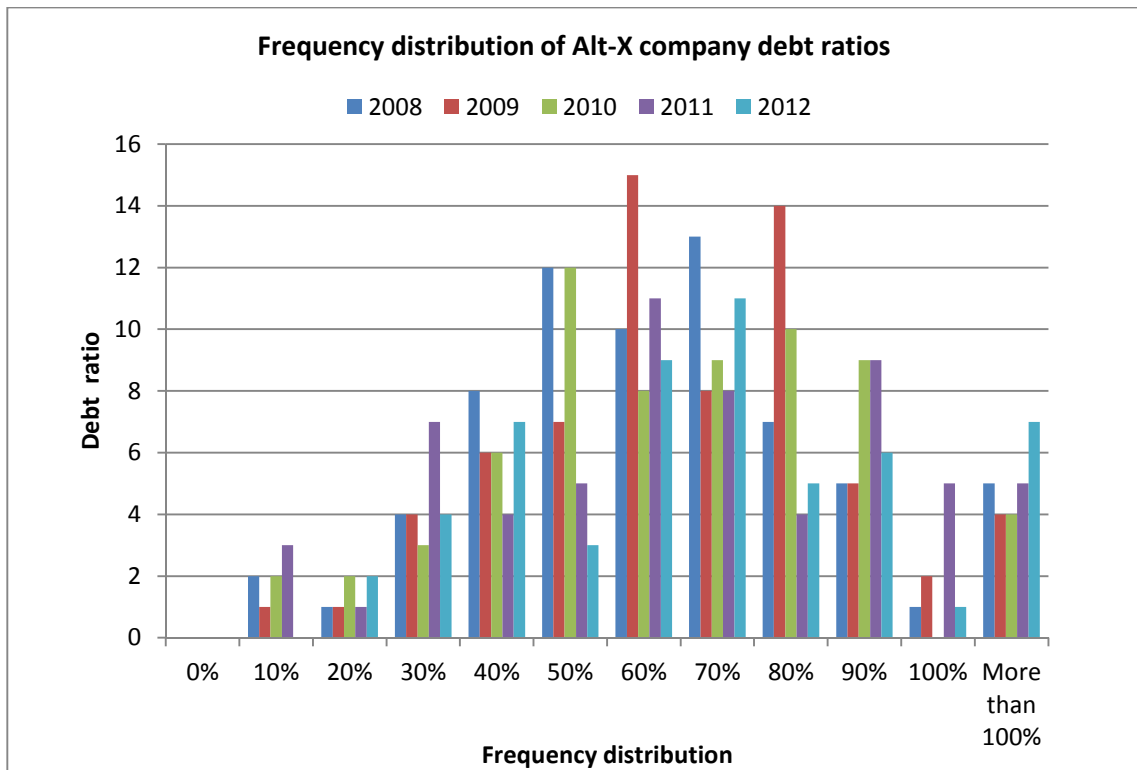


Figure 7

	2008	2009	2010	2011	2012
Average debt ratio	58%	64%	75%	87%	65%
Average debt ratio over the period	70%	70%	70%	70%	70%
Median debt ratio	59%	59%	59%	60%	62%
Median debt ratio over the period	59%	59%	59%	59%	59%
Standard deviation of debt ratios	25%	37%	106%	189%	36%

Figure 8

To consider Correia's (2009) finding that the debt ratios of companies listed on the Alt-X had been relatively low, the debt ratios of companies was calculated as total debt divided by the total assets of each company. This represents the extent to which a company's assets are financed using debt. Following Correia's (2009) study the debt ratios of companies listed on the Alt-X has risen, likely to finance the losses incurred over this period as discussed above. The average debt ratio over is 70%, with the debt ratio of 58% 2008 rising to a debt ratio of 87% in 2011 and

then falling to 65% in 2012. Of interest is the extent to which the standard deviations of the debt ratio rose substantially from 2008 to 2009 indicating dispersions in the debt ratios used by companies. The number of companies that have debt ratios in excess of 100% has grown over the period tested as well from 7% in 2008 to 13% in 2013. Accordingly, the assessment made by Correia (2009) that companies listed on the Alt-X had relatively low levels of financial leverage does necessarily appear to be the case subsequent to the financial crisis of 2008, particularly given the increased variability of debt ratios amongst companies listed on the Alt-X

Over the period 2008 to 2012, there have been eight bankruptcies on the Alt-X, four of which have come from the technology and industrials sector whereas only one bankruptcy occurred in the consumer services sector. Although given the size of the population tested, it is difficult to infer whether the bankruptcies are more prevalent in one particular sector over another.

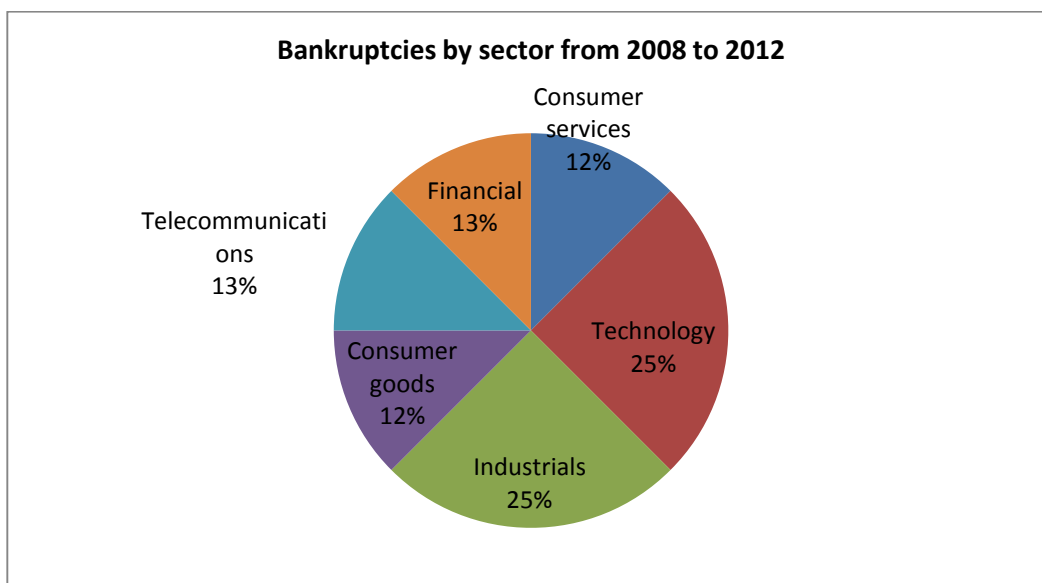


Figure 9

Given the small population tested, it is difficult to infer whether there is one year in the period tested that has had a more significant prevalence of bankruptcies than any other year. Of the companies listed in 2008, two of the companies went bankrupt in 2009, one in 2010, four in 2011 and one in 2012. Notably one of the companies that failed in 2011 is a financial services company and falls outside of the scope of this study.

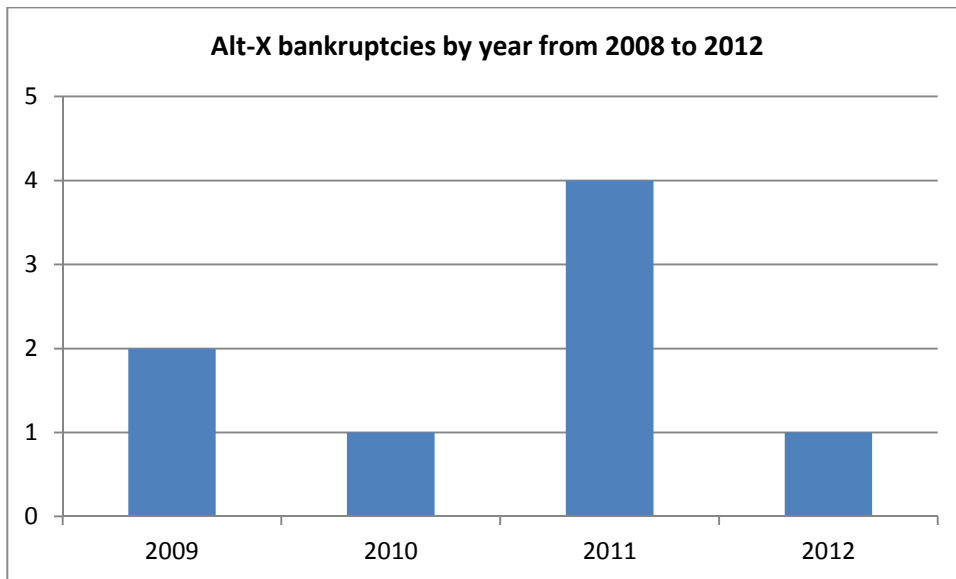


Figure 10

There appears to be strengthening of many of ratios discussed in the 2012 year which may be as a result of the corporate failure events of the 2011 year. The improvements in the ratios may not necessarily be as a result of an intrinsic improvement in the performance of the underlying companies, but it may rather simply be as a result of an improvement in the averages after the removal of the failed companies of 2011 from the dataset. Therefore, it is not fair to conclude that there has been an improvement in the corporate solvency of companies listed on the Alt-X in the 2012 financial year without perhaps further evaluation. This shall be considered later.

Correia (2009) performed an analysis of the stocks listed on the Alt-X using 2008 financial year to determine whether the falling share prices was indicative of corporate failure by calculating the Z-Score and Z-EM Scores. In that study Correia (2009) concluded that the companies listed on the Alt-X were not subject to high probabilities of corporate failure.

Subsequently there have been numerous bankruptcies on the Alt-X and the overall index has not significantly recovered. There are a large proportion of companies that had incurred losses and had rising levels of debt likely to compensate for negative cash generation.

This study covers five periods subsequent to the Correia's (2009) study and allows for the retrospective analysis of the findings at the time.

It has been well documented in academic literature that the Altman Z-Score and EMS Score do not predict corporate failure three years preceding corporate failure with as much accuracy as it

does within three years of corporate failure. Without pre-empting the outcome of this study, it does need to be acknowledged that the findings of Correia's (2009) application of the Altman Z-Score and the Altman Z-EM score may well have given the conclusion expected considering the loss of accuracy with extended forecast periods.

Therefore, the research question is whether there was an increase in the risk of corporate failure in years subsequent to the 2008 financial crisis that was not evident in the Z-Score and Z-EM Score calculated at the time of the crisis by Correia (2009).

2.2 Definitions

2.2.1 Corporate failure

Altman defined corporate failure as a company that is legally bankrupt and placed in liquidation (Altman, 1968). Similarly, other studies have defined corporate failure as when a company files for bankruptcy in terms of chapter five and six of United States bankruptcy laws (Ohlson, 1980), and the legal definition according to the United Kingdom Insolvency Act of 1986 (Charitow et al, 2004)

Beaver (1966) defined corporate failure as a inability of a company to pay its debts as they fall due through corporate actions such as bankruptcy, default on debt payments, overdrawn bank balances, or failure to pay a preference dividend to shareholders (Beaver, 1966).

Deakin (1972) defined corporate failure as companies that had entered into bankruptcy, insolvency or liquidation.

The South African Companies Act defines financial distress as when it is unlikely that a company will be able to pay all of its debts as and when they fall due within a 6 month period and a company shall become insolvent within a 6 month period.

With respect to South African research, De Lay Rey (1981) defined corporate failure broadly as when a company is in a net liability position, when it can no longer meeting its financial liabilities, pay out preference dividends and it is no longer in a position to pay out ordinary dividends. Therefore, it appears as though the definitions of corporate failure used on other South African studies both legally and in terms of historical studies have been greatly consistent with that of studies performed in the United States and the United Kingdom. This addresses the

concerns raised by Altman (2005) that the Z-Score and Z-EM models would not be entirely comparable among different countries due to legislative and regulatory practices.

Therefore, for the purposes of this study, corporate failure, financial distress, or any other synonym thereof shall be defined as when a company is placed in liquidation. Determining whether a company is expected to be able to pay off its debts and remain liquid within a 6 month period is a greatly subjective test which would require information that is not publicly available such as cash flow forecasts and an understanding of the prospects of a company. Therefore, although using the South african definition of financial distress would have been an interesting definition to apply, it is impracticable to do so for the purpose of this study.

An objective of this paper was to consider whether Correia's conclusion that companies listed on the Alt-X were not according to the Z-Score and Z-EM Score subject to corporate failure risk. One factor to consider is the changes in legislation around corporate failure and bankruptcy. Subsequent to Correia's 2008 study on the Alt-X, a new South African Companies Act 2008 was implemented replacing the Companies Act No.61 of 1973.

The revised Companies Act introduced a new proceeding similar to that of the US Bankruptcy Code 11, Chapter 11 into South African company law. Chapter 6 of the Companies Act No.71 of 2008 now requires that a company that is in financial distress is required to enter into business rescue proceedings, which allows the company to be temporarily placed under the supervision of the court, allows for a temporary moratorium on the company's claimants, and allows for the company to develop a business rescue plan allowing it to trade out of its financial distressed position.

This process may be implemented by the board of directors of a financial distressed company if the company is in financial distress and there appears to be a reasonable prospect of rescuing the company, but this may not be adopted if the liquidation proceedings have already been initiated against the company. Alternatively business rescue proceedings may also be initiated by a court order upon application of any stakeholder, whether it be shareholder, creditor, or an individual employee or trade union (Mindlin, 2013).

The US Code 11 was first published in 1926, and accordingly was implicit in Altman's (1968) Z-Score and Z'EM-Score. Accordingly, the alignment of South Africa's bankruptcy legislation with that of the United States' legislation shall perhaps bring about better comparability between the studies. However, this is not expected to significantly impact the results of this

study as corporate failure has been defined as when the company enters into liquidation and therefore the basis for comparison is consistent between South Africa and the United States before and after the implementation of the South African Companies Act No.71 of 2008.

3 Data and methodology

Data was selected for all companies listed on the AltX from 2008 to 2012 excluding financial services companies and property funds. The data was extracted from McGregor BFA. The data was processed through an excel model calculating the Z and Z-EM scores.

In Correia's (2009) study on the application of Altman Z-score and Z-EM scores to the AltX, differences were identified when using the market value of equity at the date of the financial statements and using the market value of equity three months after the financial statement date to allow investors to take the information disclosed within the financial statement into the share price. This study uses the mid-year market value of equity to give an even basis for comparison year on year. Alt-X listed companies are required to publish interim financial statements and release profit warning on SENS, meaning that financial statement data has increased transparency.

A factor to consider discussed by Ohlson (1980) is that a company may publish their financial results after entering into bankruptcy after the financial reporting date but before the date of publication of the financial statements and accordingly the financial statement data may not be appropriate as an objective factor to include in a financial distress predictor. To address this factor, the data used in this study was tested to determine whether the date of publication of the financial statements was before that of the date of bankruptcy and adjusted for.

3.1 Altman's Z Score

Altman's Z Score is calculated as follows:

$$Z = 1.2X_1 + 1.4X_2 + 3.3 X_3 + 0.6X_4 + 1.0X_5$$

$$X_1 = \text{Working capital / total assets}$$

$$X_2 = \text{Retained earnings / total assets}$$

$$X_3 = \text{Earnings before interest and taxes / total assets}$$

$$X_4 = \text{Market value of equity / book value of debt}$$

$$X_5 = \text{Sales / total assets}$$

The calculated Altman Z Score can be classified and interpreted into three different categories: companies that are expected to fail (less than 1.81), companies that are expected to not fail

(above 2.99), and companies where it is uncertain as to whether they will fail or not (between 1.81 and 2.99).

No adjustments are made to the financial statement ratios as had been performed in the ZETA model (Altman et al., 1977). Although outside the scope of this study, it would be interesting to determine whether the results the Altman Z-Score and the Altman Z-EM score would have been significantly different in terms of its failure prediction strength had certain adjustments been made as it had been in calculating the Altman ZETA-Score. Other than those adjustments mentioned by Altman et al. (1977), perhaps adjustments for accounting policies may be adopted, such as adjusting for accounting policies applied to financial instruments, where if a financial asset is classified as held for trading any gains or losses in the fair value of the instrument go to the income statement, whereas if the financial asset is classified as available for sale then the gains or losses in the fair value of that instruments are taken through other comprehensive income. Another adjustment to gain consistency in accounting policies may be to remove the effect of revaluation of land. The choice of the revaluation model for property, plant and equipment allows for a company to revalue their land and buildings annually, thereby increasing their asset base. This will therefore directly affect the comparability of financial statements and likely the predictive power of a corporate failure prediction model.

For the purposes of this study the scores are calculated as originally envisaged in the Altman's (1968 & 1995) study.

3.1.1 Working capital/total assets

Working capital over total assets is the factor in the formula that considers the liquidity in the business. Liquidity was considered to be a contributing factor to corporate failure as a firm that had been consistently incurring losses is likely to have a shrinking working capital as a result of operating cash flow outflows (Altman, 2000).

In this formula, working capital is defined as the company's current assets less its current liabilities. These amounts are taken directly from the company's financial statements as published and no adjustments are made to them accordingly. Other ratios considered by Altman (1968) to consider liquidity were the current ratio and liquidity ratio; however these were found to be contribute less to the multiple discriminant analysis than the working capital over total assets ratio (Altman, 2000).

3.1.2 Retained earnings/total assets

Retained earnings over total assets is considered to be a measure of leverage of a company as it represents the total accumulated earnings reinvested into the assets of the business, with the remainder of the total assets being financed through debt. Altman (2005) mentions that the retained earnings of a company is susceptible to distortion due to restructurings and dividends. Fortunately due to the size of the companies on the Alt-X and the relative age of most companies listed on the exchange, such corporate events are unlikely and no such events were identified during this study for the period tested. Furthermore, Correia (2009) found that companies listed on the Alt-X appear to have relatively low levels of financial leverage and accordingly the contribution of such corporate events if they were to occur would be unlikely to alter conclusions reached.

3.1.3 Earnings before interest and taxes/total assets

Earnings before interest and taxes over total assets is the measure used to represent profitability in the model and represents how a company's assets have been used to generate profits. The measure is taken before tax and earnings to create a measure that is consistent among firms irrespective of the company's leverage or tax structure (Altman, 2000). Earnings before interest and taxes is an unadjusted amount taken directly from the financial statements.

3.1.4 Market value of equity/book value of total liabilities

Market value of equity over total liabilities is calculated as the market value of all the company's equity instruments including preference shares and any other equity instruments divided by the total liabilities of the company per the published financial statements (Altman, 2000). The inclusion of the market value of equity is the only variable in the Z-Score that is not obtained directly off of a company's financial statements and accordingly it includes a market expectations factor into the corporate failure prediction model. The factor represents the solvency consideration in the corporate failure mode and it represents the extent to which market values can fall until such stage as a company's liabilities exceed its assets fairly value and the firm is therefore technically insolvent (Altman, 2000).

3.1.5 Sales/total assets

The sales over total assets, or better known as the asset turnover ratio, is the ratio that represents a company's activity and the sales and total assets variables are unadjusted and taken directly from the financial statements. Altman (2000) notes that the asset turnover ratio individually makes the least significant contribution to the accuracy of the Z-Score model, but when combined with the other components of the model it significantly increases the models predictive ability.

3.2 Altman's Z-EM score

A company's Z-EM Score is calculated in two phases. Firstly, a score (EM Score) is calculated based on inputs into a formula, which has been derived using the multiple discriminant analysis technique. Thereafter the score is modified for a countries sovereign yield spread to arrive at the bond equivalent rating (Altman, 2005). Further adjustments may then be made to the EMS score to factor in a company's sensitivity to foreign exchange fluctuations, the company's industry, and the competitive position that a company holds in its particular sector.

Unlike the Altman Z-Score, the Z-EM score has the advantage that it can be applied to companies not traded on a formal exchange and its application is not limited to manufacturing companies but it can rather be applied to all companies (Altman, 2005). Therefore for the purposes of this study, this method may be more relevant than the Altman Z-Score as it better fits the profile of companies traded on the AltX.

The Z-EM Score is calculated as follows:

$$\text{Z-EM} = 6.56X_1 + 3.26X_2 + 6.72X_3 + 1.05X_4 + 3.25$$

$$X_1 = \text{Working capital / total assets}$$

$$X_2 = \text{Retained earnings / total assets}$$

$$X_3 = \text{Operating income / total assets}$$

$$X_4 = \text{Book value of equity/ book value of debt}$$

The variables used in the formula are consistent with that of the Z-Score and do not require any modification. The book value of equity is the only new variable introduced and includes all equity components such as share capital, preference capital, retained earnings, or it can be calculated otherwise as a company's total assets less its total liabilities. The final constant term in the score has been calculated as the median of the Z-Scores for failed companies in the United States and serves as a base line for determined default level bond equivalent ratings. Once the Altman Z-EM Score has been calculated, a bond rating equivalent can be determined. The bond equivalent rating table has been derived from an analysis of financial statements (Altman, 2005).

Rating	EM Score range	
AAA	>8.15	
AA+	7.60	8.15
AA	7.30	7.60
AA-	7.00	7.30
A+	6.85	7.00
A	6.65	6.85
A-	6.40	6.65
BBB+	6.25	6.40
BBB	5.85	6.25
BBB-	5.65	5.85
BB+	5.25	5.65
BB	4.95	5.25
BB-	4.75	4.95
B+	4.50	4.75
B	4.15	4.50
B-	3.75	4.15
CCC+	3.20	3.75
CCC	2.50	3.20
CCC-	1.75	2.50
D	<1.75	

Table 1

Similar to the classifications in Altman's (1968) Z-Score, companies with rating BBB and higher are considered to be safe, companies with ratings between BBB- and B are considered to be in the grey zone, and companies with bond equivalent ratings below B are considered to be in financial distress (Altman, 2005).

The Z-EM Score may be further adjusted for industry factors, foreign exchange devaluation risk, competitive positions and sovereign spread (Altman, 2005). For the purposes of this study this has not been performed, firstly as these adjustments would require a considerable amount of judgement in determining the extent of any adjustment and accordingly may diminish the empirical relevance of this study, secondly no such adjustments are made in order for this study to be comparable with other studies performed (Correia, 2009).

4 Results

The Altman Z-Scores for all companies listed on the Alt-X from 2008 to 2012 were calculated on the basis discussed without any adjustment. Correia (2009) found that only 11% of companies listed on the Alt-X had Z-Scores that indicated a likelihood of corporate failure. Similarly, this study also found 11% of companies listed on the Alt-X had Z-Scores that indicate a likelihood of failure. The difference between the studies is that Correia's (2009) study used the market value of equity variable in the formula as the market value of equity three months after the financial statement year end. This study uses the mid-year market value as the input variable into the Z-Score formula.

Notably, the 2009 year indicated considerably higher levels of corporate failure likelihood when compared to the 2008 year. Thereafter, the likelihood of corporate failure decreased for years following 2009. The majority of bankruptcies over the period occurred in the 2011 year which interestingly is the year where the average Z-Score over the period was the strongest and the highest proportion of firms were considered not to be likely to fail.

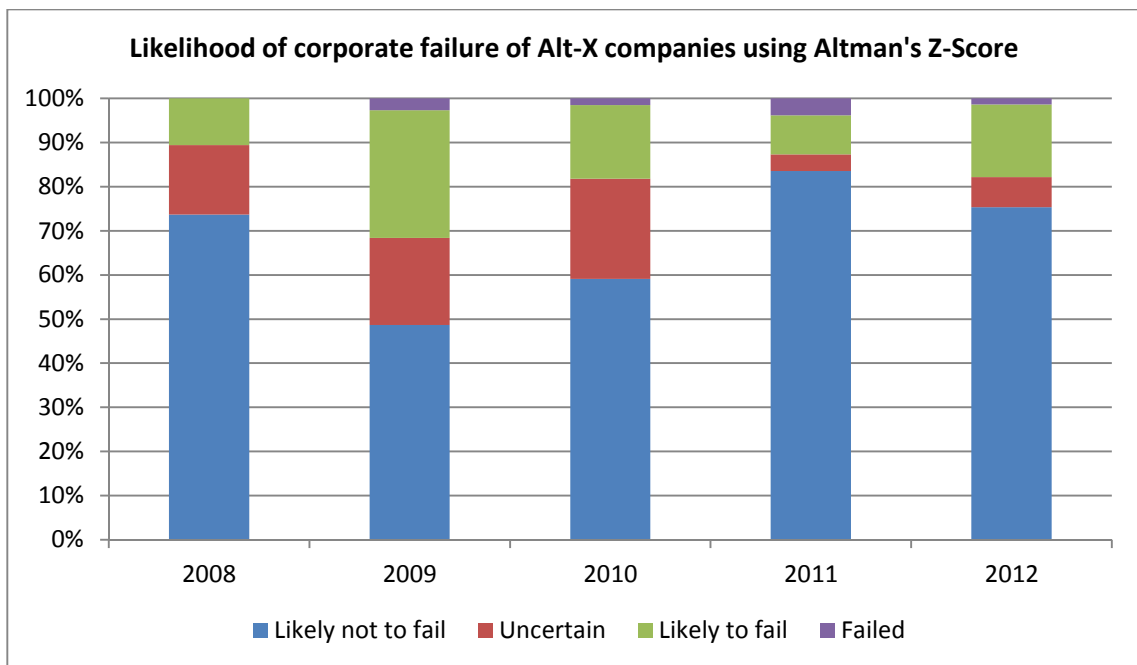


Figure 10

Since the 2008 year, the average Z-Scores of companies listed on the Alt-X have been steadily improving. Although when considering the standard deviation and median of Z-Scores over the period, there appears to a trend in that the spread of companies Z-Scores are widening and a

clear differentiation is being made over time between firms that are expected not to fail and firms that expected to fail. In 2011, the there is a substantial increase in the maximum Z-Score calculated and the minimum Z-Score calculated and over the period 2008 to 2011 there is a clear increase in the range of values (from 27.97 to 184.75).

	2008	2009	2010	2011	2012
Mean	4.14	3.73	4.76	5.09	4.01
Standard Error	0.38	0.43	1.18	2.47	0.59
Median	4.02	3.49	3.25	3.10	3.62
Mode	3.43	4.07	2.66	4.21	7.10
Standard Deviation	3.17	3.56	9.49	19.46	4.34
Sample Variance	10.04	12.64	89.97	378.81	18.86
Kurtosis	15.32	16.74	23.41	17.74	10.76
Skewness	-2.18	2.41	4.36	-0.46	-0.67
Range	25.91	31.65	76.50	184.76	36.51
Minimum	-13.81	-7.59	-17.46	-95.99	-15.88
Maximum	12.10	24.06	59.04	88.76	20.63

Table 2

However, following the corporate failures of 2011, the 2012 median, mean and standard deviation of Z-Scores appears to normalise. Further to the corporate failures over the period, there have also been companies previously listed on the Alt-X that had been privatised and delisted. These shall be considered later in this study.

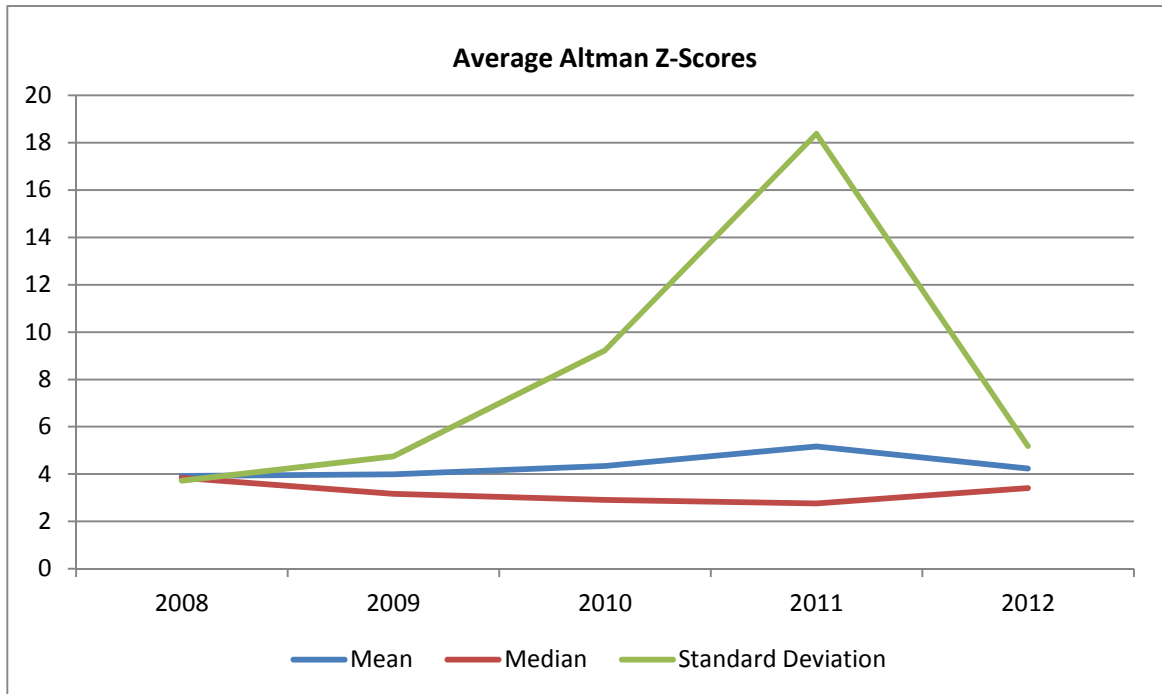


Figure 11

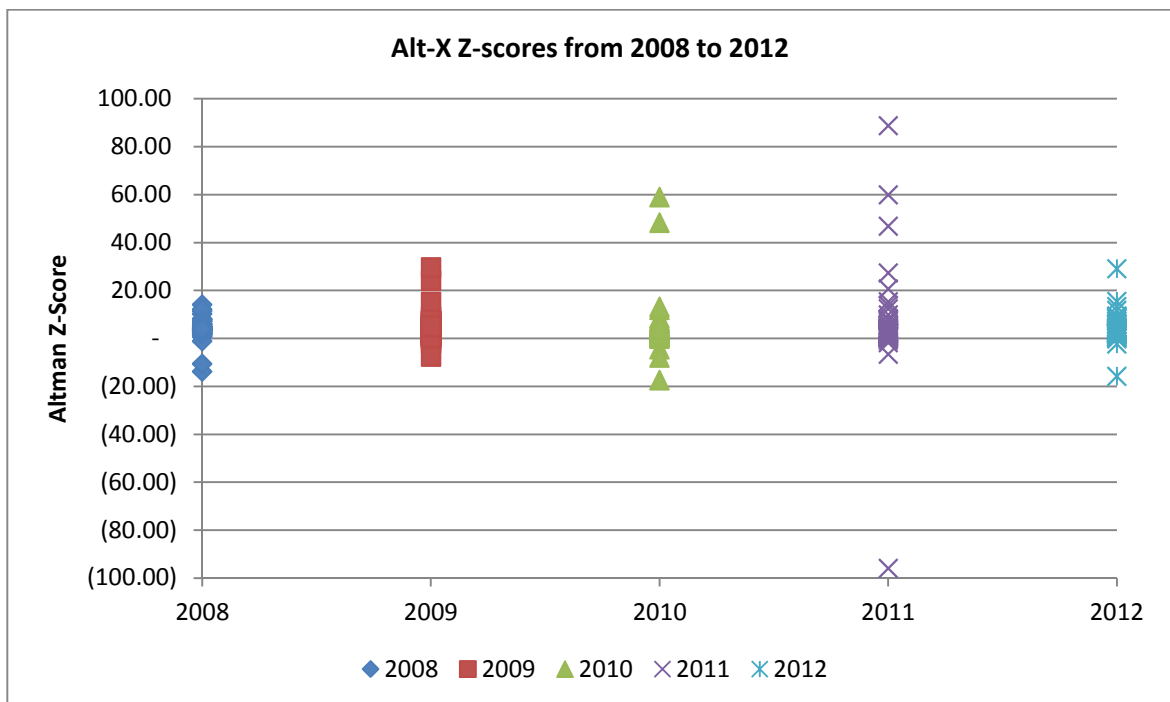


Figure 12

With respect to the average Z-Scores of companies, the largest contributor to the Z-Scores for the companies listed on the Alt-X has been the market value of equity over total liabilities followed by the turnover over total assets component of the formula followed by the market value to total liabilities ratio and the retained earnings to total assets. Interesting, the 2011 year, with the highest mean Z-Scores in the period tested was the year where the mean earnings before interest and taxes over total assets and the working capital over total assets ratios had turned into negatives, which would have seemingly brought down the mean Z-Scores of companies listed on the Alt-X. However, this was substantially offset by an increase in the market value of equity over total debt ratio. The contribution made by the sales over total assets ratio appears to have remained fairly consistent over the period. It shall be interesting to see if the ZEM Scores which exclude the market value of equity component and look at book values alone would yield different results particular when considering that the Alt-X index has substantially underperformed the JSE Main Board has discussed earlier and the debt to equity ratio of companies have increased somewhat but not substantially. This shall be considered later in this study.

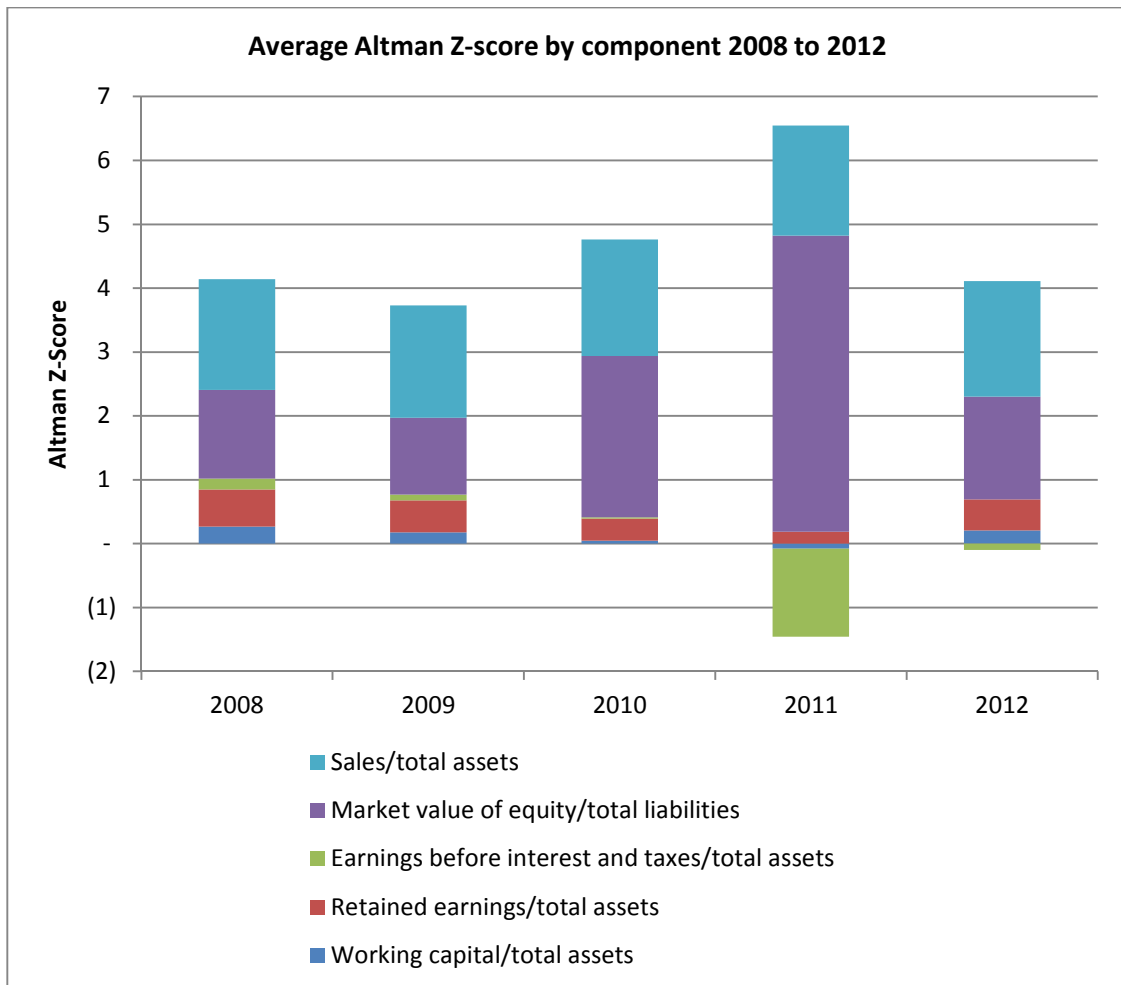


Figure 13

Figure 14 demonstrates that the market value of equity to total debt ratio has increased substantially since 2008, but this has been offset by a decline in all other variable inputs into the Altman Z-Score formula with the exception of the sales to total assets ratio that has remained relatively constant when compared to the other ratio inputs. The most notable of the declining ratios has been the Earnings before interest and taxes ratio over total assets ratio.

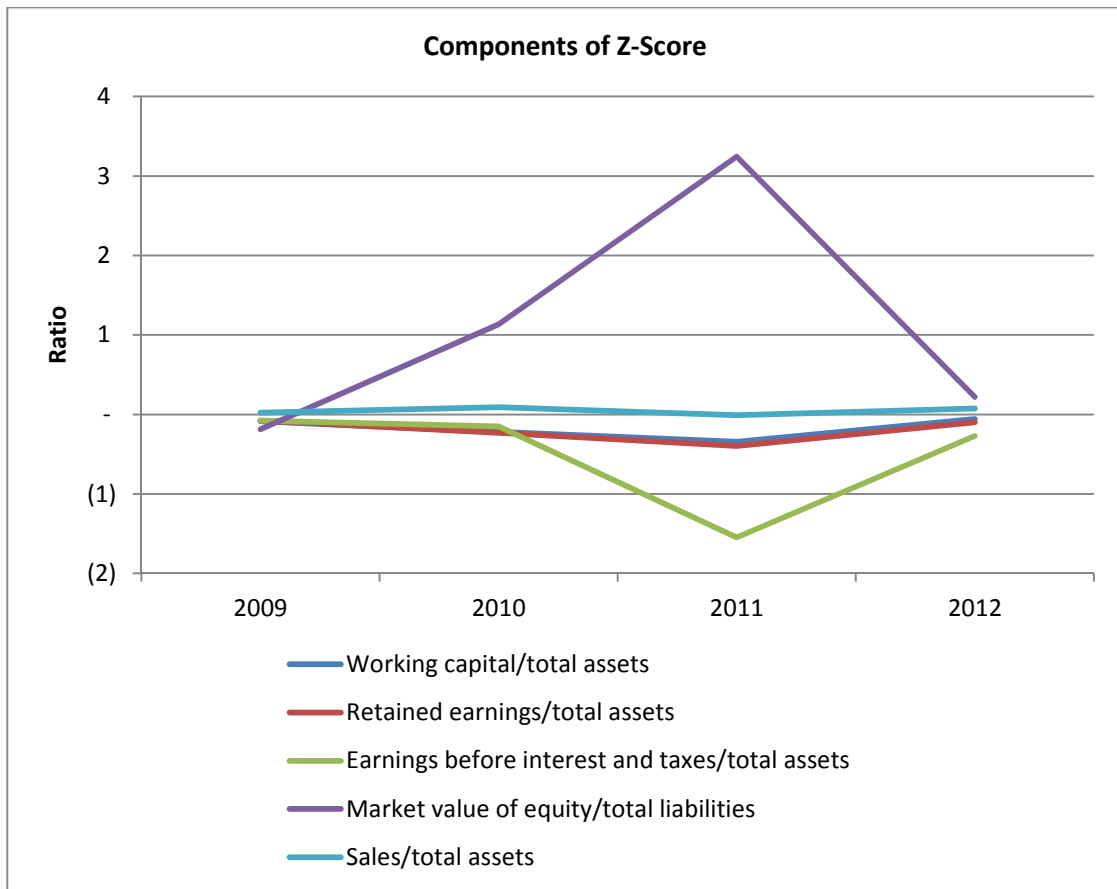


Figure 14

With respect to sectors, there have differing trends among sectors, with the consumer goods market and the consumer services market appearing to have improved their solvency whereas the healthcare sector and the utilise sector appear to have declined with respect to solvency. Although given the small size of companies in each of these sectors, it is difficult to infer any bias in terms of sector from this study.

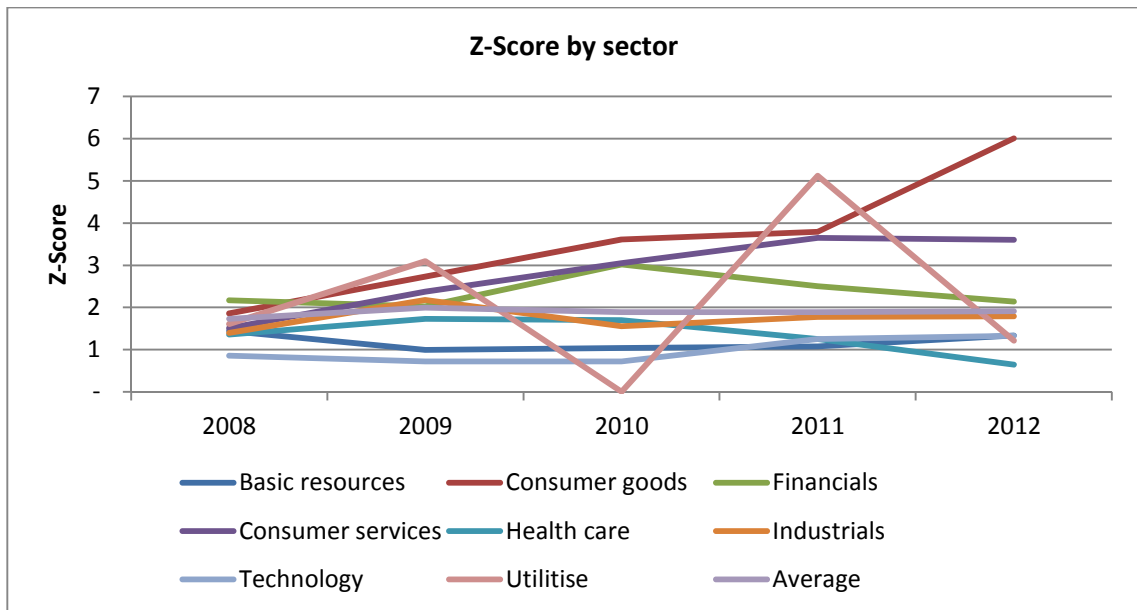


Figure 15

4.1.1 Accuracy of the Altman Z-Score

Over the period, six non-financial companies listed on the Alt-X filed for bankruptcy. To assess the accuracy of the Altman Z-Score, we isolated the firms that entered into bankruptcy and calculated the Altman Z-Scores for the two financial years preceding bankruptcy. Financial data is unavailable for the year of bankruptcy as these financial statements are not published in the year that the company enters into bankruptcy.

The results of the analysis are presented below:

	1 year preceding	2 years preceding
Expected not to fail	17%	17%
Uncertain	17%	33%
Expected to fail	66%	50%
	100%	100%

Table 3

Therefore the Z-Score appears to reasonably forecast when a company is expected to enter bankruptcy. To further assess the accuracy of the Z-Score in predicting bankruptcy, the Z-Scores of the companies listed on the Alt-X that had not entered into bankruptcy over the period

was calculated for the period and presented in the table below (referred to as a type 2 error in previous literature).

	2008	2009	2010	2011	2012
Expected not to fail	78%	72%	70%	70%	71%
Uncertain	14%	18%	19%	20%	19%
Expected to fail	8%	10%	11%	11%	10%
	100%	100%	100%	100%	100%

Table 4

The results appear to be consistent year on year with approximately 70% of the companies listed on the Alt-X over the period having Z-Scores indicative of firm survival. Of concern is the number of firms with Z-Scores that indicate expected corporate failure. From the previous analysis, it is fair to assume that a firm with a 'expected to fail' Z-Score may only declare bankruptcy a few years after initially achieving such a Z-Score. Therefore those companies with low Z-Scores in years 2010 to 2012 may still enter into bankruptcy subsequent to this study. However, the 'expected to fail' companies in earlier periods such as 2008 and 2009 are of concern as, if the model holds true, these companies would have expected to enter into bankruptcy in the period. Although this study would be limited as numerous possible actions may have occurred subsequently that may have rescued the companies from financial distress.

To study what has subsequently occurred to the companies listed as likely to fail in 2008 and 2009, the Z-Scores of these companies was calculated for the 2012 financial year with the exception of one company which was taken private in 2011 and accordingly the 2011 financial year results were used in the analysis. The table below presents the findings of this analysis:

Z-score classification of companies with 'expected to fail' Z-Scores in	
Moved to expected not to fail	36%
Moved to uncertain	0%
Remained expected to fail	64%
	100%

Table 5

From the analysis it appears that a large proportion of companies classified as expected to fail in 2008 and 2009 that have not declared bankruptcy in the period have remained in the same classification in the latest calculated Z-Score classification.

The Z-Score used for purposes of this study is not subject to any sort of adjustment as discussed in the literature review. As an area for future research, it would be interesting to determine whether the companies that consistently have low Z-Scores but survive nevertheless have some sort of structural effect or International Financial Reporting Standards (IFRS) manipulation that makes the one size fits all Z-Score inappropriate for assessing corporate solvency.

Despite the above, 36% of companies have over the period been able to trade out of their distressed position. As another avenue for further research, it would also be interesting to assess what the success factors for these companies were to allow improvements to their Z-Scores, whether it is through corporate actions such as share issues or whether these companies have simply traded out of their poor positions.

4.1.2 Analysis of the Z-Score based on firm size

Altman (1968) excluded from companies with assets less than \$1 million and more than \$25 million. Companies with assets exceeding \$25 million were excluded as there were few accounts of bankruptcy of large firms before 1966 and to reduce the size effect bias, in that small firms would have exaggerated financial ratios and therefore skew the results of the analysis (Altman, 2000).

As part of the analysis, the Z-Scores of companies are stratified by the market value of the company's assets to identify whether there is a significant prevalence of insolvency within a certain size range of companies listed on the Alt-X over the period. The results below are presented for combined for all periods to take into account that a firm's asset size may have increased significantly over the period tested.

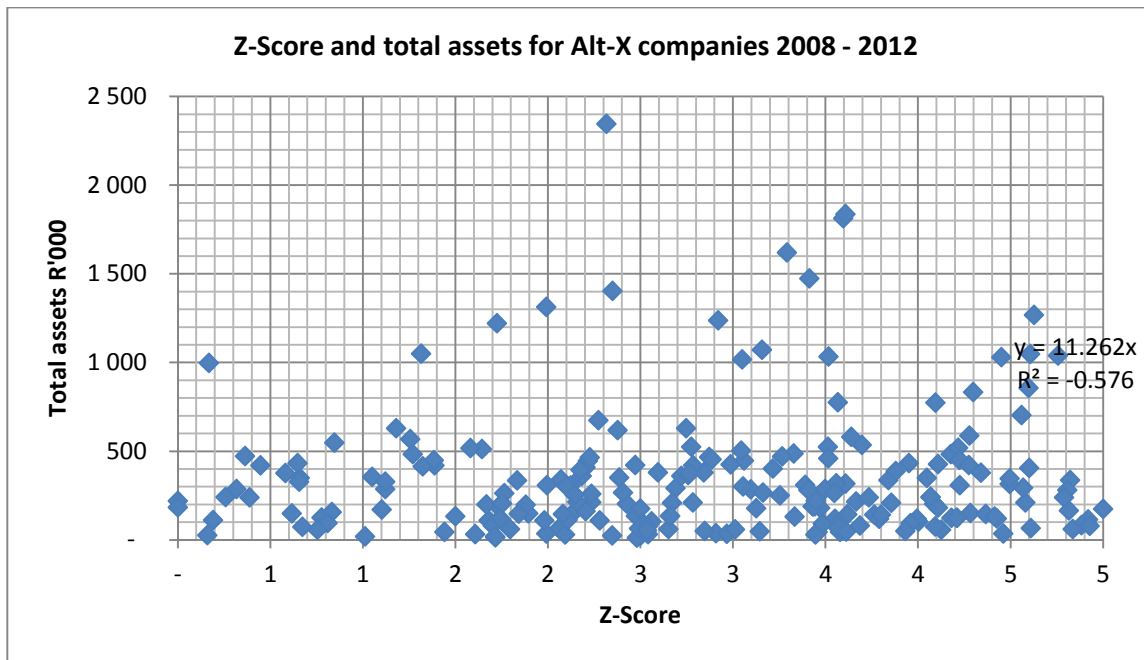


Figure 16

Accordingly, there does appear to be a bias in the Z-Score dependent on the size for companies listed on the Alt-X, although it should be considered that the companies listed on the Alt-X are generally smaller than those perhaps found on the JSE Main Board and if an adjustment was to be made to remove companies with assets below \$ 1 million as made by Altman (2005), on an inflation adjusted basis it would be likely that all of the companies listed on the Alt-X would not be included in Altman's (1968) original study.

4.2 Altman Z- EMS

The Altman (1995) Z-EM Score is perhaps more interesting and relevant to this study on the Alt-X as it was specifically designed for companies operating in emerging markets and it is not restricted to manufacturing companies as the Altman Z-Score is (Altman, 2005).

The Z-EM Score does not include any consideration for the market price of equity as the Altman (1968) Z-Score does. This will perhaps deal with the criticism to the Z-Score such as the reliability of prices from the Alt-X, which it may be argued due to the exchange not having sufficient liquidity and volume in order to achieve a price that is representative of the fair value of the equity instruments. The EM Score uses data from the financial statements of companies, which have been published in the case of Alt-X listed companies.

For purposes of calculating the bond equivalent ratings of companies listed on the Alt-X, 3.25 had been added to the first calculation of the Z-EM score as discussed earlier and the data presented is inclusive of this amount. Accordingly, using the Z-EM score with the 3.25 included therein, the results of the EMS score can be broadly classified into the following categories:

- $Z - EMS > 5.85$ Unlikely to fail
- $4.35 < Z - EMS < 5.85$ Uncertain as to whether failure shall occur or not
- $Z - EMS < 4.35$ Likely to fail

According to the Altman Z-EM Scores calculated over the period, more companies on the Alt-X are expected to fail than that calculated using the Altman (1968) Z-Score. Correia (2009) found that approximately 11% of companies were likely to fail using the Altman Z-EM score in the 2008 year. This study found that approximately 75% of companies listed on the Alt-X were unlikely to fail, 16% of companies were likely to fail and it was uncertain as to whether 9% of companies would or would not fail. The findings of this study are accordingly consistent with that of Correia's (2009) findings with respect to the Altman Z-EMS scores of Alt-X listed companies in 2008. However, in subsequent years, there has been a substantial increase in the number of companies likely to experience corporate failure, reaching a peak in 2011 of 34% and thereafter declining in 2012 to 22%, being a substantial number of companies.

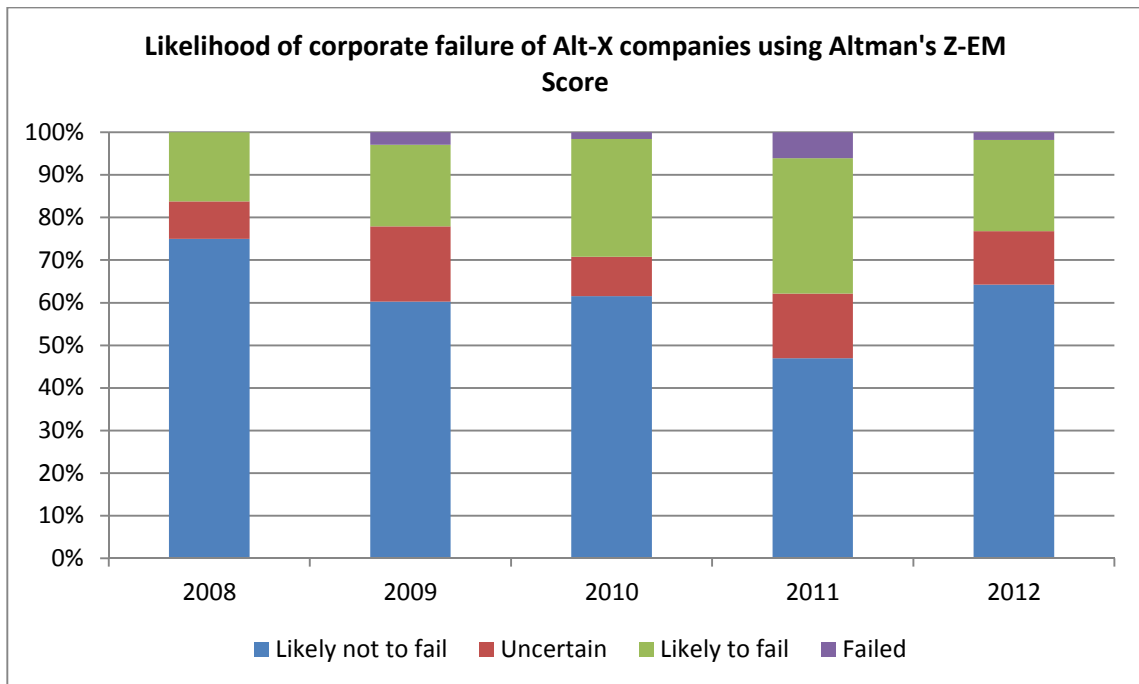


Figure 17

The descriptive statistics of the Altman Z-EM score over the period are presented in Table 6. Notably the mean Z-EM score has decline over the period tested which is contrary to the Altman (1968) Z-Score which had shown on a mean basis a steady improvement. The median has declined over the period consistent with the mean and consistent with the median of the Altman (1968) Z-Score. Consistent with the Z-Score is the spike in the volatility of the EMS scores in 2010 and 2011.

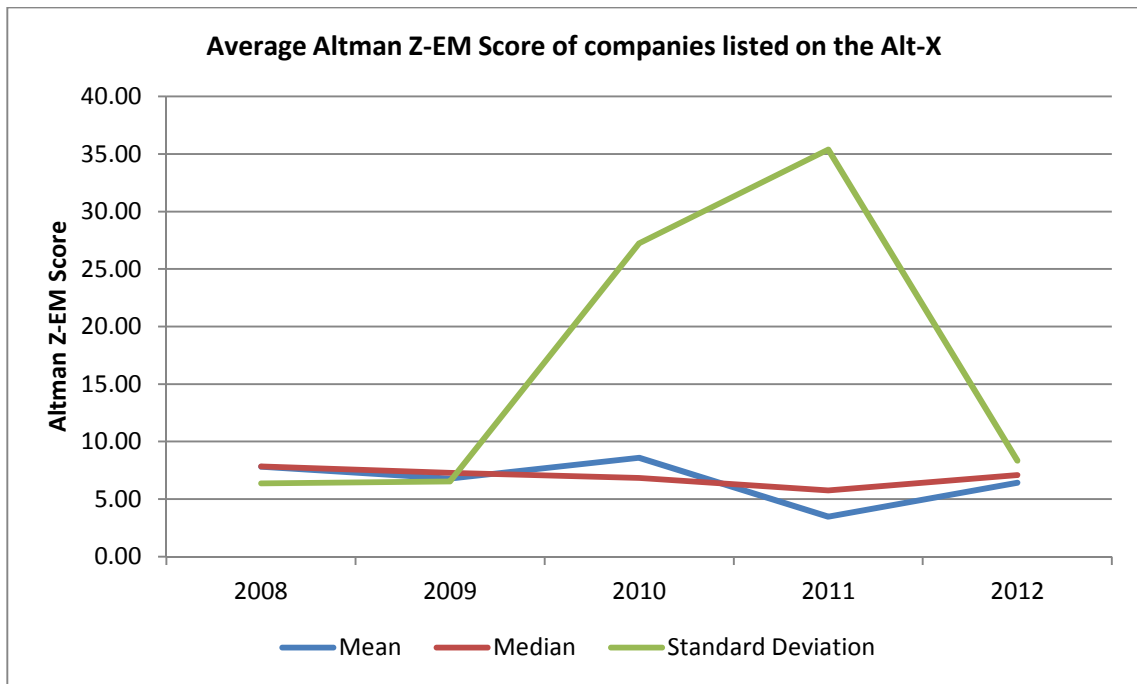


Figure 18

In analysing the components of the Z-EM Score, it appears as though the equity to total liabilities of the companies listed on the Alt-X has been the most significant contributor to the Z-EM scores. This is consistent with Correia's (2009) finding that companies listed on the Alt-X are typically subject to low levels of financial leverage. Similar to the findings of the Altman (1968) Z-Score analysis, the decline in the earnings before interest and taxation over total assets has had the most dramatic impact on the Z-EM scores over the period as well as the fall in the working capital over total assets ratio, which may be expected to move hand in hand with the earnings over total assets ratio as falling or negative cash generation from operations would be expected to diminish the working capital base of a company.

Z-EMS Score	2008	2009	2010	2011	2012
Mean	7.81	6.79	8.58	3.48	6.42
Standard Error	0.77	0.80	3.38	4.49	1.12
Median	7.84	7.29	6.83	5.76	7.09
Mode	7.55	8.43	6.75	10.28	8.05
Standard Deviation	6.36	6.53	27.24	35.38	8.34
Sample Variance	40.48	42.63	741.75	1251.76	69.57
Kurtosis	19.81	13.72	44.80	43.82	20.00
Skewness	-3.06	-2.03	5.58	-5.61	-3.41
Range	53.13	55.11	279.65	353.84	64.34
Minimum	-30.68	-28.73	-74.63	-247.29	-41.19
Maximum	22.44	26.38	205.02	106.55	23.15
Sum	531.39	454.79	557.81	216.04	353.02
Count	68	67	65	62	55

Table 6

Of interest is the extent to which the equity over total liabilities ratio increase in 2010 and 2011 and how in 2012 it has returned to similar levels as that of 2008 and 2009. This may be indicative of a change in the preferred capital structure of companies in response to the financial crisis of 2008 and 2009. Alternatively, it may be as a result of reluctance on the part of borrowers to lend to smaller cap companies, thereby resulting in additional capital investment requirements from equity holders.

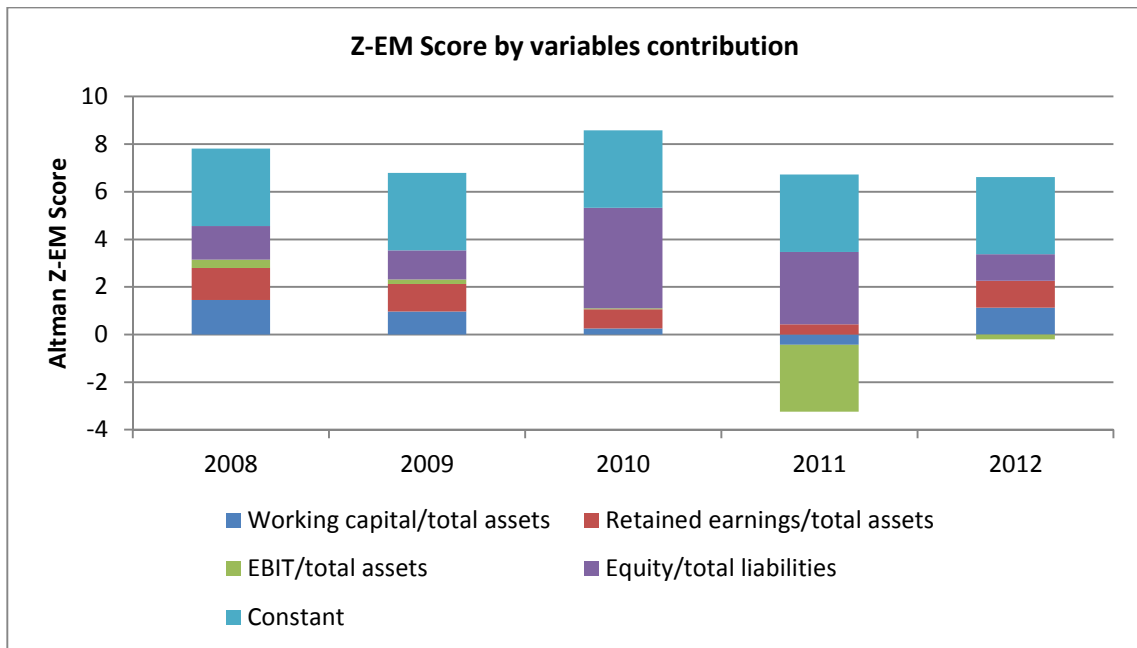


Figure 19

Using the 2008 inputs into the Altman Z-EM Score as the base line for comparative, it would appear as though the working capital over total assets and the retained earnings over total assets showed a substantial improvement after having declined from the 2008 levels, but had subsequently increase in 2012. The earnings before interest and taxation ratio had a substantial effect on the score in the 2011 year but have had a positive effect on the 2012 year. Similar to the study using the Altman (1968) Z-Score, this may be due to the exclusion of the companies that failed in 2011 from the 2012 results and accordingly may not be indicative of an improvement but rather an average improvement by removing failing companies.

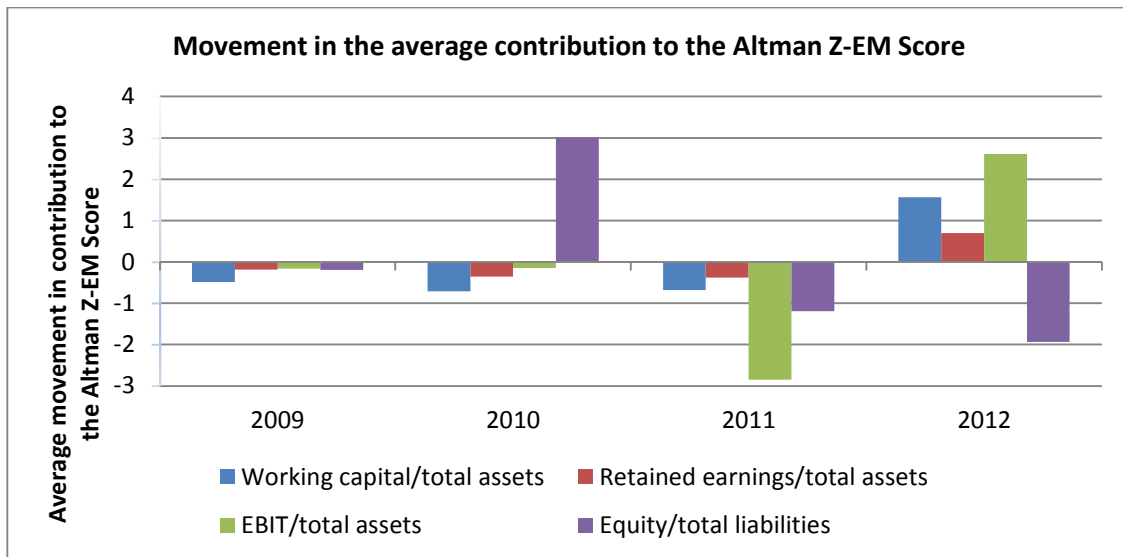


Figure 20

4.2.1 Accuracy of Z-EM Score

Over the period, six non-financial and non-property based corporate failures had occurred on the Alt-X. Although the population used is relatively small when compared to previous studies, it is still of interest to analyse how accurate the Altman Z'EM score has been over the period tested. Z-EM Scores for companies were calculated for Alt-X listed companies two years prior to corporate failure occurring. From the testing, it appears that of the six bankruptcies, the Altman Z-EM Score only successfully predicted corporate failure for one of the companies in the two years preceding corporate failure. In this study, the Altman Z'EM score had successfully predicted the corporate failure for the same company in both years, and the other five companies all had Z-EM Scores indicating that they were unlikely to fail.

	1 year preceding	2 years preceding
Expected not to fail	83%	83%
Uncertain	-	-
Expected to fail	17%	17%
	100%	100%

Table 7

Further analysis is performed on those companies within the period that have not entered into corporate failure. The population size in this case is considerably larger as it includes the data of companies for the entire period tested, being 300 observations.

	2008	2009	2010	2011	2012
Likely not to fail	76%	61%	61%	48%	65%
Uncertain	10%	20%	10%	17%	13%
Likely to fail	14%	20%	30%	35%	22%
	100%	100%	100%	100%	100%

Table 8

Accordingly, the Altman Z'EM Score appears to have a very large type 2 error, in that it has over the period the score has a substantial number of corporate failures that had as yet occurred. Although, it has to be acknowledged that there is a possibility that companies indicated as likely to fail in years 2011 and 2012 may still enter into corporate failure subsequent to the period of this study and thereby validate the score. A further contributing factor is that 47% of all the companies listed on the Alt-X that had not entered into corporate failure over the period had at one or another year been classified as likely to fail by the Altman Z'EM Score.

4.3 Bond equivalent ratings

Correia (2009) performed an analysis of the bond equivalent ratings of companies listed on the Alt-X in 2008 and found 63% of the bonds to be investment grade and 37% of the bonds to be junk high yield grade according to the Moody's and Standard and Poors' bond rating classification. To extend and give insight into the analysis performed using the Altman Z-EM score, the bond equivalent ratings of Alt-X companies shall be calculated and studied.

Although the results of the Altman Z-EM score test in this study do not appear to be conclusive, it would be beneficial to further study what the spread of bond equivalent ratings is for the companies listed on the Alt-X. Altman (2005) developed a method of determining the corporate bond rating for an emerging market company based on the company's Altman Z'EM score. The bond equivalent rating is based on the ratings of Standard & Poor and Moody's (Correia, 2009) yet for the purposes of presentation the Standard & Poor's bond ratings shall be presented.

Fundamentally these bond ratings are comparable and therefore presentation of Moody's would not enhance the study.

As discussed above, the Altman Z'EM Scores are converted to bond equivalent ratings using table 1 as developed by Altman (2005).

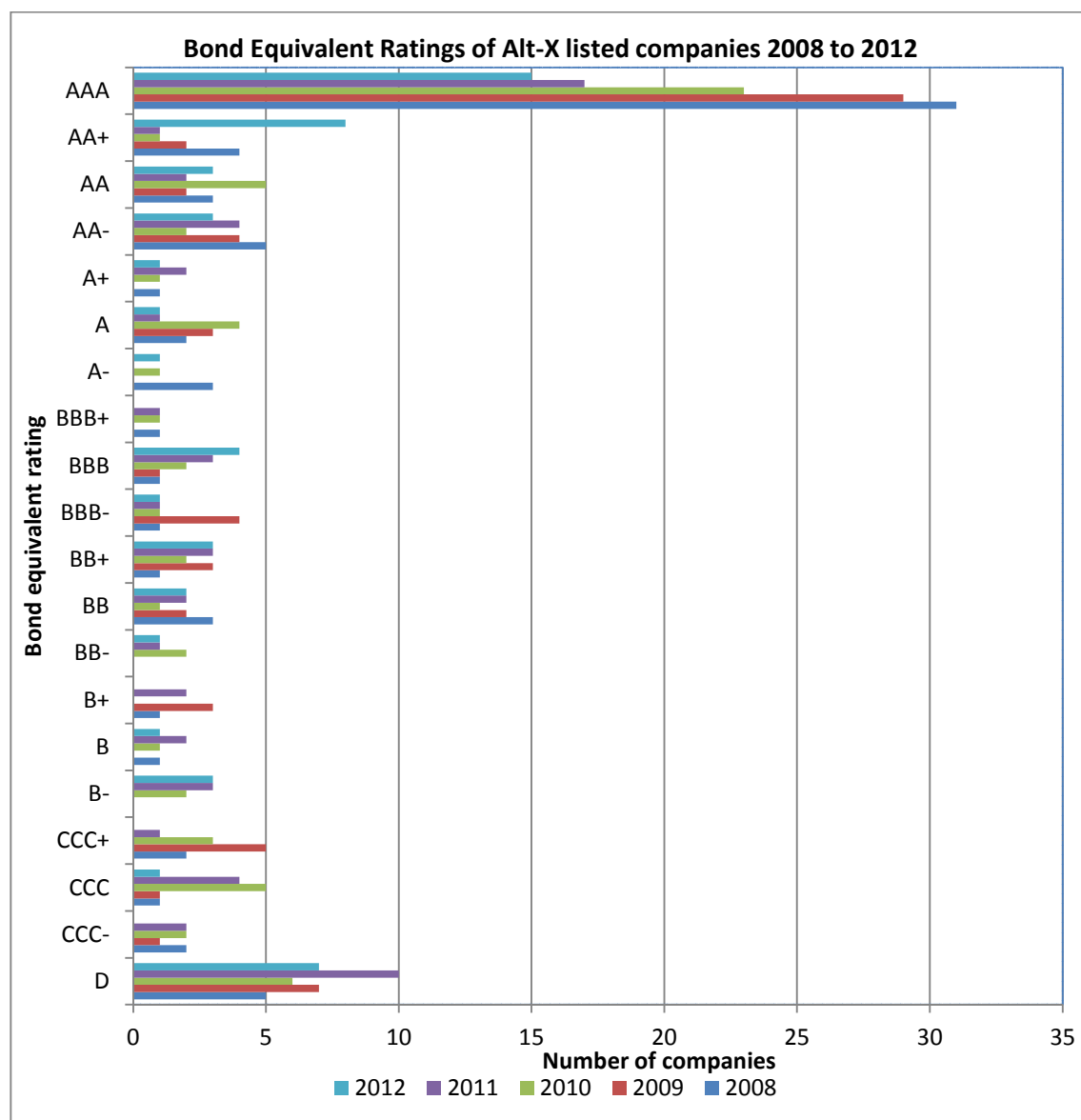


Figure 21

According to the bond equivalent ratings, a large proportion of companies listed on the Alt-X are rated as AAA over the period tested. Although it must be noted that the percentage companies in the category has fallen from approximately 32% to 15% over the five year period

tested. Furthermore, there are a substantial number of D rated companies, which has steadily risen over the period.

The bond equivalent ratings can be further categorised into investment grade or junk bonds with bond equivalent ratings above BBB- considered to be investment grade and bond equivalent ratings below BBB- considered to be junk high yielding bonds.

	2008	2009	2010	2011
Investment grade	76%	67%	63%	52%
Junk high yielding	24%	33%	37%	48%

Similarly to the results found by Correia (2009), there are a large proportion of companies listed on the Alt-X that may be considered to be investment grade according to the bond equivalent ratings. Furthermore, the proportion of investment grade companies on the Alt-X appears to be diminishing given the decline in investment grade bond equivalent ratings.

4.4 Delisting and corporate failure

In the period tested there had been nine non-financial or property companies that had been delisted, either to be taken private or acquired. Although it is difficult to empirically infer a trend from a sample of nine companies, it is interesting to analyse the Altman Z-Scores and Z'EM Scores of these companies. It is well documented in academic literature that companies experiencing financial difficulty often merged or are acquired in order to avoid corporate failure. Therefore, the Z-Score and Z'EM Scores of delisted companies was calculated in the year preceding the delisting.

	Altman Z-Score	Altman Z'EM Score
Unlikely to fail	56%	67%
Uncertain	11%	-
Likely to fail	33%	33%
	100%	100%

Of the companies that had delisted in the period, 56% and 67% of these companies Altman Z and Altman Z'EM Scores that indicated that they were unlikely to fail, whereas both scores indicated that 33% of the companies were likely to fail one year before being acquired. This proportion appears to be higher than that of Correia's (2009) study where it was found that 17%

of the companies that had delisted in the 2008 year had indicators of corporate failure with respect to their Altman Z - Score and Z'EM Score.

Empirically, it cannot be inferred that companies delisted on the Alt-X had done so to avoid corporate failure, and furthermore the mean Altman Z-Score and Z'EM Score of those companies one year before corporate failure is 4.15 and 6.65 respectively compared to a mean of all Alt-X trade companies of 4.34 and 6.61 respectively which are not substantially different.

Although the size of the population does not allow for empirical conclusions to be reached, there do appear to be indications that some companies delisted due to privatisation or acquisition and merger from the Alt-X may be doing so in an attempt to avoid corporate failure. Interestingly, companies that had delisted from the Alt-X had experienced on average a 17% decline in the Altman Z-Score and a 30% decline in the Altman Z' EM Score from the second year to the year preceding delisting.

5 Conclusion

The objective of this study was to analyse the corporate solvency of companies listed on the Alt-X subsequent to the financial crises of 2008-2009. The basis for this study is the study performed by Correia (2009) where Correia (2009) concluded that companies listed on the Alt-X did not display indicators of corporate insolvency in 2008. This study extended Correia's (2009) study to the period 2008 to 2012.

The Altman Z-Score of companies listed on the Alt-X were calculated and it was found that according to the Z-Score that there was an increase in corporate failure risk in 2009, which had subsequently decreased over the period up to 2012. The Z-Score levels calculated in 2008 indicated that only approximately 11% of companies listed on the Alt-X were likely to experience corporate failure. This amount increased substantially to 30% in the 2009 year, which appears to have been driven primarily by the falling earnings to total assets ratio. The Z-Scores of companies subsequently improved and by the end of the 2012 year the Altman Z-Score indicated that approximately 15% of companies were likely to fail. However, this has been driven greatly by an improvement in the market value to total liabilities levels of companies listed on the exchange an improvement in the earnings before interest and tax over total assets ratios. The market value over total liabilities ratio is of interest as it is perhaps indicative of a change in preferred capital structure over time period, with the debt ratios of companies decreasing.

The Altman Z-EM Scores of companies listed on the Alt-X was calculated and it was found that the average Z'EM score had declined over the period but had improved in 2012. This is in contrast to the Altman Z-Score calculations which indicated an improvement in corporate solvency over the period. Although this may appear to be somewhat contradictory, both predictors have a seemly large standard deviation from 2009 to 2011 and accordingly the mean results may be skewed accordingly. When analysing the median of the Z-Score and Z-EM Score, both indicate that corporate solvency over the period had steadily declined.

The Altman Z-EM Score further found over the period that the proportion of companies expected to enter into corporate failure had increased from approximately 18% to 22% over the period.

The accuracy of the Altman Z-Score and Altman Z'EM Score was assessed by calculating the scores of companies that had entered into corporate failure during the period. On the population tested it was found that the Altman Z-Score better predicted corporate failure than the Altman Z-EM Score, with the Altman Z-Score accurately predicting 66% and 50% of corporate failures one year and two years preceding corporate failure whereas the Altman Z'EM Score only successfully predicted 17% of corporate failure in both one year and two years preceding corporate failure. This is unexpected as the Altman Z'EM Score was specifically designed for emerging market economies and did not include a market element, which addressed the concern that the lack of liquidity in the Alt-X would result in spurious results. Although it is acknowledged that due to the small sample of size used a statistically significant result could not be inferred.

To further test the accuracy of the Altman Z-Score and the Altman Z-EM score, the scores of companies that had not entered into corporate failure was calculated and it was found that the Altman Z-Score and Altman Z-EM score had inaccurately predicted that 10% and 22% of companies that had not entered into corporate failure had a high likelihood of corporate failure. Although it is acknowledged that the corporate failures predicted in years 2011 and 2012 may only be realised in years subsequent to this study.

Both applications found that the greatest contributor to the decline in the solvency over the period had been the fall in the earnings before interest and taxation over total assets ratio. This however had been mitigated somewhat by the positive contributions made by the capital structure ratios, being the market value of equity over total debt and the book value of equity over total debt ratios for the Altman Z-Score and Altman Z'EM Scores respectively. This is perhaps consistent with findings of Correia (2009) who concluded that the companies listed on the Alt-X were not subject to high likelihoods of corporate failure due to their low levels of financial leverage.

The bond equivalent ratings of companies listed on the Alt-X was thereafter calculated and found that a large proportion of companies had investment grade bond equivalent ratings, but this had declined from 76% in 2008 to 52% in 2012. In 2008, approximately 30% of companies had AAA bond equivalent ratings according to their bond equivalent ratings. By 2012, this amount had declined to 15% and the proportion of companies with D grade bond equivalent ratings had increased from 5% to 10%. Furthermore, over the period the distribution of the bond

equivalent ratings had increased, over time allowing for a clear distinction between the investment grade and junk high yielding grade bond equivalent ratings.

The Altman Z-Scores and the Z-EM Scores of companies privatised or acquired and that had delisted from the exchange were calculated to assess whether there was a trend of delisted companies being privatised or acquired in order to avoid corporate failure. The study found that 33% of companies delisted had a high probability of corporate failure one year before being acquired or privatised according to the Z-Score and Z-EM Score. Although the population size is too small in this test to infer a statistically significant result, the result does give us insight into the actions taken by companies to avoid corporate failure.

Based on the above factors, there appears to be a marginal increase in corporate failure risk over the period 2008 to 2012 in the wake of the financial crisis of 2008 and 2009. Nevertheless a large proportion of companies listed on the exchange still have low levels of corporate failure likelihood. Consistent with the findings of Correia (2009), the low levels of corporate failure likelihood has been greatly influenced by the low levels of financial leverage of companies on the exchange, which has over the period tested indicated a trend to more conservative capital structures.

With respect to futures studies, it would be interesting to analyse the stocks listed on the exchange using other corporate failure prediction models such as Altman's Zeta model and other multiple discriminate analysis models such as those derived by Edminster (1972) and Blum (1974). Furthermore, over this period there may have been impairments affecting the earnings of companies listed on the exchange, and accordingly it would be interesting to see if results would have differed had a model such as that created by Taffler and Agarwal (2007) that makes adjustments such as the capitalisation of leases and the removal of abnormal income statement items would yield differing results. Furthermore, it would be interesting to see if the Altman Z-Scores and Altman Z-EM Scores for smaller cap companies listed on the main board differed to companies listed on the Alt-X.

Consistent with the findings of Correia (2009), this study does not find an increased likelihood of corporate failure that is consistent with the dramatic decline in equity prices from 2008 to 2009 and the gradual decline in equity prices thereafter.

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