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The Use of Multi-discriminant Analysis for the Prediction of Corporate Bankruptcy in Malaysian Textile Industry

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Abstract: Malaysian textile industry is a very important and dynamic sector of the Malaysian economy, which necessities the need to predict success or failure of firms in the industry. This study uses Altman's Z-Score bankruptcy prediction model to assess financial positions of 12 sampled Malaysian textile companies. Findings from the study indicate that, from 2007 to 2011, 18.97% of the sampled companies had a Z-Score of less than 1.23 (distress), 79.3% fall amidst 1.23 to 2.9 (Grey) and just 1.73% indicates a Z-Score above 2.9 (safe). The study concludes that most of Malaysian textile companies fall within the grey zone (between 1.23-2.9) specified by the model. This suggests that most Malaysian textile companies are in the danger zone of slipping into bankruptcy and liquidation if appropriate care is not taken. Recommendations are inferred on how Malaysian textile companies will move to the safe zone of the Altman's bankruptcy prediction model in the years ahead.

Keywords: multi-discriminant; Altman Z-Score; prediction; bankruptcy; textile industry
JEL Code: M41

1. Introduction

Textile is one of the basic consumption items in both developed and developing countries (Socio-Economic & Environmental Research Institute, 2005). In Malaysia, the production of textile, especially clothing and apparel, is predominantly labor-intensive and therefore requires relatively modest capital to start up and operate. However, there are two main segments of Malaysian textiles and apparel industry namely: Upstream segment, which consists of industries that engage in the production of fiber, yarn, fabrics and wet processing, and Downstream segment, which is synonymous with the production of garments, textile products (home textile) and accessories (Malaysian External Trade Development Corporation, 2012).

According to the Malaysian Industrial Development Authority (MIDA), the transformation and growth in production and processing of textiles and apparels in Malaysia were first recorded in the early 1970s when some textile industries in the country embarked on export-oriented industrialization strategy. Consequently, with the intensified local and international competition, Malaysian textile manufacturers start moving up their value chain by diversifying into the production of higher value-added textiles, implementing automation and computerized manufacturing processes. They equally seek business collaboration with foreign companies to acquire new

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technologies, to undertake research and development activities, to explore new processes and new applications with the view of producing higher value-added products. Presently, the Malaysian textile industry is a proud employer of more than 68,000 staffs both skilled and unskilled (Malaysia Industrial Development Authority, 2012).

However, despite the success recorded so far by Malaysian textile industry, there is still need for companies in this industry to improve and perfect their processes in order to guarantee their long term survival, meet up with the pace in technological innovations and thus compete favorably with their international competitors. Therefore, for these companies to overcome the aforesaid challenges; corporate performance evaluation should be conducted and the best instruments for this are financial ratios and similar instruments. Turning into the memory lane, researchers used financial accounting ratios generated from companies' financial statements to predict the success or failure of companies in various industries across the globe. Accordingly, financial statements are the accounting reports that quantify information regarding the financial position of an entity and the results of its operations over a period of time (Sittichai & Kennedy, 2005).

Financial statement gives the overall picture of a company, but to analyze each and every aspect of business extensively, financial ratios and other similar instruments are used. Financial analysis conducted on the contents of financial statements is used to analyze the success, failure, and progress of business. Financial ratios are a popular tool for a wide range of users including shareholders, creditors, employees, management, suppliers, government agencies, stockbrokers, financial analysts and other users. Financial ratios serve as a basis for evaluating the financial condition and performance of a company through computing a set of key ratios from the financial statements (Sittichai & Kennedy, 2005).

Moreover, financial analysis avails management of a company to predict its upcoming trends in the company and also to compare its performance and condition with the common performance of similar businesses in the same sector. In most cases a standard is set against which evaluations are carried out. This process will basically involve the following under listed points (The Manage Mentor, 2003):

- Analyze three to five years past data, determine the financial ratios, evaluate the trend of the data, and try to predict future trends in that particular industry.
- Compare between the average performances of a company against the industry average. Depending upon the ratios, the current viability of the business vis-à-vis on various aspects (profitability, liquidity, solvency, productivity, etc) which is the yardstick of future viability predicted.
- An in-depth analysis of the average performance of the company as well as the industry that assist the company in the course of evaluation is required in order to determine a company's core strength against its weaknesses, and also its opportunities over threats.
- The financial analysis avails direction to a company through predicting future trends and also ascertaining the strengths and weaknesses of the company. As such, a suitable strategic plan is to be implemented with the aid of this information.
- A company is most likely to gain a competitive advantage and perhaps identify its focus areas by exploiting the information from the financial ratios analysis.

Nevertheless, the purpose of this paper is certainly to test the applicability of Edward Altman's Z-score in predicting corporate bankruptcy in the Malaysian textile industry. The study adopts the multiple discriminant analysis developed by Edward Altman in 1968. The model encompasses working capital over total assets ratio, retained earnings over total assets ratio, earnings before interest and taxes over total assets ratio, the market value

of equity over book value of debt and sale over total assets ratio. These ratios are imbedded into the Z-score, having been accepted globally as good measures of financial performance based on their individual merits.

The rest of the paper is organized in four sections. The next section is on review of related literature, section three describes the methodology and data set, results and discussion are reported in section four, while section five carries conclusion and recommendations based on the findings of the study.

2. Literature Review

2.1 Conceptual/Theoretical Framework

Past records have shown that many studies were carried out on the use of financial ratios to predict business bankruptcy in different areas of Malaysian economy which range from insurance, banking, manufacturing (Ben, Mohd, & Shanmugam, 2011; Mohammed & Kim-Soon, 2012). To the best of the researchers' knowledge, few efforts had been made with regards to forecasting companies' bankruptcy in the Malaysian textile industry. On this ground, the research is intended to explore a new perspective in the use of financial ratios to predict tendencies of bankruptcy in Malaysian textile industry. The research used the Altman's popular model known as Altman's Z-score model to forecast companies' bankruptcy. The model is based on five independent variables, each of which represents traditional financial ratio and they collectively produce the index called Z-score which stands for the dependent variable. The degree of association amongst the dependent and independent variables is as illustrated diagrammatically below:

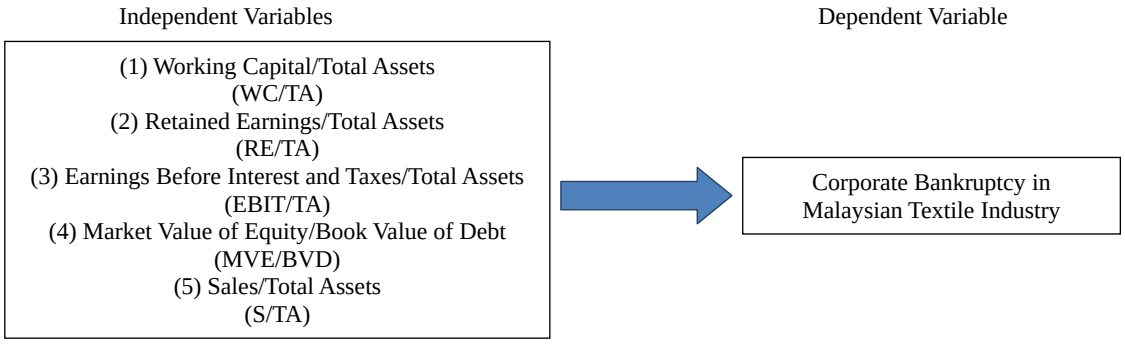

Figure 1 Research Framework

Source: Sittichai and Kennedy (2005)

Moreover, this research is supported by the concept of multi-discriminant research (MDA), which is termed as Altman Z-score model. The model is a systematic representation created by Edward Altman in the 1960s which includes a mixture of five unique financial ratios used for forecasting future business' performance. Altman Z-Score model combines accounting ratios of liquidity, activity, leverage and profitability to form a catalog of probability, which is an effective indicator of corporate performance in forecasting bankruptcy. The Z-score is a set of financial ratios in a multivariate perspective, based on a discriminant model for the companies, where a single measure is unlikely to predict the complexes of their decision making (Sarbapriya, 2012).

The Altman Z-scores, is probably the most extensively used and applied model for predicting financial distress (Bemmann, 2005). Altman developed this intuitively appealing scoring method at a time when the traditional ratio analysis was losing favor with academics (Altman, 1968). Altman Z-Score model requires a firm to have a publicly traded equity and be a manufacturer. The research gathered data from 33 bankruptcies and 33

non-bankruptcies, during the period 1946 to 1965 (20 years), to find discerning factors for bankruptcy forecast. Altman analyzed 22 potentially important variables of the 66 firms by using multiple discriminant analysis (MDA) to build the discriminant function with five variables. This model was subsequently modified to become Altman Z-Score model (1993) that used the same variables with additional features (Sarbapriya, 2012).

The Z-Score calculation is based on figures from a company's financial statements. It employs seven pieces of data taken from a company's income statement and balance sheet. Five ratios are then extrapolated from these data points as shown in Table 1 below:

Table 1 Financial Statements Figures Used in Z-score

Data Point	Where Found in Financial Statements	Formula for Calculation
Earnings Before Interest & Taxes (EBIT)	Income Statement	Revenue-Operating Expenses
Total Assets	Balance Sheet (Total Assets)	Total Current Assets + Net Fixed Assets + Intangible Assets
Net Sales	Income Statement (Net Revenues or Sales)	(This number in the financial statements reflects deduction of returns, allowances and discounts)
Market (or Book) Value of Equity	Book Value found on Balance Sheet (Stockholders' Equity)	Total Market Value (public Cos.) or Book Value (private Cos.) of all shares or stocks
Total Liabilities	Balance Sheet	Total Current Liabilities + Long Term Debt
Working Capital	Balance Sheet	Total Current Assets - Total Current Liabilities
Retained Earnings	Balance Sheet (Part of Stockholders Equity)	(Portion of net income retained by the corporation rather than distributed toowners/shareholders)

Source: Sarbapriya, 2012.

The independent variables of five ratios are measured in ratio scale. The operational definition of dependent and independent variables is systematically presented below:

Table 2 Independent Variables of the Study

Conceptual definition	Operational definition
T1 = Working Capital/Total Assets	Measures liquidity, a company's ability to pay its short-term obligations. The lower the value the higher the chance of bankruptcy.
T2 = Retained Earnings/Total Assets	Measures age and leverage. A low ratio indicates that growth may not be sustainable as it is financed by debt.
T3 = Ebit*/Total Assets *Earnings Before Interest And Tax	A version of Return on Assets (ROA), measures productivity–the earning power of the company's assets. An increasing ratio indicates the company is earning and increasing profit on each dollar of investment.
T4 = Market Value Of Equity/Total Liabilities	Measures solvency–how much the company's market value would decline before liabilities exceed assets.
T5 =Net Sales/Total Assets	Measures how efficiently the company uses assets to generate sales. Low ratio reflects failure to grow market share.

Source: Sarbapriya, 2012.

The Zones of discriminations and their interpretation are:

- 1.23 or less—"Distress" Zone
- From 1.23 to 2.9—"Grey" Zone
- 2.9 or more—"Safe" Zone

The Altman Z-Scores model is helpful in forecasting business failure and simplifies the process of predicting companies' financial performance in educational research. A Z-Score above "2.9" indicates an organization to be healthy; such an organization is also not likely to get into bankruptcy. However, Z-Scores which range from "1.23 to 2.6" are taken to lie in the greyish area, while a Z-score below "1.23" is an indicator that there is a propensity

for the organization to go into bankruptcy in the next two years.

Early research concluded that Altman Z-score model was discovered to be around 80 to 90% right in the course of predicting bankruptcy a year prior to the event in a series of multiple tests in addition to three distinctive periods of time over the next 31 years. Thus, a type II error, classifying the company as bankrupt while it is not going so, of 15 to 20% was also included in these tests (Ben et al., 2011).

However, the approach of Altman's Z-Score model has obtained adequate approval by management accounting firms, auditors, data source systems, and legal courts used for loan assessment. The model has been used in a different nations and situations, although it was originally intended for openly organized production companies presenting resources of more than $1 million (Ben et al., 2011).

2.2 Review of Empirical Studies

Measuring financial performance of a firm has become imperative and prominent in the context of emerging hyper competition at almost every sector of a business (Ramaratnam & Jayaraman, 2010). Therefore, the use of financial ratio is an outstanding way of forecasting the failure or success of a company based on its financial performance. Thus, the use of financial ratios is one of several alternative procedures used by auditors, accounting firms and financial analyst as a useful tool to recognize areas in a business' financial report where errors, misclassifications or potential fraudulent reporting of results and financial status may have taken place.

Green (1978) stated that financial ratios have long been regarded as means of testing the financial health of reporting entities, using their financial statements. They also used to assess the financial liquidity, activity and productivity of companies to enable investors to evaluate the companies' performance and their subsequent likelihood of success. On the other hand, Beaver's (1966) suggested that standard financial ratios are capable of predicting companies' performance. This is an indication of the prominent role financial ratios play in almost all the variables used as predictors of company financial performance and their future financial position.

Deakin (1972) conducted a research which revealed significant proof that investors uses financial ratios to study and analyze published financial data, emphasized its usefulness and inconsistent with the accounting and finance literature which affirms its useful to investors. While Gardiner (1995) in a review of some of the most important financial ratios stated that ratio analysis is globally identified as a powerful financial instrument and is used by investors when deciding between choices of investments.

In the past, researchers had carried out empirical studies on the effectiveness of financial ratios in corporate success assessment and predicting corporate failure. Most recently, researchers have used ratios as predictor variables in models to predict companies' performance for both profit oriented and non-profit organization (Ben et al., 2011; Casteuble, 1997).

Green (1978) declared that previous business performance forecast were univariate in characteristics, beginning with the research of Fitzpatrick (1932), Winakor and Smith (1935) and Merwin (1942). However, the most well-known univariate bankruptcy prediction model was originated by Beaver (1996) which sets a new direction in forecasting performance using other statistical techniques such as the multiple discriminant analysis by Altman (1968), Mutchler (1985), Koh and Killough (1990) and Ganesalingam and Kumar (2001). The logistic regression model was used by Gilbert and Ohlson (1980) and Zavgren and Friedman (1998) while artificial neural network was used by Balcaen and Ooghe (2006) and Pramodh and Ravi (2007). From their research, using different statistical techniques to estimate companies' performance, it is apparent that the capability to predict business failure or success is of utmost importance to those who use financial reports in their planning process, and managers with effective predictive models can take remedial actions and possibly avoid expected failure in

their own company.

Altman's Z-Score model achieves a high level of predictive precision although this is still a topic of educational discussion. Since then, numerous researches have been published which adopted variants of the original Altman model. However, according to the proponents of other statistical techniques such as Seaman, Young and Baldwin (1990) criticize that multi discriminant analysis has certain flaws, such as the breach of certain assumptions in multivariate statistical techniques (Ben et al., 2011).

A conditional probabilistic analysis done by Ohlson (1980) which was intended to eliminate the crucial assumptions used in MDA discovered that, using logistic regression proves to have a greater predictive precision in comparison to Altman's model. Similarly, the analysis by (Ohlson, 1980; Keating, Atomic, Gordon & Greenlee, 2005) on evaluating the predictive capacity of multi-discriminant analysis used by Altman and the Logistic Regression technique by Gilbert and Ohlson (1980) discovered that both Altman and Logistic Regression techniques are less frugal than other multivariate models. Consequently, Boritz and Kennedy (1995), proposed a different approach for business forecast using artificial intelligence which is referred to as artificial neural networks (ANN) and a different neural network models which is matched with the traditional bankruptcy prediction techniques like MDA, logit and probit, although it was discovered that the results for Type I and Type II errors differ significantly across the different ANN's techniques.

Nevertheless, ratio analysis, despite its usefulness in predicting companies' performance is not devoid of some limitations. For instance, different companies operate in different industries each having different environmental conditions. Differences in regulations and market structure between two companies from the same industries might be misleading. Similarly, accounting standards permit the use of different accounting polies which invariably impair on comparability of accounting numbers as such ratio analyses become less useful in such situations. In the same vein, ratio analysis explains the relationships of past information while others are more concerned about current and future information to aid their relevant decisions.

Feroz E. H., Kim S. and Raab R. L. (2003) asserts that ratio analyses are commonly used to evaluate company performance; although the computation of ratios is easy, but problems are encountered while interpreting their meanings. As a matter of fact, ratio analysis is usually belittled because of its subjectivity, since a financial analyst has to choose and use different ratios to evaluate the overall company's performance.

3. Methodology

This study is analytical in nature and, therefore, involves the prediction of bankruptcy using 12 selected sampled companies from the Malaysian textile industry. The study is mainly based on secondary data; the data were drawn from the financial reports available at the Data Stream of Sultanah Bahiyah library of the Universiti Utara Malaysia. The period of review spanned 2007 to 2011. Thus, a simple random sampling technique was used as a basis for selecting the twelve (12) sampled Malaysian textile companies. Hence, the Altman Z-score model was used for the prediction.

4. Results and Discussions

This section presents the results of the combination of five financial ratios that were utilized in the Altman Z-score model to predict corporate bankruptcy. The study was carried out on 12 Malaysian textile companies quoted in the main market of Bursa Malaysia for the period 2007 to 2011. The Z-Score results of the 12 Sampled

Companies are presented in Appendix A.

Given recourse to the Altman Z-Score model which entails that a category of companies with a Z-score above 2.9 are assumed to be on “safe zone”, companies with Z-score amidst 1.23 to 2.9 are to be classified as companies on a “grey zone”, while companies with Z-score that is lower than 1.23 are within the realm of “distress zone”. From the result of the analysis in the Appendix A, it can be inferred that most of the sampled Malaysian textile companies fall within the grey zone from 2007-2011. Therefore, this scenario suggests that most Malaysian textile companies are relatively stable as such there may probably not go into bankruptcy in the near future, but then their long term survival is not assured since those companies are not found within the safe zone.

Nevertheless, some of the sampled companies had a different scenario within the three years. For instance, Mega textile had a Z-score of less than 1.23 (Distress) from 2007-2009 and a Z-score of 1.23-2.9 (Grey) in 2010-2011. This is an indication of improvement in the performance of the company in recent years. Similarly, Pacific Peninsula Textile had a Z-score of (1.586) from 2007 to 2009, which falls within the grey zone. But in 2010, the company’s Z-score was (0.904) which indicate that the company is within the ambit of distress zone. Swiftly, in 2011 the Z-score rise to (3.4). This situation indicates that the company’s performance is moving in either direction. While, the duo of Perak Textile Mills and Penang Textiles indicates a Z-Score of less than 1.23 (Distress) in the first two years (2007, 2008) but from 2009 it indicates a Z-Score of between 1.23-2.9, this is a signal of improvement in the corporate performance of the companies lately.

However, Textile Corporation had a Z-Score that is less than 1.23 (Distress) from 2007 to 2010. But in 2011, the Z-score increased to 1.86 (Grey Zone). Despite the improved survival rate, the company is not fully saved given that its Z-score is still within the gray zone. Acrylic Textile had a Z-Score of 1.171 (Distress) in 2007, but from 2008 upward, the company’s Z-Score rises to between 1.23-2.9 (Grey Zone). This can be attributed to improvement in corporate performance of the company and a signal of stability in its corporate existence.

Moreover, Appendix-B carries the aggregate summary of the overall performance prediction of these sampled companies within the years under study. Specifically, the result demonstrate that in 2007, 41.7% of the sampled companies were found within the distress zone, 58% were in the grey zone, while none of the companies had a Z-Score above 2.9. In 2008, 33% of the companies were in the distress zone and 83.3% fall in the grey zone, none were in the safe zone. In 2009 and 2010, 16.7% of the sampled companies were found to be in the distress zone, 83.3% in the grey zone therefore none of those companies were in the safe zone. But in 2011, none of the companies fall in distress zone, most of the companies fall within the grey zone and 8.3% were in the safe zone. Therefore, at a glance, the overall performance indicates that from 2007 to 2011, 18.97% of the sampled textile companies were “Distress”, 79.3% were “Grey” and just 1.73% were “Safe”.

From the above discussion, it is realistic to conclude that there is general improvement in the performance of Malaysian textile companies from 2007 to 2012; this means that Malaysian textile industry had attributes of success rather than failure.

5. Conclusions and Recommendations

5.1 Conclusions/Findings

Based on review of related literature, discussion of results obtained and personal observations, the following are the major findings/conclusions of the study:

(1) The study proves that financial analysis using multi-discriminant ratios could be used to predict success

or failure in the Malaysian textile sector. The financial statements of 12 Malaysian textile companies were analyzed using Altman Z-Score model to predict their bankruptcy and sustainability.

(2) The study found out that from 2007 to 2011, 18.97% of the sampled Malaysian textile companies had a Z-Score of less 1.23 (distress), 79.3% fall amidst 1.23-2.9 (Grey) and just 1.73% indicates a Z-Score above 2.9(safe).

(3) This study concludes that most of Malaysian quoted textile companies, despite recording an overall improvement in their corporate performance from 2007 to 2012, still fall within the grey zone (1.23-2.9) of the Altman Z-score model. This suggests that most Malaysian textile companies are in the danger zone of slipping into bankruptcy and liquidation level if appropriate care is not taken.

5.2 Recommendations

On the basis of the findings/conclusions of the study, the following recommendations are made:

(1) That Malaysian textile companies should be prudent in managing their resources (materials, machines, men and money), embark on aggressive marketing of their textile products in the local and international market to enhanced financial performance, and strive to improve their corporate social performance and other stakeholder-friendly actions for them to move to the "Safe Zone" of the Edward Altman bankruptcy prediction model in the years ahead.

(2) Malaysian textile companies are enjoin to be consulting with financial analysts regularly to ascertain their bankruptcy/solvency status so as to be well prepared to face the challenge of remaining as "Going Concern".

5.3 Frontier for Further Research

The study recommends further research in the Malaysian textile industry with much larger sample and the use of other bankruptcy prediction models which may have stronger predictive ability and provide more accurate and generalizable results.

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Appendix A Z-scores of Sampled Companies

S/N	Company's Name	Years				
		2007	2008	2009	2010	2011
I.	Innovative Industrial Textile	2.169 Grey	2.168 Grey	2.188 Grey	1.984 Grey	1.826 Grey
II.	Kamunting Textile Industries	1.821 Grey	2.544 Grey	1.992 Grey	2.354 Grey	2.178 Grey
III.	Mega Textile	0.939 Distress	1.138 Distres	1.215 Distress	1.525 Grey	1.592 Grey
IV.	Pacific Peninsula Textile	1.586 Grey	1.567 Grey	1.507 Grey	0.904 Distress	3.477 Safe
V.	Perak Textile Mills	1.174 Distress	1.192 Distress	1.598 Grey	1.513 Grey	1.628 Grey
VI.	Southcorp. Ind.Textile	1.674 Grey	1.654 Grey	1.988 Grey	1.921 Grey	1.834 Grey
VII.	Textile Corporation	0.859 Distress	0.389 Distress	0.505 Distress	1.042 Distress	1.836 Grey
VIII.	Penang Textile	0.853 Distress	1.13 Distress	1.496 Grey	1.74 Grey	1.764 Grey
IX.	Acrylic Textile	1.171 Distress	1.777 Grey	1.722 Grey	2.254 Grey	1.737 Grey
X.	Mydodi Textile	1.691 Grey	1.863 Grey	1.705 Grey	1.954 Grey	1.863 Grey
XI	Hualon Corporation	2.28 Grey	2.46 Grey	1.874 Grey	2.059 Grey	2.071 Grey
XII	Bright Sail(M) Sdn. Bhnc	2.085 Grey	1.35 Grey	1.636 Grey	2.495 Grey	1.959 Grey

Source: Computed by Researchers, 2012.

Appendix B Summary of the Study's Prediction

YEARS	DISTRESS	GRAY	SAFE
2007	41.70%	58.30%	0%
2008	33.30%	66.70%	0%
2009	16.70%	83.30%	0%
2010	16.70%	83.30%	0%
2011	0%	91.70%	8.30%
TOTAL SCORES	91.7 = 18.97%	383.3 = 79.3%	8.3 = 1.73%

Source: Computed by Researchers, 2012.