THE USE OF ACCOUNTING AND FINANCIAL RATIOS TO PREDICT FAILURE: THE CASE OF JORDAN

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ABSTRACT

The study aimed to use the financial performance of Jordanian companies in order to predict financial failure. To achieve this, financial ratios were applied. Data was collected from selected companies through an analysis of relevant documents as well as through interviews with senior management in industrial companies operating in Jordan. The findings indicate that there are essentially four ratios that could explain and predict financial performance of a company in the Jordanian setting; these are a ratio of current assets to total assets, a ratio of debtors to sales, a ratio of net profit before interest and tax to current liabilities, and a ratio of the market value of capital-to-book value of the total debt, the latter of which appears to be the most important ratio.

Following this, a model comprising three financial ratios that are deemed the strongest influence, based on their statistical significance, was constructed, and this model was used to re-rate a sample of successful and failed food companies. The constructed model was able to distinguish between successful and failed companies, as follows:

D1=0.416*X25-0.001*X21+0.004*X19-1.943

D2=-1.720*X25+0.028*X21+0.459*X19-11.183

Thus, the paper's contribution is the constructed model that could be employed by potential investors and other stakeholders in order to predict failure.

Keywords: Financial Performance, Solvency, Bankruptcy, Criteria, Testing, Ranking.

INTRODUCTION

There are many studies of statistical of failure prediction models have described in the literature, testing of whether such methodologies work in practice are lacking. This paper study and examines the performance of the same companies with solvency for predicting bankruptcy and comparison in both models. These models are a model suggested for measuring the values of financial performance (Al-Kassar & Soileau, 2012), and applying the financial failure model (Z-score) used by Taffler (1983). In addition, the results have correlated and tested, in order to classify and rank company values.

Since the development of the Z-Score, financial innovation has paved the way for further development of corporate bankruptcy prediction models. The option-pricing model developed by Black and Scholes in 1973 and Merton in 1974 provided the foundation upon which structural credit models were built. KMV (Kealhofer, McQuown and Vasicek), Now Part of Moody's Analytics Enterprise Risk Solutions, was the first to commercialize the structural bankruptcy prediction model in the late 1980s. Miller (2009) noted, "*The Distance to Default is not an empirically created model, but rather a mathematical conclusion based on the assumption that a company will default on its financial obligations when its assets are worth less than its liabilities. It is also based on all of the assumptions of the Black-Scholes option pricing model, including for example, that asset returns are log-normally distributed*".

There are many dimensions upon which to measure the performance of a credit scoring system, but the most relevant way to compare models with different sample sets is by measuring the models' ordinal ability to differentiate between companies that are most likely to go bankrupt from those that are least likely to go bankrupt (Bemmann, 2005).

Many governments are interested in establishing investment projects because of the importance of the role government play in the efforts to build a stable economic base. This reflected in many developing countries, which are looking for opportunities to improve their political, economic, social and cultural aspects. Generally, projects need a lot of money and resources to finance them. Therefore, finding and using the best method to control these investments and resources to achieve development objectives in different fields and avoid insolvency is of great importance. Gerdin (2005), states that Management Accounting Systems (MAS) can considered as "*those parts of the formalized information system used by organizations to influence the behavior of their managers that leads to the attainment of organizational objectives*". Managers in some organizational contexts are likely to benefit from accounting information that is detailed and issued frequently, whereas MAS information in other contexts tends to be general rather than detailed, and issued less frequently (Gerdin, 2005).

The empirical literature reviewed by Chenhall (2006), for example, indicates that non-financial performance measures are more widely adopted in Just In Time (JIT) and Total Quality Management (TQM) settings. Other studies like Abdel-Kader & Luther (2008) have highlighted the need for additional research to increase our understanding of organizational and environmental factors that explain the development of management accounting systems, including the use of non-financial measures. Accounting information plays an important role in individual and corporate decision-making. In particular, a fundamental use of accounting information is to help different parties make an effective decision concerning their investment portfolios. Much of the accounting literature assumes that accounting and financial reporting in a country is a function of its environment (Belkaoui & AlNajjar, 2006). The management accounting literature reveals that changes in the environment and the technology of a company can lead to new decision making and control problems (Abdel-Maksoud et al., 2010).

In Jordan, the industrial sector is the most important economic component. The latest figures place its contribution at about a quarter of the Gross Domestic Product (GDP). Similarly, the industrial sector contributes about 15% of the Jordanian workforce (Jordan Chamber of Industry, 2017).

Furthermore, the Jordanian industrial sector is said to contribute close to 90% of the total merchandise exports (Jordan Chamber of Industry, 2017). From this perspective, it is clear that the industrial sector is a crucial economic sector, and it is a significant earner and hence contributor to the country’s foreign exchange.

Such an important economic sector cannot be allowed to collapse. Moloi (2016a:2016b) argue that risk management is crucial, and doubly important for governments to implement in those industries that are important to the country's economy.

In the past, industrial sector companies in Jordan have suffered financial failure. As a result, many of them were wound up, and those that belonged to the state were privatised. In order for this unfortunate circumstance to be avoided or mitigated, it is important that the factors that lead to these companies' demise are identified, monitored, and mitigated. Moloi (2014) refers to these factors as key indicators of vulnerability in his paper entitled "*Leading internal and external sources of credit risk"*.

Mubarak (2012) also point to the need for indicators of vulnerabilities as key in identifying firms that might collapse. Mubarak (2012) appears to be of the view that accounting information plays a crucial role as an indicator of vulnerabilities, thus offering predictability. Therefore, their view is that financial ratios remain the key indicator of vulnerability in any firm.

In this paper, the authors argue that there are a number of statistical failure prediction models proposed by different researchers, however, research validating as to whether or not failure prediction models actually work in practice is lacking, since research has largely focused on the following:

1. The use of the best financial ratios in predicting company failures-according this sort of analysis, the most accurate prediction is selected, and it represents the trend (Beaver, 1966).
2. A trend that aims to improve financial ratios in the form of a model that can predict the companies' failure potential using a multiple linear analysis of the discriminatory variables, and this represents the trend (Altman, 1968).

This study makes a moderate contribution to failure prediction models by using statistical methods, especially the method of analysis known as the multivariate linear discriminatory method. This method develops financial ratios by building a quantitative model consisting of a set of financial ratios using indicators to distinguish and predict financial performance of industrial plants in the case of Jordan.

Research Objectives

To create a model can measure the financial performance of the companies mathematically. To apply it to measure financial failure (solvency) of the companies, and, to see whether there is correlation between them, through testing the values by t-test, and classify and rank them accordingly.

Research Problems

Thus, the research questions that this study sought to answer are stated as follows:

Is it possible to construct a model that will be able to predict whether industrial companies will succeed or fail in general? Then are accounting and financial ratios have the ability to predict financial failure of companies?

Based on these questions, the main aim of this study was to develop a model to predict the financial failure of industrial plants. The constructs of this model are based on financial ratios. The authors argue that this study is of importance due to the following reasons:

1. It presents an analysis and explanation of the financial ratios that affect the measurement of financial performance, and determine the relative importance of each financial ratio, and these could be useful for fellow researchers and investment analysts.
2. It provides a control model through the stock exchange for the early detection of faltering financial performance of Jordan's industrial installations, and the stock exchange could then use this to improve its surveillance, and tighten its oversight and compliance by implementing laws and regulations that help to offset the obstacles and solve problems.

LITERATURE REVIEW

In accounting, financial analysis is one of the tools that help practitioners to obtain different information about the financial statements. It plays an important role in the process of performance evaluation and in the prediction of businesses' successes or stumbles. The Black-Scholes model for pricing options as well as the Merton model built in 1974 provide the foundation upon which structural credit models have subsequently been built. The Kealhofer, McQuown and Vasicek (KMV) Company, which is now part of Moody's Analytics Company Risk Solutions, was the first company to commercialise the structural bankruptcy prediction model in the late 1980s.

There have been debates as to whether or not models can accurately predict default. Some opponents of default prediction models, such as Miller (2009), have argued that "*the distance to default is not an empirically created model, but rather a mathematical conclusion based on the assumption that a company will default on its financial obligations when its assets are worth less than its liabilities*".

Khanfar & Mattarneh (2011) appear to discard the idea of models or mathematical formulation. They propose that financial analysis is crucial in determining whether the company is a going concern or not. Therefore, the method to reach that determination-whether it is a model or a mathematical formulation-does not necessarily matter.

Al-Nu'aimi & Al-Tamimi (2008) support the idea that the method does not necessarily matter. In addition to this, they observe that financial analysis converts vast amounts of historical figures to organised relationships, and that it also provides information that is beneficial to decision-makers for the purpose of evaluating companies' financial and credit positions (Al-Nu'aimi & Al-Tamimi, 2008).

In addition to the views expressed above, Al-Khalayla (2012) proposes that financial statement analyses provide information that aids with the estimation of institutional value. These analyses could also be used as a planning tool, thus becoming a control, a method of performance evaluation, and to identify deviations (Arshad et al., 2015).

Researchers such as Chenhall (2006), Belkaoui & Al-Najjar (2006), Abdel-Kader & Luther (2008), and Abdel-Maksoud et al. (2010) argue that using financial information as the main predictor of failure is narrow. Accordingly, there could be other organisational and environmental factors that researchers should investigate in order to understand the role of these factors.

Khanfar & Mattarneh (2011) support the views held by the opponents of analysing financial information for the purpose of predicting failure. Therefore, they suggest that the predictors of failure could include amongst other things, the following:

1. Financial position.
2. Judgment of a company's profitability potential.
3. Judgment on financial and operational performance efficiencies (this is supported by Karajeh et al., 2006).

4. Internal control restriction and future planning.
5. Knowledge of a company's weaknesses and strengths.
6. Knowledge of a company's solvency (its ability to meet its debt position in the long or short term).

In this regard, Khanfar & Mattarneh (2011) are of the view that financial analysis as a predictor of a company's failure should be broadened as this would then address the point of '*narrowness*' highlighted by researchers such as Chenhall (2006), Belkaoui & Al-Najjar (2006), Abdel-Kader & Luther (2008), and Abdel-Maksoud et al. (2010).

Typically, sources of financial analyses emanate from the financial statements. According to IAS 1 Presentation of Financial Statements, a complete set of financial statements would typically include the following:

1. A statement of financial position (balance sheet) at the end of the period.
2. A statement of profit or loss and other comprehensive income information for the period (presented as a single statement, or by presenting the profit or loss section in a separate statement of profit or loss, immediately followed by a statement presenting comprehensive income beginning with profit or loss).
3. A statement of change in equity for the period.
4. A statement of cash flows for the period.
5. Notes comprising a summary of significant accounting policies and other explanatory notes.
6. Comparative information prescribed by the standard (IAS 1.10).

In a similar vein to the above, prominent studies in the field of failure prediction, such as that of Beaver (1966), Altman (1968), Taffler (1977:1983:2005), Argenti (1976), De Toni & Tonchia (2001), Fook Yap et al. (2012), Al-Kassar & Soileau (2012:2014), and many others have used the following combination of financial ratios:

1. Liquidity ratios.
2. Activity ratios.
3. Solvency ratios.
4. profitability ratios.
5. Market ratios.

The Altman model could be described as follows:

$$Z=0.0012(WC)+0.014(RE)+0.033(EBIT)+0.006(MVE)+0.00999(NCI)$$

Where,

WC: is the ratio of working capital scaled by total assets.
RE: is the ratio of retained earnings scaled by total assets.
EBIT: is the ratio of earnings before interest and taxes scaled by total assets.
MVE: is the ratio of market value of equity scaled by the book value of total debt.
NCI: is the ratio of sales scaled by total assets.

Altman's (1968) guide is that a minimum Altman-Z score of 1.8 is necessary to avoid failure; however, it is only when a Z-score is around 3.0 or more that the company could be deemed to be fairly safe.

Using the following modified Z-Score model, Taffler (1983) studied solvency in British companies:

$$Z\text{-}Score=C_0+0.053*(PBT/CL)+0.13*(CA/TL)+0.18*(CL/TA)+0.16*(NCI)$$

Where,

C_0: constant.

PBT/CL: is the ratio of profit before taxes scaled by current liabilities.

CA/TL: is the ratio of current assets scaled by total liabilities.

CL/TA: is the ratio of current liabilities scaled by total assets.

NCI: 'no credit' interval is calculated as the difference between the quick assets and current liabilities scaled by the daily operating expenses [(quick assets-current liabilities)/daily operating expenses] as a measure of short-term liquidity; more specifically, the ratio indicates the number of days, which a company can continue to finance operations from its existing quick assets if revenues are cut-off.

Based on the Taffler (1983) model, the coefficient percentages C1 to C4 contribute 0.53, 0.13, 0.18, and 0.16 respectively, to the model’s operation. In companies with a ZT-Score above a certain threshold (i.e. Z-Score=0) it was predicted that they would not fail during the subsequent year.

METHODOLOGY

This study is not used either models of Altman or Taffler. The paper pursues an inductive approach to analysis, which is an approach based on observation and testing, and depends on the data, and the information available about the subject under study. This study has been conducted for general-purpose framework aspects in the field of financial analysis in an attempt to predict the level of success or failure in companies, with a focus on the method of analysis, which is multivariate linear discriminatory analysis.

Furthermore, this study constructs a quantitative model that includes a set of financial ratios. The authors are of the view that this could be used to evaluate the performance of industrial plants in the industrial sector to help predict the success of these companies, or their failures before they occur. This would then enable management to make appropriate decisions at the appropriate time to address these problems, in pursuit of success.

HYPOTHESES

This study has constructed the following hypotheses:

Ho1: There is a positive effect statistically significant at the level of significance ($\alpha \leq 0.05$) between financial ratios and the predictors of failing financial performance in industrial companies.

This hypothesis is divided to the following sub-hypotheses:

Ho_{1a}: There is a positive effect statistically significant at the level of significance ($\alpha \leq 0.05$) between liquidity ratios and the predictors of failing financial performance in industrial companies.

Ho_{1b}: There is a positive effect statistically significant at the level of significance ($\alpha \leq 0.05$) between activity ratios and the predictors of failing financial performance in industrial companies.

Ho_{1c}: There is a positive effect statistically significant at the level of significance ($\alpha \leq 0.05$) between the solvency and predictors of failing financial performance in industrial companies.

Ho_{1d}: There is a positive effect statistically significant at the level of significance (α ≤ 0.05) between profitability ratios and predictors of failing financial performance in industrial companies.

Ho_{1e}: There is a positive effect statistically significant at the level of significance (α ≤ 0.05) between market ratios and predictors of failing financial performance in industrial companies.

Ho_2: Distinguishes a quantitative predictive model consisting of a set of financial ratios, which could be obtained by using the statistical method accurately between successful industrial companies and distressed companies.

Study Model

The model of the study would present a set of independent variables (financial ratios), and the dependent variable would be the financial performance of the industrial companies. Figure 1 below presents the dependent variable and the independent variables.

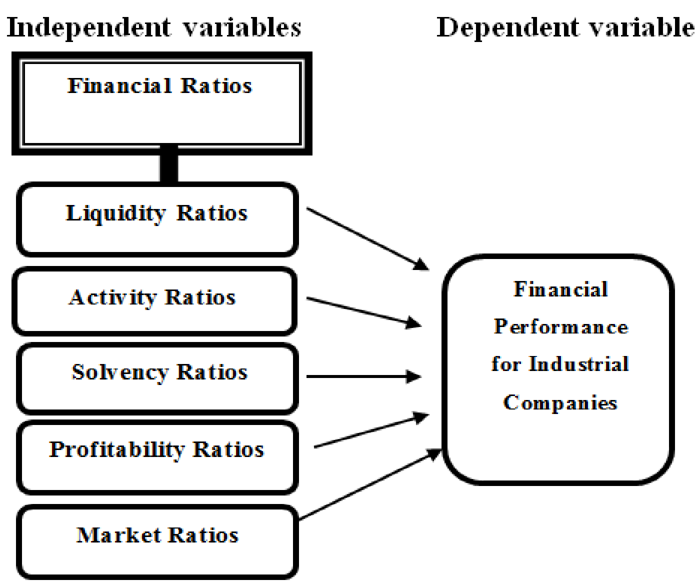

FIGURE 1
STUDY MODEL

It is important to note that the financial ratios highlighted above have been utilised by other previous studies. These studies have set focussed on the best financial ratios that work on performance measurement and prediction of financial failure. They have identified 30 financial ratios, divided into five groups: liquidity; activity; solvency; profitability; and the market (Appendix 1).

The Population of the Study Sample

The study examined a sample of industrial sector companies operating in Jordan. There are 70 companies in this sector, and the food sector, which is the focus of this study, included twelve companies, representing 17.1% of the total of the industrial sector.

Data Collection

To achieve the purposes of the study, sources in which data and information could be collected were identified, namely the audited financial statements authorised by industrial companies, such as balance sheets and income statements for the sample of the research companies for the period 2008-2016, which records were publicly disclosed by the companies in the study sample.

Instrument

The audited financial statements used are for the period 2008-2016. This a rate of four-year cycles for each company observed. The statistical methods used to achieve the study's objectives are as follows:

1. The relevant financial information was inserted into an Excel programme to calculate the results of financial ratios, which represent the percentage of each of the study's independent variables.
2. The inclusion of financial ratios extracted by the Excel programme to the SPSS statistical software to measure the effect of the independent variables in the prediction of a stalled financial performance.

The statistical analysis of data consisted of the following tests:

An analysis of the data on the basis of a multiple linear regression equation and using the Stepwise method.

1. **Discriminatory multivariate linear analysis:** This analysis follows a discriminatory linear multivariate approach to build a model consisting of a number of financial ratios, by selecting the best financial ratios and the most accurate in distinguishing and predicting potential failures in industrial companies. It also selects a set of ratios in the form of a linear equation through several steps, the most important test being the Wilks Lambda test, and it checks the equal variance matrices for each group through the Box M test, which calculates the level of statistical significance.
2. **Test Olap Cubes**: This test was used to ensure that the independent variables underwent normal distribution.
3. **Wilks Lambda Test**: The Wilks Lambda test is known for the selection criterion it uses. For instance, it tests whether or not independent variables under review are significant. The selection criterion is as follows: if the value is higher than the level of significance (0.05), this would mean that it is likely that there is no significant effect of the independent variables on the dependent variable. However, if value is lower than the level of significance (0.05), this would mean that it is likely that the independent variables would have an effect on the dependent variable. This test has been used to determine the best financial ratios in predicting a stalled financial performance in the industrial installations of the study sample.
4. **Analysis of Variance Test:** The Analysis of Variance (ANOVA) method relies on the so-called F test, which depends mainly on the analysis of the data. If the number of independent variables consists of one variable, it is referred to as a One-way ANOVA. If the independent variables consist of two variables, it is referred to as Two-way ANOVA. Should the independent variables number more than two, as is the case in this study, then the analysis of variance is referred to as the N-way ANOVA.

RESULTS

This section aims at presenting the analysed results of the sample data.

The First Major Hypothesis:

Ho1: There is a positive effect that is statistically significant at the level of significance ($\alpha \leq 0.05$) between financial ratios and predictors of failing financial performance in industrial companies.

The regression equation was tested as follows:

$$Y=a+b_1 X_1+b_2 X_2+\ldots b_{30} X_{30}$$

Where,
Y: represents the dependent variable, which is the financial performance.
a: is the fixed value.
b: is the regression coefficient, which measures the amount of change in Y if X changed by one unit.
X: is the ratio calculated.

Table 1
ANALYSIS OF VARIANCE TO TEST THE VALIDITY OF THE MODEL

Source of variation	Sum of squares	Degrees of freedom	Squares Average	Value of (F) Calculated	Statistical Significance
Regression	1808754.282	30	60291.809	21734448.309	0.000*
Residual	0.036	13	0.003		
Overall	1808754.318	43			

*Impact statistically significant at the level of significance (α ≤ 0.05).

Table 1 above demonstrate that statistical significance exists at the level of significance (α ≤ 0.05) for a number of independent variables (financial ratios) in the companies' financial performance. The value of F calculated at 21,734,448.309 is the highest of value F degrees of freedom in the spreadsheet (30, 13) which amounts to 1.958. To test the impact of the financial ratios on the overall financial performance of the industrial companies' sample in the study, a multiple regression analysis was applied as follows Table 2.

Table 2
MULTIPLE REGRESSION ANALYSIS TO TEST THE IMPACT OF THE FINANCIAL RATIOS ON THE COMPANIES' FINANCIAL PERFORMANCE

Independe nt variable	Correlation coefficient R	Interpretative value R^2	Regression coefficient	Beta coefficient	Value (T)	Significance
Independent	Correlation coefficient R	Interpretative value R^2	Regression coefficient	Beta coefficient	Value (T)	Significance
variable	0.98	0.96	0.009	0	0.085	0.934
Constant			0.249		0.729	0.479
X1			0.009	0	0.085	0.934
X2			-0.007	0	-0.052	0.96
X3			0.155	0	0.94	0.365
X4			0.503	0.001	1.489	0.16
X5			-0.008	0	-0.711	0.49
X6			0.01	0	0.265	0.795
X7			-0.233	0	-0.377	0.712
X8			0.196	0	0.627	0.541
X9			-0.009	0	-0.918	0.375
X10			0.014	0	0.91	0.38
X11			0.002	0	1.45	0.171
X12			-0.07	0	-0.465	0.649
X13			-0.012	0	-0.217	0.831

Table 2
MULTIPLE REGRESSION ANALYSIS TO TEST THE IMPACT OF THE FINANCIAL RATIOS ON THE COMPANIES' FINANCIAL PERFORMANCE

X14			-0.004	-0.001	-2.479	0.028*
X15			-0.001	0	-0.294	0.774
X16			-0.08	-0.001	-2.42	0.031*
X17			0.079	0	1.667	0.119
X18			0.001	0	1.012	0.33
X19			0	0	0.058	0.955
X20			0	0	0.022	0.983
X21			0	0	0.246	0.81
X22			-0.003	-0.001	-1.933	0.075
X23			0.01	0.001	0.354	0.729
X24			0.015	0.001	4.924	0.000*
X25			0.461	0.025	15.424	0.000*
X26			-0.003	0	-1.074	0.302
X27			0	0	0.769	0.456
X28			-0.002	-0.001	-2.329	0.037*
*Impact statistically significant at the level of significance (α ≤ 0.05).						

The results of the multiple regression analysis showed that there is a statistically significant effect at the level of significance (α ≤ 0.05) of the variables X14, X16, X24, X25, X28, X29 to predict financial performance. The results of the analysis show that the independent variables together explain 96% of the variance in predicting financial performance. The following chart (Figure 2) illustrates the financial ratios of the impact on the financial performance.

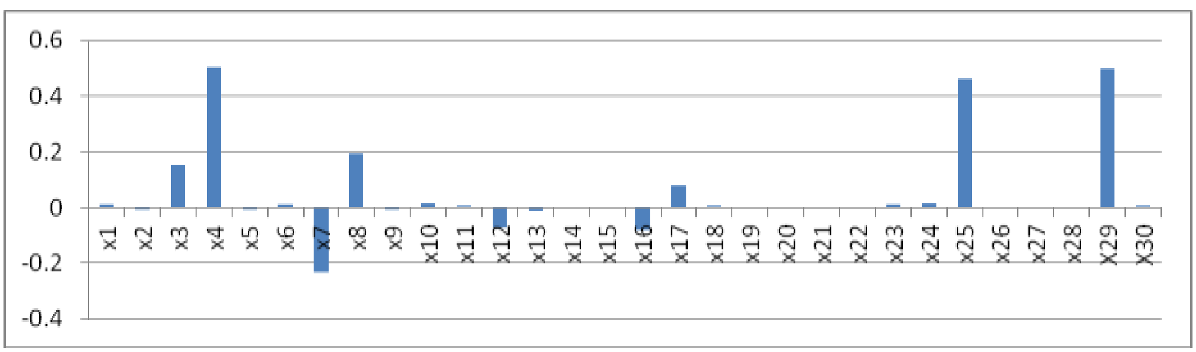

FIGURE 2
REGRESSION COEFFICIENTS FOR THE FINANCIAL RATIOS AND THEIR IMPACT ON FINANCIAL PERFORMANCE PREDICTION

Thus, we accept the first major hypothesis *H01: there is no statistically significant effect on the level of significance (α ≤ 0.05) between financial ratios and predictors of a stalled financial performance.*

Table 3 demonstrates the results of the stepwise regression analysis, and reveals that there are eight groups of financial ratios that can significantly explain the dependent variable, namely financial performance, was statistically significant at 0.05.

The results of the multiple regression analysis in the table below illustrates that the existence of eight standard models (statistical) of the independent variables has an effect that is statistically significant at the level of significance (α ≤ 0.05) on the financial performance.

The variable X30, a ratio of capital to total debt income in the six models have had indications of strong statistical correlation.

Table 3
MULTIPLE REGRESSION ANALYSIS TO TEST THE IMPACT OF FINANCIAL RATIOS TO PREDICT FINANCIAL PERFORMANCE

Groups	Independent variable	Correlation coefficient R	Interpretative value R^2	Regression coefficient	Beta coefficient	Value (T)	Significance
1	Constant	0.965	93.10%	-0.415		-0.508	0.614
	X30			0.504	1	252.188	0.000*
2	Constant	0.960	92.20%	-0.029		-1.358	0.182
	X30			0.5	0.992	9374.578	0.000*
	X25			0.502	0.027	252.942	0.000*
3	Constant	0.942	88.70%	-0.062		-3.974	0.000*
	X29			0.5	0.992	12982.12	0.000*
	X25			0.488	0.026	188.03	0.000*
	X24			0.009	0.001	6.51	0.000*
4	Constant	0.937	87.80%	-0.136		-4.451	0.000*
	X30			0.5	0.992	13205.65	0.000*
	X25			0.487	0.026	198.59	0.000*
	X24			0.01	0.001	7.086	0.000*
	X8			0.162	0	2.744	0.009*
5	Constant	0.939	88.20%	-0.129		-4.446	0.000*
	X30			0.5	0.992	13971.41	0.000*
	X25			0.534	0.028	27.37	0.000*
	X24			0.011	0.001	7.911	0.000*
	X8			0.164	0	2.941	0.006*
	X23			-0.048	-0.003	-2.444	0.019*
6	Constant	0.957	91.60%	-0.059		-1.677	0.102
	X30			0.5	0.992	14993.07	0.000*
	X25			0.543	0.029	30.062	0.000*
	X24			0.01	0.001	8.608	0.000*
	X8			0.178	0	3.498	0.001*
	X23			-0.06	-0.003	-3.295	0.002*
	X14			-0.002	0	-2.945	0.006*
7	Constant	0.964	92.90%	-0.009		-0.212	0.833
	X29			0.5	0.992	15622.5	0.000*
	X25			0.536	0.029	30.705	0.000*
	X24			0.01	0.001	9.064	0.000*
	X8			0.155	0	3.154	0.003*
	X23			-0.054	-0.003	-3.043	0.004*
	X14			-0.002	0	-3.296	0.002*
	X13			-0.018	0	-2.296	0.028*
8	Constant	0.967	93.50%	0.039		0.941	0.353
	X30			0.5	0.992	16346.72	0.000*
	X25			0.517	0.028	29.401	0.000*
	X24			0.011	0.001	9.939	0.000*
	X8			0.279	0	4.327	0.000*
	X23			-0.035	-0.002	-2.017	0.051*
	X14			-0.002	0	-4.429	0.000*
	X13			-0.023	0	-3.062	0.004*
	X16			-0.034	0	-2.702	0.011*

*Impact statistically significant at the level of significance ($\alpha \leq 0.05$).

Test Results of the First Sub-Hypothesis

H01a: There is no statistically significant effect at the level of significance (α ≤ 0.05) between liquidity ratios and predictors of a stalled financial performance.

The hypothesis was tested by entering a set of variables, liquidity ratios X1-X8, to gain access to the financial ratios with the greatest impact on financial performance as follows Table 4.

Table 4
MULTIPLE REGRESSION ANALYSIS TO TEST THE IMPACT OF LIQUIDITY RATIOS TO PREDICT FINANCIAL PERFORMANCE

Independent variable	Correlation coefficient R	Interpretative value R^2	F Value	Significance	Regression coefficient	Beta coefficient	Value (T)	Sig.
Constant	0.482	23.20%	2.023	0.042*	197.676		1.878	0.068
X_1					-81.136	-0.569	-0.826	0.414
X_2					117.838	0.59	0.841	0.405
X_3					104.356	0.129	0.696	0.491
X_4					157.728	0.205	0.972	0.337
X_5					2.111	0.036	0.229	0.82
X_6					-3.462	-0.077	-0.523	0.604
X_7					-16.075	-0.017	-0.093	0.926
X_8					-507.984	-0.522	-2.424	0.020*

*Impact statistically significant at the level of significance (α ≤ 0.05).

The results of the multiple regression analysis and the existence of the effect of statistical significance at the level of significance (α ≤ 0.05) only when the variable X8 of variables liquidity ratios eight to predict financial performance, where the value of t-calculated at 2.424, and its statistical significance is 0.020. The regression results indicate that the liquidity ratios combined explain for the eight ratios is 23.2% of the variation of financial performance. Thus, the first sub-hypothesis is accepted.

Test Results of the Second Sub-Hypothesis

Ho_1b: There is a positive effect of statistical significance at the level of significance (α ≤ 0.05) between activity ratios and predictors of failing financial performance of industrial companies.

The results of multiple regression analysis indicates a lack of effective statistical significance at the level of significance (α ≤ 0.05) for any of the ratios of activity to predict financial performance (Table 5). Where the values of t-calculated less than the t-value, these values critically show that the rates of activity of the five combined ratios explain 2.5% of the variation of financial performance. Although the highest among the group that had an impact on the financial performance is variable X11, a ratio of sales to working capital reached statistical significance of 0.920. Thus, we reject the second sub-hypothesis, and accept the alternative hypothesis, which states that:

No effect is statistically significant at the level of significance (α ≤ 0.05) between activity ratios and predictors of failing financial performance.

Table 5
MULTIPLE REGRESSION ANALYSIS TO TEST THE IMPACT OF THE ACTIVITY RATIOS ON PREDICTORS OF FINANCIAL PERFORMANCE

Independent variable	Correlation coefficient R	Interpretative value R ²	F Value	Significance	Regression coefficient	Beta coefficient	Value (T)	Sig.
Constant	0.158	2.50%	0.194	0.963*	-64.847		-0.898	0.375
X9					4.328	0.08	0.365	0.717
X10					1.881	0.048	0.256	0.8
X11					-0.137	-0.016	-0.101	0.92
X12					-33.847	-0.082	-0.407	0.686
X13					17.411	0.131	0.586	0.561

*Impact statistically significant at the level of significance (α ≤ 0.05).

Test Results of the Third Sub-Hypothesis

Ho_1c: There is a positive effect of statistical significance at the level of significance (α ≤ 0.05) between the solvency and predictors of failing financial performance of industrial companies.

Table 6
MULTIPLE REGRESSION ANALYSIS TO TEST THE IMPACT OF SOLVENCY RATIOS TO PREDICT FINANCIAL PERFORMANCE

Independent variable	Correlation coefficient R	Interpretative value R ²	F Value	Significance	Regression coefficient	Beta coefficient	Value (T)	Sig.
Constant	0.484	23.40%	2.088	0.039*	68.835		0.503	0.617
X_{14}					-0.494	-0.065	-0.306	0.761
X_{15}					0.417	0.068	0.325	0.747
X_{16}					2.281	0.229	1.423	0.162
X_{17}					-13.537	-0.038	-0.273	0.786
X_{18}					-0.116	-0.019	-0.137	0.892
X_{19}					-3.808	-0.298	-2.087	0.048*

*Impact statistically significant at the level of significance (α ≤ 0.05).

The results of the multiple regression analysis show the effect of significance at the level of significance (α ≤ 0.05) of the variable X19 of debt ratios on financial performance, which is the proportion of debtors to revenue, where the value of t-calculated is higher than t-value at the critical degree of freedom of 43 and the level of significance at 0.05, and reached 2.021. Results of the analysis did not show the presence of the impact for the rest of the solvency ratios to predict financial performance. The regression results show that all solvency ratio indicators combined explain 23.4% of the variation of financial performance. Thus, we accept the third sub-hypothesis (Table 6).

Test Results of the Fourth Sub-Hypothesis

Ho_1d: A positive effect is statistically significant at the level of significance (α ≤ 0.05) between profitability ratios and predictors of failing financial performance of industrial companies.

Table 7
MULTIPLE REGRESSION ANALYSIS TO TEST THE IMPACT OF PROFITABILITY RATIOS TO PREDICT FINANCIAL PERFORMANCE

Independent variable	Correlation coefficient R	Interpretative value R ²	F Value	Significance	Regression coefficient	Beta coefficient	Value (T)	Sig.
Constant	0.711	50.60%	3.793	0.001*	-42.248		-0.898	0.375

Table 7
MULTIPLE REGRESSION ANALYSIS TO TEST THE IMPACT OF PROFITABILITY RATIOS TO PREDICT FINANCIAL PERFORMANCE

X20					-0.455	-0.049	-0.227	0.822
X21					-0.192	-0.142	-0.99	0.328
X22					1.008	0.678	4.06	0.000*
X23					-42.75	-1.743	-0.863	0.394
X24					0.542	0.039	0.137	0.892
X25					51.355	2.042	1.048	0.302
X26					0.669	0.027	0.227	0.822
X27					0.533	0.171	1.267	0.213
X28					-0.725	-0.153	-0.838	0.408
X29					-0.002	-0.08	-0.508	0.615

*Impact statistically significant at the level of significance ($\alpha \leq 0.05$).

The results of the multiple regression analysis show an effect of significance at the level of ($\alpha \leq 0.05$) of the variable X22 of profitability ratios on financial performance. This is the ratio of net profit before tax to current liabilities, where the value of t-calculated is higher than t-value at the critical degree of freedom at 43 and the level of significance at 0.05, which were 2.021. The regression results show that profitability of all 10 ratios collectively explains 50.6% of the variation in financial performance, we thus accept the forth sub-hypothesis (Table 7).

Test Results of the Fifth Sub-Hypothesis

Ho_1e: There is a positive effect of statistical significance at the level of significance ($\alpha \leq 0.05$) between market ratios and the predictors of failing financial performance in industrial companies.

Table 8
MULTIPLE REGRESSION ANALYSIS TO TEST THE IMPACT OF MARKET RATIO TO PREDICT FINANCIAL PERFORMANCE

Independent variable	Correlation coefficient R	Interpretative value R^2	F Value	Significance	Regression coefficient	Beta Coefficient	Value (T)	Sig.
Constant	1	100%	124598.86	0.000*	-0.52		-0.702	0.486
X30					0.503	1	352.985	0.000*

*Impact statistically significant at the level of significance ($\alpha \leq 0.05$).

The analysis of simple regression tested for the existence of the effect of statistical significance at the level of significance ($\alpha \leq 0.05$) of the variable X30, which is a ratio of capital to total debt to predict financial performance, where the value of t-calculated is higher than t-value at the critical degree of freedom of 43 and the level of significance at 0.05, which was 2.021. The regression results show that the ratio of capital to total debt explains 100% of the variation of the financial performance, thus the fifth sub-hypothesis is accepted (Table 8).

The Second Major Hypothesis

Ho_2: distinguishes a quantitative predictive model consisting of a set of financial ratios, which will be achieved by using the statistical method accurately between successful industrial companies and those that are distressed.

In order to prove or deny this hypothesis, this study followed a number of statistical methods to arrive at a strong and reliable outcome. This study employed the discriminatory analysis method. It is used in prediction or classification where the dependent variable is qualitative in nature, i.e. the determination of whether the company is either distressed or non-distressed. The following steps were followed:

1. Step 1: This step involved the verification of independent variables (financial ratios) used in the study of the normal distribution, mean, and others (Table 9).
2. Step 2: This step ensured that there were equal variance matrices, one of the steps of analysis to test the discriminatory "*Box's M*", which was to establish whether the matrices are of equal variance (Table 10).
3. Step 3: This step tested whether or not there were differences between the dependent variable, and the independent variables. The authors tested the possibility of the existence of differences using Wilks Lambda to establish the function of discrimination, which consists of a number of financial variables (Table 11).
4. Step 4: This step sought to arrive at the discrimination linear function equation, and to do so the authors extracted the parameters of this function, using the Stepwise method, which provided the results of the most important variables of financial transactions, where each of the variables extracted the coefficient discrimination (Table 12)
5. Step 5: This step tested the equation on a group of successful companies and a group of failed companies (Table 13).

Table 9
OLOP CUBES TEST

Variables	Total	No. of Co.	Mean	Kurtosis coefficient	Skewness coefficient
X1	21.28	12	1.7733	4.664	1.977
X2	13.65	12	1.1375	4.159	1.856
X3	2.34	12	0.195	5.404	2.29
X4	0.37	12	0.0308	6.922	-2.193
X5	0.03	12	-0.0025	2.233	-1.439
X6	7.83	12	0.6525	10.11	3.13
X7	1.41	12	0.1175	10.856	3.254
X8	4.8	12	0.4	-0.848	0.506
X9	62.26	12	5.66	0.497	0.602
X10	291.35	12	24.2792	11.899	3.443
X11	39.23	12	3.2692	4.34	-0.952
X12	9.51	12	0.7925	0.011	0.283
X13	36.8	12	3.0667	1.842	1.71
X14	658.01	12	54.8342	6.838	2.395
X15	541.98	12	45.165	6.838	-2.395
X16	115.02	12	9.585	11.894	3.443
X17	3.45	12	0.2875	2.19	1.145
X18	164.73	12	13.7275	7.844	2.628
X19	264.98	12	22.0817	-0.57	0.819
X20	275.48	12	22.9567	4.701	1.97
X21	356.09	12	-29.6742	10.919	-3.216
X22	630.81	12	52.5675	10.207	3.128
X23	0.63	12	0.0525	0.254	-0.744
X24	36.98	12	3.0817	-0.359	-0.234
X25	-1.95	12	-0.1625	0.72	-0.948
X26	8.16	12	0.68	4.715	1.452
X27	-51.95	12	-4.3292	1.688	-0.837
X28	-324.68	12	-27.0567	9.824	-3.029
X29	29038.28	12	2419.8567	12	3.464
X30	262.98	12	22.0019	0.59	0.829

The results of the statistical analysis of the independent variables in the table above show that most of the independent variables were scattered, and most of them are not distributed to their mean. It is worth noting that the non-achievement of the requirement of the equality of the variance matrices does not affect the quality, efficiency, quality, and efficiency of the proposed model, measured by the accuracy of the model in the classification and the prediction of successful and stumbling enterprises.

Therefore, Table 9 below describes the category-estimated coefficient functions which can be used to classify the companies sampled into one of the two groups, where the values are re-estimated by these functions, and then re-rated in the group that has the greatest value.

Table 10
EQUAL VARIANCE MATRICES
"Box's M" Test

Equal variance matrices Test	
Box's M	62.203
F value	16.238
Freedom Degree 1	3
Freedom Degree 2	18000
Significance	0

It is clear from the above table that the statistical significance was (0.00) with the freedom degree (3), which is much smaller than the 0.05 level, which is a very strong indication that there are differences between financial variables (financial ratios). The smaller the level of morale, the more unequal the matrices of the two groups are. Which means that there is strong independent variables that measure the dependent variable, which is financial performance.

After the previous tests, independent variables (financial ratios) must be subjected to the Wilks' Lambda test to see if there is an effectiveness of the independent variables by means of statistical significance, as shown in Table 11.

Table 11
TEST VARIABLES ACCORDING TO WILKS LAMBDA

Variables	Wilks' Lambda Values	F values calculated	Freedom 1	Freedom 2	Significance
X1	0.692	4.003	1	9	0.076
X2	0.725	3.422	1	9	0.097
X3	0.662	4.598	1	9	0.061
X4	0.818	2.001	1	9	0.191
X5	0.82	1.972	1	9	0.194
X6	0.931	0.664	1	9	0.436
X7	0.953	0.444	1	9	0.522
X8	0.995	0.046	1	9	0.835
X9	0.78	2.536	1	9	0.146
X10	0.863	1.427	1	9	0.263
X11	0.904	0.957	1	9	0.353
X12	0.987	0.115	1	9	0.742
X13	0.982	0.167	1	9	0.692
X14	0.613	5.689	1	9	0.041
X15	0.613	5.689	1	9	0.041
X16	0.86	1.468	1	9	0.256
X17	0.907	0.926	1	9	0.361
X18	0.765	2.771	1	9	0.13
X19	0.694	3.959	1	9	0.078
X20	0.886	1.159	1	9	0.31

Table 11
TEST VARIABLES ACCORDING TO WILKS LAMBDA

X21	0.852	1.562	1	9	0.243
X22	0.728	3.361	1	9	0.1
X23	0.293	21.714	1	9	0.001
X24	0.277	23.471	1	9	0.001
X25	0.328	18.45	1	9	0.002
X26	0.499	9.035	1	9	0.015
X27	0.74	3.156	1	9	0.109
X28	0.78	2.532	1	9	0.146
X29	0.88	1.228	1	9	0.297
X30	0.654	3.966	1	9	0.069

It is noted from the Table 11 above that there is an effectiveness of the independent variables through the statistical significance, the highest of which is the variable (X24) where the statistical significance of (0.001) is the net profit before tax to the capital invested, as well as the variable (X23) And taxes to total assets, with a statistical significance of (0.001). Followed by the variable (X25), which is the ratio of net profit after tax to total assets, with a statistical significance of (0.002).

Table 12
ESTIMATED CLASSIFICATION FUNCTIONS COEFFICIENTS

Independent variable	Success	Failed
X_{30}	0.000	4.109E-006
X_{25}	0.416	-1.729
X_{21}	-0.001	0.028
X_{19}	0.004	0.459
Constant	-1.943	-11.183

X30 was excluded from the equation, where the coefficient was equal to 0.00 in the classification of successful companies, which are close to zero in the classification of non-performing companies, according to the table above.

By applying the formula to test with the two classification factors, we derive from the table below the coefficients of the two estimated classifications, and the two are useful for reclassifying the sample establishments in one of the two groups, where the values are reassessed by these functions and then reclassified in the group with the greatest value.

Table 13
RESULTS OF APPLYING FACTORS CLASSIFICATION TO THE FINANCIAL RATIOS USED IN THE MODEL

Company	Classification of distressed (failed)	Classification of success	Result	Normal Situation
1	1.49037	-3.65396	F	F
2	-13.7726	-0.13448	S	S
3	-16.0214	1.193	S	S
4	12.80235	-7.62087	F	F
5	-13.6931	0.50014	S	S
6	-9.92347	-0.3391	S	S
7	-13.1208	-0.93018	S	S
8	18.51279	-2.95767	F	F
9	11.60064	-4.07027	F	F

Table 13
RESULTS OF APPLYING FACTORS CLASSIFICATION TO THE FINANCIAL RATIOS USED IN THE MODEL

10	10.0017	-2.15258	F	F
11	4.31522	-2.41827	F	F
12	-11.3784	-0.12695	S	S

Key: F: Failed, S: Success.

Therefore, the function of successful companies could be expressed as follows:

$$D1=0.416*X25-0.001*X21+0.004*X19 - 1.943$$

Where,

D1: The distinguishing mark of non-distressed companies resulting from the equation above.
X25: Ratio of net profit after tax to total assets.
X21: Profit before interest and tax to sales ratio.
X19: Ratio of debtors to income.

Furthermore, the functions of failed companies could be expressed using the following:

$$D2=-1.720*X25+0.028*X21+0.459*X19-11.183$$

Where,

D2: the distinguishing mark of the distressed companies resulting from the equation above.
X25: Ratio of net profit after tax to total assets.
X21: Profit before interest and tax to sales ratio.
X19: Ratio of debtors to income.

DISCUSSION

According to our study results that came in accordance with previous studies done by Beaver (1966), Altman (1968), Taffler (1977:1983:2005), Argenti (1976), De Toni & Tonchia (2001), and Fook Yap et al. (2012), for predicting the failure of the financial performance of the companies. It showed the importance of financial analysis in accounting and financial ratios in the analysis of the financial position of the company. There is a significant relationship between the financial ratios that measure liquidity and profitability, and the extent of the direction of the company towards success or falling, as mentioned by Altman (1968), and Taffler (1977:1983:2005). Stumbling does not mean the failure of the establishment, or stop work, but is the beginning of the path to the collapse of the company, which can be derived by reviewing the financial statements of the facility and analysis, as mentioned by Altman (1968) study too. The use of the method of discriminatory analysis contributed to increasing the effectiveness of accounting and financial ratios in forecasting, and the distinction between successful and failing companies. as mentioned by Altman and others. It is important to use the model on another sample of companies whose data used to construct the model to demonstrate the model's ability and effectiveness. Most previous studies have done so.

CONCLUSION AND RECOMMENDATIONS

By using a small sample of food companies in the Jordanian industrial sector, which was a limitation of this research. Also, another limitation of this paper was not take into account behavioural factors, nonfinancial data and its impact on performance evaluation. Behavioural factors, and nonfinancial data, form a field of study alongside financial data that are expected to attract the attention of other researchers in the future. This research has built a model consisting of a set of financial percentages that distinguish between successful companies and failed companies. A set of financial ratios to predict financial performance has been proposed, and this could be applied in order ensure that vulnerabilities are identified and that the appropriate action is taken on time in order to avoid financial distress before it happens.

This developed model shows that food companies could be reclassified so that one is able to distinguish between successful and non-performing companies. Furthermore, it is clear that the model does not require many financial ratios to predict that a stalled financial performance of the company is likely.

Appendix 1
FINANCIAL RATIOS AND THE EXTENT OF THE STUDY SAMPLE USED IN PREVIOUS STUDIES

Code	Description ratio	Measuring the ratio
X1	Liquidity ratio=Current assets/Current liability.	Liquidity
X2	Quick ratio=Cash+Cash equivalent+Short term investments+Receivables/Current liabilities.	Liquidity
X3	Cash ratio=Cash+Marketable securities.	Liquidity
X4	Working capital to total assets.	Liquidity
X5	Working capital to sales.	Liquidity
X6	Cash flow to total liabilities.	Liquidity
X7	Cash to sales ratio.	Liquidity
X8	Current assets to total assets.	Liquidity
X9	Inventory Turnover=Net sales to inventory.	Activity
X10	Bebtor's turnover ratio of sales to debtor's.	Activity
X11	Turnover of working capital to sales ratio=Working capital.	Activity
X12	Asset turnover ratio of sales to assets.	Activity
X13	Turnover=Ratio of current assets to current assets sales.	Activity
X14	Debt Ratio=Total liabilities to total assets.	Solvency
X15	Ownership=Total liabilities to owners' equity.	Solvency
X16	financing fixed assets ratio=(Owner equity+Long-term liabilities)/Total fixed assets.	Solvency
X17	Inventory to owner equity.	Solvency
X18	Receivables to total debt.	Solvency
X19	Debtors to sales.	Solvency
X20	Net profit to sales.	Profitability
X21	Profit before interest and tax to sales.	Profitability
X22	Net profit before tax to current liabilities.	Profitability
X23	Net profit before interest and tax to total assets.	Profitability
X24	Net profit before tax to invested capital.	Profitability
X25	Return on assets ratio=Net profit after tax to total assets.	Profitability
X26	Net operating cash flow to net income.	Profitability
X27	ROE=Ratio of net profit to owner's equity.	Profitability
X28	Retained earnings to total assets.	Profitability
X29	Net profit to the number of shares of market ratio.	Profitability

Appendix 1 **FINANCIAL RATIOS AND THE EXTENT OF THE STUDY SAMPLE USED IN PREVIOUS STUDIES**		
X30	Market ratio=Market value of capital-to-book value of the total debt.	Market ratio

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