The Usefulness Of Accounting Information, Economic Variables, And Corporate Governance Measures To Predict Corporate Failure

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ABSTRACT

This paper has the core aim of investigating the usefulness of employing accounting information, macroeconomic variables and corporate governance measures to predict corporate failure in an Egyptian setting. The empirical study is directed to adapting a corporate failure prediction model applied to a sample of Egyptian companies listed in the Egyptian stock market. A sample of 79 companies drawn from the 100 most actively traded firms listed in the Egyptian stock market has been used for the empirical testing. A pooled sample is formed covering the period 2000-2005 inclusive. The empirical study emphasized improving failure prediction accuracy by introducing two classes of variables besides financial ratios based on accounting information. These classes of variables are economic variables and corporate governance measures. Logistic regression analysis has been used to test the predictive accuracy of four models. Model I included accounting information only. Model II added economic variables to accounting information. Model III included corporate governance measures and accounting information. Finally, model IV employed these three classes of variables together. Analysis of the statistical testing results indicated that employing the three classes of variables together improved the prediction accuracy to reach 84.8% in the classification sample and 78.2% in the validation sample. Furthermore, model IV is used to predict failure up to three years prior to failure and therefore can provide a tool for failure prediction for enhancing auditing, investment and credit decisions in an Egyptian market setting.

Keywords: corporate failure prediction; accounting information; economic variables; corporate governance

INTRODUCTION

Predicting the probability of corporate failure or the company's ability to continue as a going concern has been a center of attention for the academia, professionals and company stakeholders (Hassanein, 1998). The role of accounting information in predicting future performance is regarded as a core aim (Lev, 1989). Nevertheless, for more than 40 years of continuous research, few attempts have been directed to employing variables that are endogenous as well as exogenous to the firm to enhance classification and prediction accuracy of corporate failure.

Researchers have found that firms failed even though they presented fairly good financial ratios as close as two years prior to the actual failure (for example; Laitinen, 1991). Moreover, Lev (1989) argued that Generally Accepted Accounting Principles (GAAP) are regarded as biased and deficient in providing financial variables with predictive power. This argument has seriously questioned the validity and reliability of using financial information in isolation from other non-financial variables.

This research aims at achieving the following main objective: investigating the usefulness of employing accounting information, macroeconomic variables and corporate governance measures to predict corporate failure in an Egyptian setting. This investigation is conducted with the purpose of enhancing the prediction accuracy of a model with the potential to increase the quality of investment, auditing and credit decisions.

The focus of the research is the quality of variables used –to increase prediction accuracy– rather than statistical technique utilized. It attempts to adapt a country-specific failure prediction model for companies listed in the Cairo and Alexandra Stock Exchange (CASE) and employ economic variables and corporate governance measures to enhance the predictive accuracy of a model that includes accounting ratios. The importance of corporate governance lies in its contribution to both economic prosperity and accountability. The latter has been the area of concern as well as debate not only in an Egyptian context, but also all over the world (Abou El Sood, 2005).

RESEARCH METHODOLOGY

Stemming from the main objective of this research, several steps should be undertaken to achieve that objective. *First*, analyzing the major directions of research on corporate failure prediction. *Second*, identifying explanatory variables employed in corporate failure prediction studies to determine their relative usefulness in the present study. *Third*, examining modeling techniques used in the literature to enhance the predictive ability of the present model. *Fourth*, assessing the usefulness of accounting information and corporate governance measures as well as economic variables in predicting corporate failure of listed industrial companies in Egypt. *Fifth*, investigating the usefulness of the combined model which includes the three classes of variables interacting in synergy for enhancing prediction accuracy of the model.

The empirical testing of the present study attempts to improve prediction accuracy of corporate failure by introducing two classes of variables besides financial ratios based on accounting information. These classes of variables are economic variables and corporate governance measures.

For empirical purposes, a model utilizing *accounting information* is developed (Model I). Then, *economic variables* only are inserted to the previous model to test for the possible incremental value of the second class of variables (Model II). Thereafter, *corporate governance measures* only are added to the first model to test for their usefulness (Model III). Finally, all variables -*accounting information*, *economic variables*, and *corporate governance measures*- are to be combined in Model IV to test for the overall predictive power of the three classes of variables combined.

The present study employs pooled data to conduct the analysis. That is; the empirical testing is conducted using cross sectional analysis across companies and through out a classification period of six consecutive years (2000-2005). The binary logistic regression analysis is used to conduct the empirical testing.

Failure Specified

Based on reviewing accounting literature, the present study employs a failure definition adapted from Hopwood et al. (1988) and Lee et al. (2003).

A company is to be considered among the failing companies if and only if one of the following conditions is fully satisfied over three consecutive years: (1) negative net operating cash flows in any of these three years, (2) net operating loss in any of the three years, and (3) negative working capital in any of the three years.

Sample Composition

The sample of the study is drawn from the 100 companies that are most actively traded in the Egyptian stock exchange. For a company to be included in the sample, the following conditions should be met:

(1) The company's shares must have been publicly traded in the Egyptian stock exchange and classified among the 100 most actively traded firms;
(2) The company must have been classified as industrial;
(3) The company must have had at least two years of full financial statements data prior to its failure year; and

Financial institutions are excluded from the data set, since firms in such industries are structurally different and their financial reporting practices generally preclude combining them with industrial and service firms in failure prediction studies that use financial ratios (Gilbert et al., 1990; Charitou et al., 2004).

A sample of 78 observations has been randomly selected to form a hold-out or validation sample constituting exactly 24.3% of the overall sample. The sample size is restricted due to data availability considerations especially with respect to corporate governance practices that are relatively new to the Egyptian market.

The sample composition can be summarized as shown in table (1):

Table 1: Sample of Failed and Non-failed Firms

Year	Number of Firms		Ratio of Healthy / Failed Firms
	Failed	Non-failed	
2000	22	12	**55 %**
2001	30	14	**47 %**
2002	33	21	**64 %**
2003	38	23	**61 %**
2004	42	17	**40 %**
2005	42	27	**64 %**
	207	**114**	**55 %**

Regarding the composition of the sample, the empirical testing is to be conducted without pairing. (Deakin, 1977; Ohlson, 1980; Gilbert et al., 1990, Boritz et al., 1995). The estimation sample consists of 243 observations - that is 75.7% of the total sample- for classification purposes. Such selection is based on a 75-25 ratio for estimation and validation samples. [(1)]

Period Of The Study

The sample period includes six years 2000-2005 used for classification purposes.

Variables Specification

The empirical study employs three classes of variables; namely accounting information, economic variables and corporate governance measures.

Table (2) presents financial ratios that are broken down according to proxies for major categories along with a list of economic variables and corporate governance measures.

[(1)] The 75-25 rule was used to divide the total sample to classification and hold-out sub-samples. This means that 75% of the total observations were used as estimation sample while 25% of the total observations were employed as validation sample. Such rule is adapted from data analysis and computers II course of the University of Texas at Austin by Professor Schwab, A.

Table 2: List of Variables Employed in the Present Study
(Financial ratios are broken down to major categories along with economic variables and corporate governance measures)

Class	Category	No.	Variable
Accounting information	Financial Leverage	1	Retained earnings/total assets
		2	Total liabilities/total assets
		3	Stockholders' equity/total liabilities
	Liquidity	4	Current assets/total assets
		5	Current ratio
		6	Quick assets/total assets
		7	Quick ratio
	Profitability	8	Operating profit margin
	Sales Activity/ Turnover	9	Sales/current assets
		10	Sales/total assets
Economic variables	Annual Growth Rate of Money Supply	11	M2
	Annual Growth Rate of Real Gross Domestic Product	12	GDP
	% Annual Change in Egyptian Stock Market Index	13	ESMI
	Annual Growth Rate of Consumer Price Index	14	CPI
	Interest rate on industrial borrowing for a year or less	15	IROIB
	Foreign exchange rate against the US dollar	16	EXR
Corporate governance measures	Board of Directors	17	CEO-board structure
	Disclosure and Transparency	18	Qualified audit report
		19	Remuneration of board members
		20	Risk and management policies
	Shareholders' rights	21	% block-holders
	Stakeholders' rights	22	Employee welfare
		23	Employee incentive plan
		24	Social responsibility policies

The Statistical Technique - Logistic Regression Analysis:

Logistic regression analysis (LRA) extends the technique of multiple regression analysis to research situations in which the outcome variable is categorical. Logistic regression describes the relationship between a dichotomous response variable and a set of independent variables. The independent variables may be continuous or discrete with dummy variables. The predictions may be made for the dichotomous outcome of success/failure (Friendly, 1995).

Logistic regression analysis does not require the restrictive assumptions regarding normality distribution of independent variables or equal dispersion matrices nor concerning the prior probabilities of failure (Ohlson, 1980; Zavgren, 1983). Rather, logistic regression is based on two assumptions; (1) it requires the dependent variable to be dichotomous, with the groups being discrete, non-overlapping and identifiable and (2) it considers the cost of type I and type II error rates in the selection of the optimal cut-off probability. However, due to the subjectivity of the choice of these misclassification costs in practice, most researchers minimize the total error rate and, hence, implicitly assume equal costs of type I and type II errors (Ohlson, 1980; Zavgren, 1985).
The equation of the present model could be expressed as:

$$Z_i = a + \sum_k b_k X_{k,i} + \sum_j c_j E_{j,i} + \sum_m d_m G_{m,i}$$

where;
Z_i = the probability of failure for firm i
and;
$X_{k,i}$ = the kth accounting variable of firm i
$E_{j,i}$ = the jth economic variable of firm i
$G_{m,i}$= the mth corporate governance variable of firm i
a, b_k, c_j, d_m are regression coefficients

The use of logistic regression in the present study could be justified by the following points. First, the output of the LRA, the logit score referred to as Y in the regression equation, is a score between zero and one, which immediately gives the probability of failure of the company rather than the score of failure as opposed to non-failure (Ohlson, 1980).

Second, the estimated coefficients in LRA can be interpreted separately as the importance or significance of each of the independent variables in the explanation of the estimated failure probability (Ohlson, 1980; Mensah, 1984; Zavgren, 1985), provided that there is no multi-collinearity among the variables. Third, logistic regression analysis allows for qualitative variables (dummies) to be used (Ohlson, 1980; Keasey and Watson, 1987).

Research Hypotheses

The present empirical study is oriented to test the following hypotheses:

H_{0A}: there would be no increased prediction accuracy in a model using macroeconomic variables and accounting information compared to a model using only accounting information.

H_{0B}: there would be no increased prediction accuracy in a model using corporate governance measures and accounting information compared to a model using only accounting information.

H_{0C}: using a model that combines the three classes of variables would not produce significant increase in prediction accuracy.

EMPIRICAL TESTING

Model I includes only accounting information. The variables selected through the stepwise method are: retained earnings/total assets, total liabilities/ total assets, equity-to-debt ratio, current assets/total assets, current ratio, and operating profit margin. The coefficients in the four models can be viewed in table (3).

Model II incorporates macroeconomic variables. Nonetheless, only the consumer price index variable is selected in the final model iteration with a positive coefficient of 5.687. That could be attributed to the fact that economic variables in general affect the financial performance of all sample firms alike, therefore, not having a significant value to the predictive power of the model. Model III adds corporate governance measures only to accounting information. The model reveals that joint CEO-board structure has a negative coefficient indicating that higher probability of failure is associated with lower joint CEO-board structures. Analysis results have been contrary to the research expectation as well as the results of previous studies.

Such results could be attributed to the fact that most of the sample companies (77% of healthy firms and 55% of failing firms) have joint CEO-board structures; which might seem a country-specific attribute affecting the sample of Egyptian firms. Nonetheless, it can be beneficial not to embrace the efficient ownership structure of anonymous small diversified shareholders common to the US, UK and "economic theory". According to Dyck (2000), when legal protections are ineffective, ownership concentration can provide the functions of a corporate governance system and enhance promise fulfillment. Bebchuk (1999) points out that ownership concentration may be more efficient than efforts to introduce disperse shareholding.

Table 3: Coefficients of the binary logistic regression models

	Model I *	Model II **	Model III †	Model IV ††
Constant	0.457		0.457	0.520
RETA	-8.240	-8.316	-8.240	-9.052
TLTA	4.131	4.552	4.131	4.615
SETL	-0.053	-0.052	-0.053	-0.050
CACL	0.442	0.391	0.442	0.380
QATA	-4.609	-4.360	-4.609	-4.239
OPM	-3.354	-3.246	-3.354	-3.546
CPI				5.687
CEOB			-0.933	-0.955

*** Model I** includes accounting variables
**** Model II** includes accounting and economic variables
† **Model III** includes accounting and corporate governance variables
†† **Model IV** includes accounting, economic and corporate governance variables

Finally, model IV combines the three classes of variables. The final selected variables and related regression coefficients as shown in table (3) are used to derive the logistic regression equation:

$$Z_i = \underset{}{0.520} - \underset{(0.004)}{9.052}\, RETA + \underset{(0.000)}{4.615}\, TLTA - \underset{(0.034)}{0.050}\, SETL + \underset{(0.030)}{0.380}\, CACL$$
$$- \underset{(0.000)}{4.239}\, QATA - \underset{(0.000)}{3.546}\, OPM + \underset{(0.105)}{5.687}\, CPI - \underset{(0.014)}{0.955}\, CEOB$$

** significance (p-value)*

Regarding economic variables, the model includes annual growth rate of consumer price index (CPI) which has a positive coefficient. This result might be due to the effect of inflation on companies' borrowing. Companies are obligated to pay their financial obligation with interest according to the inflationary conditions, which raises question regarding companies' probability to default. With respect to corporate governance measures, CEO-board structure remains important in predicting company failure. This result might be due to the concentrated ownership in which the board member is also a major shareholder. This structure might seem contrary to other governance structures in other countries like USA and the UK. It seems interesting to know how the integration among the three classes of variables increased the predictive power of the failure prediction model. General economic conditions alone might not seem valuable in enhancing predictive accuracy, as they have a uniform effect on all firms. However, when affecting company endogenous characteristics, such macroeconomic indicators become more meaningful and more value-adding.

Tests Of Goodness Of Fit

It could be noticed from table (4) that combining the three classes of variable in model IV improves the log likelihood, Cox & Shell (R^2), Nagelkerke (R^2) and Hosmer & Lemeshow test compared to other models.

Table 4: Results of the Tests of Goodness of Fit

Model	-2 log likelihood	Cox & Snell R^2	Nagelkerke R^2	Hosmer & Lemeshow test
I	224.633	0.333	0.454	8.092
II	221.764	0.341	0.465	23.129
III	218.476	0.349	0.477	8.594
IV	215.273	0.358	0.488	14.703

Classification Accuracy

The classification and prediction accuracy of the four models is assessed and summarized in table (5).

Table 5: Classification and Prediction Accuracy of the Fitted Models – One Year Prior to Failure

Model	Firms	Classification Accuracy	Prediction Accuracy
I	Failing	65.6%	58.3%
	Healthy	88.2%	77.8%
	Entire Sample	**79.8%**	**71.8%**
II	Failing	65.6%	58.3%
	Healthy	88.2%	77.8%
	Entire Sample	**79.8%**	**71.8%**
III	Failing	71.1%	75%
	Healthy	91.5%	77.8%
	Entire Sample	**84%**	**76.8%**
IV	Failing	71.1%	70.8%
	Healthy	92.8%	81.5%
	Entire Sample	**84.8%**	**78.2%**

Out-Of-Sample Validation Of The Model

Validation tests examine the ability of the estimation model to predict failure of a new set of observations. Testing of hypotheses is conducted through the z-statistic as the sample is large enough to support its use. With respect to difference in proportions of model I and model II, since $P_1 = P_2$, then, the first null hypothesis is accepted, i.e. the addition of economic indicators to the accounting information would not enhance the accuracy of predication as stated in the first hypothesis "*there would be no increased prediction accuracy in a model using both macroeconomic variables and accounting information compared to a model using only accounting information*".

Similarly, when calculating the difference in proportions for model I and model III, results indicate a p-value of 0.0708 which means that model III is marginally significant. Therefore, the second null hypothesis H_{0B} which states that "*there would be no increased prediction accuracy in a model using both corporate governance measures and accounting information compared to a model using only accounting information*" could be rejected.

Regarding difference in proportions for model I and model IV, the z-statistic equals 1.88 which corresponds to a level of significance of 0.031. Hence, there seems to be an appropriate ground on which to reject the third null hypothesis H_{0C} which states that "*using a model that combines the three classes of variables would not produce significant increase in prediction accuracy*". It could be concluded that integrating accounting information, economic variables, and corporate governance measures improves the prediction accuracy for the sample firms.

Testing Multicollinearity And Examination Of Residuals

Multicollinearity diagnostics reveal no dependency among predictor variables. Results can also be matched against by Pearson's correlation coefficients. Examination of residuals does not indicate a reason for concern. Moreover, most cases of the sample have standardized value of less than ± 2.5. Few cases, i.e. sample firms, have absolute values of more than 2; however such cases do not exceed 5% of the sample firms. Therefore, it could be said that the model is a good representation of the actual data.

Robustness Of The Model

To test the robustness of the three-class-variables model, prediction results were generated for up to 5 years prior to the event of failure based on a circular sample. A summary of results is presented in table (6).

Table 6: Model Robustness -Testing for Several Years Prior to Failure

Years Prior to Failure	No. of firms in the sample	Percentage Correct
1 year	79	78.2%
2 years	61	73.7%
3 years	54	70%
4 years	44	66.7%
5 years	34	66.7%

Results indicate that the model is robust and valuable results could be obtained for up to five years prior to failure. However, predictive power decreases as the time lag increases, this might be due to losing the predictive ability of the independent variables as the time lag increases between the information used in the analysis and the event of failure. Such results might prove valuable for various interested parties.

The model could be used by auditors to estimate the probability of failure –and hence audit risk– for client firms one year prior to failure. Estimating probability of failure for up to 3 years could seem valuable for credit rating agencies and financial institutions considering granting loans to companies. Furthermore, investment decisions in listed companies could be enhanced through predicting failure for up to 3 years prior to failure.

CONCLUSION

A three-class-variable model proves superior in predicting corporate failure among the sample firms – at the 5% level. The final model stresses the importance of leverage and liquidity as important factors in predicting failure. Integrating the three classes of variables together in one model produces a relatively high prediction accuracy, which has been hypothesized.

Concerning macroeconomic factors, inflation –as reflected in percentage change in consumer price index– proved significant. The effect of increasing inflation and the financial burden on a firm might be a reason for such a firm to experience failure.

The final composite model includes the existence of a CEO-board structure as a significant corporate governance measure used in failure prediction. Such variable is negatively associated with failure. The negative association could be explained as follows: the CEO who is also setting as a chairman for the board of directors might be a deterrent to high probability of failure. This result has been contradictory to good corporate governance guidelines. Therefore, such element seems worthy of being studied thoroughly as a country-specific indicator of corporate governance practices.

FURTHER RESEARCH

The present study emphasizes the usefulness of incorporating other non-accounting information to models containing accounting information with the core aim of enhancing corporate failure prediction. Future research work in the arena of predicting corporate failure could be directed in two main streams:

A. Focusing on the enhancement of prediction accuracy of the model by relaxation of underlying assumptions and sampling characteristics.
B. Improving prediction through utilizing other explanatory variables that are environment-specific and conceptually well-furnished.

Further research efforts would be needed to cover these points:

1. Macroeconomic variables affect companies uniformly. Hence, it seems important to study the effect of macroeconomic indicators –over a time series– on companies' probability of failure. The time series might

encompass an economic cycle with booming and recessionary conditions. Therefore, it may seem necessary to account for the problem of non-stationarity of data in longer time series.

2. The conformity to good corporate governance practices seems vital in failure prediction. However, measures selected in the model of the present study are based on country-specifics. Therefore, when developing such a model in other environments, adaptation to the local settings seems essential. Making good use of local corporate governance guides in choosing which measures to include in the model seems invaluable in reflecting country-specific practices.
3. Defining corporate failure instead of identifying bankrupt firms might provide early warning signals to interested parties when using failure prediction models. The bankruptcy event seems to be happening as a final stage after failure signs take place.
4. Further investigation is needed regarding the effect of the statistical technique used in failure prediction. Comparing results when using logistic regression to other methods seems worthy of examination.
5. Adapting the prediction model to industry, size, and age of companies seems important. Therefore, further studies would seem to be needed to generate more specific results that might be useful for investment, financing and auditing decisions for such companies.
6. Incorporating misclassification costs into the model might be another interesting area for investigation. Such analysis might enhance user-specific decisions.
7. Further research can provide useful results concerning other market settings comparable to the Egyptian setting. Countries furnishing good corporate governance practices might provide interesting comparison. In-depth analysis of results might shed light on policy recommendations.

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