

Accounting Disclosure Quality and Bankruptcy Prediction

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ABSTRACT

The complexity of economic environment and information asymmetry makes financial reporting and accounting disclosure policies crucial to stakeholders, hence the role of accounting disclosure quality in bankruptcy prediction realm has been investigated in this study. The Result of Genetic algorithm show that accounting disclosure quality significantly increases the accuracy of bankruptcy prediction model and it can be regarded as a complementary variable to other variables used in the bankruptcy literature. To examine the research hypotheses, the listed Companies of Tehran Stock Exchange have been investigated between 2004 and 2010.

Keywords: Disclosure quality, Information asymmetry, Bankruptcy, Genetic Algorithm, bankruptcy prediction

JIE code: M41 G33 C45

1-Introduction:

Numerous public Companies have been experiencing financial crisis in recent years which brought various studies investigating the shared attributes of these firms, specifically the time and the situation they are all involved in when the crisis has occurred. Thus providing reliable and timely information in order to assess financial condition and business operation is vital to investors and financial institutions. Poor disclosure of financial information has played an essential role in making financial crises last over the years (Glassman 2003). Mandatory or voluntary Disclosure of accounting information is critical in proper functioning of capital markets. These points to information and agency problem between management and external stakeholders. To mitigate the effect of these two problems and alignment of manager and owner interests, efficient contracts between owner and agent is made in order to provoke management incentives to disclose adequate and necessary information (Healy and Palepu 2001). However environmental, economical and institutional factors such as defects in regulation and the cost of gathering desired information prevent agency and information problems to be completely resolved. Accounting disclosure is made mandatory due to uncertain economic environment making many companies disclose high quality information just to buildup confidence and decrease the uncertainty level investors are involved in.

Due to differences in corporate disclosure quality and financial reporting among firms, this research aims to investigate the role of information asymmetry (the quality of financial disclosure) in bankruptcy prediction field. Different financial and economical situations can change the level of financial disclosure and its quality. Managers follow their own self interest thus different incentives, financial factors; economical situations and cost-benefit analysis dictate certain level of accounting disclosure in order to achieve their targeted ends. Hence we seek to explore the role of disclosure quality in bankruptcy and financial crisis prediction.

2-Literature and conceptual framework

importance of cash flow information regarding firms facing financial crisis (Baler ,2003). This situation raises default and bankruptcy risk along with uncertainty regarding future cash flow. Timely financial reporting can be a reliable source explaining these difficulties and management's strategies. The factors which depict a harsh time for firms indicate increased information asymmetry between management and stockholders, uncertainty regarding future cash flow, reduction in manager's reputation, loss of major clients and increase in creditors' interests due to high default risk. (Wruck ,1990; Whitaker, 1999).

Managers usually face dilemma regarding financial disclosure quality and adequacy, on one hand they try to disorient investors' attention when firm is dealing with crisis and on the other hand they have moral obligation to inform all the stakeholders and potential decision makers about firm's overall status. Positive accounting theories and voluntary disclosure policies are discussed to explain management's decisions regarding financial reporting and disclosure. Positive accounting attempts to explore contractual and political factors influencing management's attitude toward financial reporting and disclosure (Watts and Zimmerman, 1986). Manager's opportunistic behavior results in over estimating firm's performance in order to achieve the highest possible reputation and compensation (watts ,2003). Firms with high leverage characteristics prevent disclosing reliable information in an opportunistic way which is partly due to debt covenant violation (Persons, 1995). Conversely researcher found that high leverage firms tend to publish high quality informative financial statements to impress creditors (Frankel and Roychowdhury, 2006). This indicates different management scenarios in which the opportunistic behavior of manager is accorded with its relative financial and economical environment. firms with high growth opportunities tend to disclose less informative statements(Piotroski, 2003 ; Leuz, 2004). On the contrary firms with no future growth opportunities publish high quality financial statements in order to mitigate information asymmetry. (LaFond and Watts ,2008) .

Researches regarding voluntary disclosure have focused on the role of information on capital markets (Healy and Palepu, 2001). Managers usually make a counterbalance between complete disclosing of financial information regarding future performance of the firm and debt covenant and corporate governance information. Managers temp to decrease the level of information asymmetry between inside and outside stakeholders and thus reduce the cost of capital associated with the firm. Diamond and Verrecchia, 1991 ; Botosan and Plumlee, 2002). disclosure quality of IPOs and concluded that six months before the initial public offering the level of disclosure quality increases(Lang and Lundholm ,2000).

One of the most important incentives of managers regarding voluntary disclosure is compensation in the form of stock options. Managers attempt to show the real value of stock on hand as compensation through high quality disclosure(Healy and Palepu , 2001) Although this phenomenon can be seen from Hyper hypothesis as well which states managers can lure the market through false

but high quality information regarding future prospect of the firm which in fact manipulates investors. firms disclose high quality information only when their performance is desirable(Jiao 2011 ; Lang and Lundholm, 1993). Risk of stock and information asymmetry is mitigated in firms with acceptable disclosure quality (Graham et al, 2005). Another research depicted positive and significant relationship between some aspects of voluntary disclosure quality and anticipated future cash flow(Plumlee et al, 2010). Also firms with powerful CEOs depict a better performance although combined with high fluctuation in the level of performance (Wu et al, 2011).

The quality of financial reporting is highly and positively correlated with firm size and liquidity of its stock (Kadlec and McConnell 1994) . Big and mature firms try to depict a better picture of firm in financial markets by disclosing adequate information (Chang et all 2006). Also firms with low stock liquidity have incentive to reinforce their disclosure quality partly to gain investors' trust in firm and consequently increase their stock liquidity. Firms which improved their disclosure quality were better valued by market the next year, this reaction by market has made small firms which were recently listed to publish and disclose high quality information in order to signal improvements in future performance (Bushee, and Miller 2007). In many cases it is assumed that the quantity of information provided by disclosure shows quality of it. However the term disclosure quality and transparency of accounting information system are used as substitute and therefore offer precise definition of transparency and quality are difficult. In this regard descriptions such as: adequacy, comprehensiveness, informativeness and timeliness of disclosure are used as the representative of disclosure quality (Wallace et al, 1994). Albeit the quality refers to completeness, accuracy and reliability (Singhavi and Desai, 1971) . Meanwhile many researchers believed that accuracy of information depicts its quality (Zhang, 2005).

Two basic approaches for measuring disclosure quality have evolved within the academic literature. The first involves direct disclosure scoring by the researcher based on a self-developed disclosure index. Examples constitute Wiseman (1982) and Botosan (1997). The second involves the use of external ratings of disclosure such as those published in TSE. This study is based on the second approach, although each method has its own advantages and disadvantages. Subjective judgment by researcher's disclosure index could be named as a disadvantage of the first approach. As such, the index may not fully reflect the views of relevant user groups such as investors, creditors or financial analysts; On the other hand its advantage is due to its Applicability to a broad cross section of firms and not being restricted to those firms covered by the external agency. (Artiach and Clarkson, 2011).

Firms dealing with financial crisis in its early stages tend to increase the level of disclosure however this upward trend declines in following years (Webb and Cohen 2007). Management's temptation regarding disclosure increment may have two alternative logics. First from ethics point of view the manager regardless of market reaction discloses complete and relevant financial information, the second point of view relates to economical attributes which believes had the financial indexes of firm indicate a bad situation, the manager would increase the level of disclosure partly to decrease cost of capital and to avoid non accurate valuation by market participants. With reference to academic literature it is anticipated the demand for information increases when firms encounter financial crisis and that disclosure improvements can modify some costs such as covenant, capital and debt. Contrary view, managers avoid disclosure increment due to its direct and indirect aftermaths (Graham et al, 2005).

The first formal study in bankruptcy field was performed by Altman in 1968. He used five variables and achieved 95% accuracy for a year prior to bankruptcy and 83% for two years before bankruptcy. He modified his Multivariate Discriminant Analysis formula by replacing book value of owners' equity instead of its market value which is depicted. In addition, Using Logit algorithms and four variables investigated bankrupted firms between 1967 and 1970 and reached 85.1% accuracy (Ohlson, 1980).

He used Probit algorithm to study bankrupted firms(Zmijewski, 1984). Variables were not theoretically chosen but were rather based on his previous studies and experiences. Forty bankrupt and 800 non bankrupt firms were his statistical population. previous studies and their findings were not suitable for Japanese manufacturing industry, thus he proposed a new model appropriate for all manufacturing, business and service industries which resulted in 86% prediction accuracy(Shirata ,1998). These Parametric statistical methods have some restrictive assumptions such as the linearity, normality and independence among predictor or input variables Considering that the violation of these assumptions for independent variables frequently occurs with financial data (Deakin,1976), however Artificial Neural Network (ANN) became widely popular from early 90s (Back et al 1996). Since then many studies compare the prediction accuracy of ANNs and statistical models. Artificial neural networks have capability of including all variables in bankruptcy prediction due to nonexistence of statistical constraints such as normality and independence of variables (Back et al, 1996; shin and lee, 2002; Wilson and Sharda, 1994). While traditional statistical methods assume certain data distributions and focus on optimizing the likelihood of correct classification (Liang et al, 1990), inductive learning is a technology that automatically extracts knowledge from training samples. Hence the difference between a statistical approach and an inductive learning approach is that different assumptions and algorithms are used to generate knowledge structures Research hypothesis (Shin and Lee, 2002). Artificial intelligence models have the ability to use all the variables to predict by limiting the release of certain statistical assumptions such as linearity, normality and independence of predictor variables (Davalos et al, 2009) .

According to bankruptcy literature and the importance of disclosure in business realm, the problem this research seeks to embark is whether disclosure quality can be considered as a useful variable in bankruptcy prediction. Another aim of this study is to assess prediction accuracy of bankruptcy models by including disclosure quality as a predictor variable in those models, thus the followings are the research hypothesis:

- H1:** the accuracy of Altman's model would improve by including disclosure quality as a predictor variable.
- H2:** the accuracy of Ohlson's model would improve by including disclosure quality as a predictor variable.
- H3:** the accuracy of Zmijewski's model would improve by including disclosure quality as a predictor variable.

3-Research methodology

In order to evaluate the research hypothesis, the predictor variables used by Altman (1968), Ohlson (1980) and Zmijewski (1984), are separately assessed in bankruptcy prediction using Genetic algorithm. Table 1, shows all variables are used in this research. The next step would be running the algorithm again except this time the disclosure quality is also included in prediction procedure as a predictor variable. Finally a comparison is made between the accuracy of genetic model before and after the second phase. The information used in this survey is gathered from audited financial statements and Tehran Stock Exchange data bank between 2004 and 2009. The total population summed to 3476 firm-years in desired period where only 94 firm-years were considered bankrupt due to Article 141 of commercial codes of Iran which states "had the cumulative losses of a firm reaches at least half of the firms legal capital, the board is responsible for holding an extraordinary general meeting of shareholders, deciding between liquidation and survival". Based on the principals of sampling in limited population, the minimum required sample data is 40 firm/years. Those companies which had a change in their fiscal year along with financial institutions and banks were excluded from statistical population. These constraints combined with lack of relevant market data reduced our

bankrupt sample to 45 firm-years. Then 45 non bankrupt firm-years were randomly selected in desired period.

3 -1: Measuring disclosure quality and setting bankruptcy criterion

TSE gauges disclosure quality (DISQ) of listed firms according to their reliability and relevance, the results which are published annually are finally summarized as a score and are assigned to each firm. One of the fundamental attributes of relevance is timeliness, an influencing factor on firm's score to

Table1: variables

model	variable	Description
Altman		
	X1	Net working capital/total assets
	X2	retained earnings/total assets
	X3	earnings before interest and taxes/total assets
	X4	Market value of equity/book value of total liabilities
	X5	Sales/total assets
Ohlson		
	TLTA	Total liabilities divided by total assets
	WCTA	Working capital divided by total assets
	CLCA	Current liabilities divided by current assets
	OENEG	1 If total liabilities exceed total assets, 0 otherwise
	NITA	Net income divided by total assets
	FUTL	operating cash flow divided by total liabilities
	INTWO	1 If net income was negative for the last 2 years, 0 otherwise $(NI_t - NI_{t-1}) / (NI_t + NI_{t-1})$ where NI_t is net income for the most recent period
	CHIN	period
Zmijewski		
	NITL	Net income divided / total liabilities.
	TLTA	Total liabilities divided / total assets.
	CACL	Current assets divided / current liabilities

Forecast of return on stock, quarterly financial statements, portfolio condition, dividend payout schedule and etc. reliability points to standard deviation of financial forecasts and the difference between actual results and budget statements sent to TSE. Bankruptcy criterion is based on article 141 of commercial codes of Iran, information related to bankrupt firms are gathered one year prior to actual bankruptcy.

3-2: Bankruptcy prediction model based on genetic algorithm

GA works as a stochastic search technique to find an optimal solution to a given problem from a large number of solutions. The searching procedure in these algorithms takes place in four methods: initialization, selection, crossover and mutation (Davis 1991; Holland, 1975). In order to release of statistical constraints such as normality and independence of predicting variables, the model used in this research is based on Genetic Algorithm. The model presented in this paper provides an if-then rule; each rule is associated with a chromosome consisting of N genes. Each gene has three fields:

$C_i (gene1(X1, Le1, V1), gene2(X2, Le2, V2), \dots, geneN(Xn, Len, Vn))$

Where

X_i : variable, Le_i : logical equation, V_i : value, Q_i : quality

Logical equation is simply "<" or ">" related to cut-off point, value is the cut-off point for each variable determined by the rule. The purpose of GA is to find optimal solutions in order to maximize bankruptcy prediction accuracy. Hence Carvalho's (2002) optimization model is used here:

$$\text{Accuracy} = \frac{(tp + tn)}{N(\text{Size of population})}$$

Tp is the total number of non-bankrupt firms where the algorithm predicted non-bankrupt, tn is the total number of bankrupt firms where algorithm predicted correctly. N is the total number of predictions.

4- Empirical results

The variables used in this survey are gathered from bankruptcy literature. The descriptive statistics are demonstrated in table 2. The t-test between bankrupt and non-bankrupt firms is executed and the results are also shown in table 1. The findings suggests a meaningful discrepancy between Altman's variables X_1 , X_3 ; TLTA, NITA, FUTL and INTWO from Ohlson's model; and NITL and TLTA from Zmijewski's model between two groups. In addition variable DISQ which represents a proxy for disclosure quality has a meaningful discrepancy between two groups, thus the disclosure quality is lower in bankrupt firms comparing to non-bankrupt ones.

Table 3 shows the results from running the algorithm with and without disclosure quality Using Altman's variables. In this model, the prediction reached 90.78 accuracy while including DISQ increased prediction accuracy and made it 93.7%. After determining the model accuracy it's necessary to compare the accuracy of algorithm with and without disclosure quality. In order to accept or reject research hypothesis, hence T- test is used to test the difference between two algorithms. Had the statistical significance reaches above 5%, ergo the first hypothesis is accepted. Also the algorithm reached 91.19% accuracy via Ohlson's variables while including disclosure quality as a predictor variable in the algorithm improved prediction accuracy and reached 95.8%, thus according to t-test result, the second hypothesis is accepted. In addition, the prediction accuracy of GA using Zmijewski's variables before and after entering DISQ is 90.78 and 94.15 respectively, therefore under t-test result making the third hypothesis accepted. According to findings presented in table 3, GA model with

Ohlson's variables reached the highest accuracy before and after including DISQ, plus Type I error is reduced in all three algorithms after including DISQ as a predictor variable in the GA.

5-Conclusion

The importance of financial reporting and disclosure in capital markets has been investigated in many researches; however the role of disclosure quality in bankruptcy prediction realm is a controversial matter which is investigated in this study. The aim of this research is to compare the prediction accuracy of Genetic Algorithm before and after including disclosure quality as a predictor variable along with well-known variables in literature. The findings suggest an increment in bankruptcy predictions accuracy by including DISQ. In addition bankrupt firms had lower disclosure quality compared to non-bankrupt firms; the reason might be related to direct and indirect costs facing management by increasing the level of disclosure and its quality. Thus this variable can be considered as a useful and complementary variable in bankruptcy prediction. This survey has some constraints in practice since determining a benchmark in order to segregate bankrupt firms from non-bankrupt ones is related to Article 141 of commercial codes of Iran.

Table 2: descriptive statistic

Row	variable	firms	Mean	Std. Deviation	t -statistic	significance of t- test
1	X1	health	0.07	0.16	1.775	0.079
		bankrupt	0.00	0.19		
2	X2	health	0.15	0.12	8.327	.00
		bankrupt	-0.01	0.06		
3	X3	health	0.22	0.14	7.365	.00
		bankrupt	0.05	0.06		
4	X4	health	0.44	0.46	-1.199	0.2
		bankrupt	0.60	0.76		
5	X5	health	0.92	0.48	1.806	0.07
		bankrupt	0.77	0.34		
6	TLTA	health	0.60	0.21	-6.557	.00
		bankrupt	0.82	0.09		
7	WCTA	health	0.07	0.16	1.775	0.07
		bankrupt	0.00	0.19		
8	CLCA	health	0.94	0.29	-1.694	0.09
		bankrupt	1.08	0.45		
9	OENEG	health	0.00	0.00	-	-
		bankrupt	0.00	0.00		
10	NITA	non bankrupt	0.18	0.13	8.76	.00
		bankrupt	0.00	0.05		
11	FUTL	health	0.29	0.31	5.362	.00
		bankrupt	-0.02	0.24		
12	INTWO	health	0.00	0.00	-7.091	.00
		bankrupt	0.53	0.51		
13	CHIN	health	0.17	0.25	0.948	0.34
		bankrupt	0.12	0.18		
14	NITL	health	0.40	0.42	6.463	.00
		bankrupt	0.00	0.07		
15	TLTA	health	0.60	0.21	-6.557	.00
		bankrupt	0.82	0.09		
16	CACL	health	1.15	0.34	1.645	0.1
		bankrupt	1.03	0.32		
17	DISQ	health	55.81	23.42	7.53	.00
		bankrupt	23.30	17.05		

Table 3:Independent-Sample T-test Results

H1	Ave accuracy	Error Type I
Altman model variables	90.78	7.70
Altman model variables with DISQ	93.70	7.63
T-test statistics	-9.35	0.12
Sig. (2-tailed)	0.00	0.90
H2	Ave accuracy	Error Type I
Ohlson model variables	91.19	17.63
Ohson model variables with DISQ	95.85	8.00
T-test statistics	-9.24	9.40
Sig. (2-tailed)	0.00	0.00
H2	Ave accuracy	Error Type I
Zmijeswski Model variables	90.78	18.07
Zmijeswski Model variables with DISQ	94.15	6.30
T-test statistics	-19.00	25.48
Sig. (2-tailed)	0.00	0.00

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