

# A study of the relationship between corporate governance features and bankruptcy by using survival analysis

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## Abstract

The present paper examines the effect of the internal mechanisms of corporate governance (CG) on the firm's bankruptcy. For this purpose, a sample of 76 firms enlisted in Tehran Stock Exchange (TSE) during a 9-year period (2001-2009) was selected and examined. Cox regression was used to test the hypotheses. The criteria used for the CG system mechanisms include: board size, CEO replacement and CEO dual position. Control variables include: firm size, profitability, interest coverage ratio, liquidity, financial risk and operating risk. The results indicate that there is a significant relationship between CEO replacement and bankruptcy but no significant association was observed between board size and CEO dual position with the bankruptcy.

**Keywords:** CG, Bankruptcy, Longitudinal data, Cox Regression

## Introduction

CG consists of a set of relationships between shareholders, managers and auditors of a firm which ensures the establishment of a control system in order to protect the retail shareholders' rights and exact implementation of the assembly's resolutions and preventing potential abuses. This law, which is based on accountability system and social responsibility, is a set of duties and responsibilities which should be performed by the firm's constitutions in order to lead to accountability and transparency. In the past, the CG focused on firm's leadership rather than its control; but today this has found broader dimensions and includes control, too.

Currently, enterprises are acting in a highly variable and competitive environment. Rapid and correct response to the highly variable market conditions has a great role in the enterprises' position.

With the development of monetary and financial markets and consequently, the dominance of a competitive situation, many bankrupt firms are excluded from competition. This brings concern for capital owners who look for methods to predict financial crises of the firm in order to prevent the loss of their capital principle and interest. Financial crisis, and ultimately, the bankruptcy of the enterprises can lead to huge losses in both micro and macro levels (Purheidari and Koopaei 2010). Financial crisis in Mexico 1994, unprecedented *financial crisis in East Asia* 1997, in Brazil and the liberated Russian economy in 1998, and Argentine's disastrous crisis, Enron crisis in U.S. and housing crisis 2005, and the major financial crisis in 230 years of American history in 2008, all indicate the renewal and stability of crises (Iravani 2009). Due to some factors such as the recent wave of scandals in joint stock companies such as Adelphia, Enron and WorldCom in the U.S. Congress, Marconi in England, and Royal Ahold in Netherlands, the firm leadership system has become the focus of market activists. The above scandals clearly point to the necessity of improvement in firm leadership system mechanisms and increased accounting transparency (Abdullah 2006).

On the other hand, with the expansion of firms and financial institutes, the danger of the separation of ownership from management is felt which can lead to financial crisis. In fact, with the formation of a delegation relationship, the conflict of interest occurs between managers and shareholders. That is, managers may act opportunistically, taking decisions in their own interests and in the shareholders' conflict of interests. The need of CG (firm leadership system) is raised from the conflict of interest (Mehrani, *et al* 2010).

CG is created to provide for the possibility of control and balance between managers and shareholders' interests and as a result, reduced delegation contrast. Thus,

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firms with better CG quality should have less delegation contrast (Iazadinia and Rassaeian 2010). CG aligns the goals of various groups and tries to prevent financial distress (FD) and create value. In fact, the CG mechanisms are an instrument to protect the shareholders' interests against financial crises and fluctuations.

## Statement of Problem

### *Relationship between CG Features and Financial Crises*

Theoretical link between CG and financial crises is rooted in organizational theory literature from which it is inferred that organizations often change CG and board structure when they have descending trend and/or face financial crises. It is believed that the board has a major role in CG especially in monitoring the top-level management's performance. The board has the power to employ and expel the employees and also to determine the salaries of top-level managers and to remove the conflict of interests between managers and shareholders (Purzamani 2007).

## Board Members' Independence

The level of the board of directors' independence is usually measured in one of two ways: through the number of directors and simultaneous occupation/non occupation of two organizational positions by the CEO, that is, whether both positions of chairperson and CEO are simultaneously occupied by the same person or not.

### A. CEO's dual position

In delegation theory, the CEO and chairperson positions should be totally separated in order to increase the board's control and supervision in the firm. Assigning the position of chairperson and CEO to two different persons leads to reduced CEO power in the entire complex and increased power of the board to perform its supervision tasks at the best. That is, the board will be free to examine and evaluate the CEO's performance which has a positive effect on corporate performance.

### B. Board size

The theoretical literature provides two contrasting views on the role of board size on its autonomy. The first states that a large board leads to delegation problems because some directors may act as disinterested individuals and also control and supervision over the CEO would not be efficient. The second view states that a smaller board is deprived of the advantages and benefits of specialized and various advantages, ideas and suggestions. A small board may be easily controlled by the CEO while a larger one would be more difficult to control.

## CEO Replacement

CG legislators have concluded that CEO is influential on the board as a source of executive power.

The successive crisis theory suggests that CEO replacement leads to disorders in firm's business because it weakens the organizational spirit and increases the uncertainty and conflict. This is indeed an early warning of the potential financial crisis (Purzamani 2007).

## Research Background

### *Domestic Studies*

Hasas Yeganeh (2005) states that with the shareholders being more active, the management will be better supervised and delegation problems decrease.

Purzamani (2007) in a study of CG and bankruptcy prediction, examined the realization of status quo ownership structure and the CG theory in Iran. Logit regression analysis showed no significance relationship between ownership structure, board's feature and audit's opinion with the possibility of financial crisis found.

### *International Studies*

Brancho, Fernando and Alexandro (Abdullah 2006) examined the relationship between CG and bankruptcy with regard to the debts amounts. The results show that better CG firms have lower cost of debt and higher credit while more supervision and enforcing more strict laws on bankruptcy has a positive effect on the debts amounts.

Chang (2009) examining the relationship between CG features in financially distressed Thai firms concluded that firms with independent boards (having above two percent non-bound board members) are affected by crisis and FD less than those with low percentages of non-bound directors. Also the results show a positive link between board size and FD.

Parker *et al.* (2002) examined the relationship between CG and bankruptcy prediction using survival analysis. They explored how the CG features (creditors' partnership, board size, and CEO replacement) affected the prediction of financial crises. Survival analysis techniques including C.P.H<sup>1</sup> regression was used to study the firm's evolutionary route over time. The results showed that detained firms with CEO replacement experienced bankruptcy twice as much other firms. Also, there is no significant relationship between the proxy of creditors' intervention and partnership and the changes in the combination and size of the board with bankruptcy.

<sup>1</sup>Cox Proportional Hazards

Chitnumra *et al.* (2002) examined the relationship between CG and restructuring after bankruptcy using a sample of 111 Thai firms (public and private) based on delegation theory, exploring the associations between ownership centralization, rewards in cash paid to the employees by liquidator, number of planning directors outside the board and the number of liquidators outside the board with the firm's performance after bankruptcy using OLS regression for hypothesis testing. The results showed that *supervision* and *management incentive* affected the firm's performance after bankruptcy. Also the type of the firm (public/private) was a significant factor in this respect. In addition, both supervision and incentive led to reduced delegation costs and management transformation by the board led to increased shareholder's motivation and maximized their efficiency; but no significant relationship was found between the outside directors' variables.

Marzuki jun (2005) examined the relationship between CG and bankruptcy in Malaysia using the following hypotheses:

1. Do CG features influence the bankruptcy probability?

2. To what extent do financial indices (profitability, liquidity, financial leverage) affect the bankruptcy probability?

Using CG variables including board combination, ownership structure and leadership structure and comparing healthy and unhealthy firms and using logistic and binary regression, she found no significant link between CG features and bankruptcy in Malaysia. She found a difference between profitability and liquidity ratios and that unhealthy firms had less profitability and liquidity than healthy ones.

$$\text{Bankruptcy} = b_1 \text{ CEO Replacement} + b_2 \text{ CEO's Dual Position} + b_3 \text{ Board Size} + b_4 \text{ Operating Risk} + b_5 \text{ Financial Risk} + b_6 \text{ Profitability} + b_7 \text{ Liquidity} + b_8 \text{ Firm Size} + b_9 \text{ Interest Coverage Ratio} + \varepsilon \quad (1)$$

In this model, the dependent variable is Bankruptcy. Firms whose accumulated loss is at least more than 50% of their capital are considered as bankrupt assigned the code 1; otherwise (healthy firms) are assigned the code zero.

Independent variables are:

CEO Replacement: is the same as the CEO's tenure which is the number of the years the CEO occupies this position.

Board Size: logarithm of the number of directors

CEO's Dual Position: refers to the case when the tasks of CEO and chairperson are both assigned to the same person code 1, otherwise zero.

Control variables (accounting indices) are as follows:

## Research Hypotheses

Given the background and exploratory studies, it is hypothesized that:

H1. There is a significant relationship between CEO replacement and bankruptcy.

H2. There is a significant relationship between board size and bankruptcy.

H3. There is a significant relationship between CEO's dual position and bankruptcy.

## Research Methodology

The present paper uses survival analysis method along with longitudinal data. The survival analysis studies the time period before an event occurs or the time interval between events. This model uses the survival time or risk rate as dependent variable. In bankruptcy case, the goal is to quantify the relationship between survival time and a set of explanatory variables. The risk set and risk rate are two main concepts of this model. Risk set includes individuals subject to risk and endangered by the incidence of an event in any given time period. In a discrete model, the risk rate, also known as failure rate, calculates the probability of an event at a given time for a specific entity, assuming that that entity is subject to risk in that period. This definition is not valid for a continuous model because the probability of an event occurring exactly at a specific time is extremely small. Various models have been presented for survival analysis the most common of which is that developed by Cox in 1972 (Alikhani 2006).

The model's overall form is as follows:

Financial risk: Current liabilities / Current assets  
Interest coverage ratio: Earnings before interest and tax (EBIT) / Total interest

Operating risk: Total assets / Total sales

Firm size: Logarithm of total assets

Liquidity: Current assets / Current liabilities

Profitability index: Earnings before interest and tax (EBIT) / Sales

$\varepsilon$ : value of the error term in the regression model

## Research Scope

Given the importance of the issue, the time, place and subject scopes of the research are as follows:

Temporal scope: a 9-year period between 2001 and 2009.

Spatial scope: firms enlisted in TSE

Subject scope: effect of some CG features including board size, CEO replacement and CEO's dual position on bankruptcy using survival analysis.

### Population and Sample

The population includes all firms enlisted in TSE during a 9-year period (2001–2009). Systematic elimination was applied for sampling. Firms whose fiscal years not ending March 20 were excluded; then banks and investment firms were excluded because of different natures of their activities. Finally, marginal observations (first and 99<sup>th</sup> percentiles of all observations) were eliminated. Also, in this stage, firms which did not have available information for the study period were eliminated. Thus, only 76 firms were included in the sample for models estimation and hypothesis testing.

**Table 1. Descriptive statistics about the firms**

Industry code	Industry type	Number of the firms in the sample
1	Vehicles and parts manufacturing	5
2	Manufacturing radio, television, and communication devices	2
3	Metal products	5
4	Other Non-metallic products	6
5	Cement, lime, chalk	8
6	Essential metals	6
7	Tile and ceramics	5
8	Rubber and plastic	6
9	Machinery and equipment	3
10	Electrical machinery and devices	1
11	Chemicals	5
12	Food products except sugar	7
13	Textile	2
14	Pharmaceuticals	7
15	Other industries	8
Total		76

### Data Collection

The financial statements presented to the TSE and other relevant information sources such as TADBIR PARDAZ and RAHAVARD NOVIN data banks were used for data collection.

### Data Analysis

Survival time is a non-negative random variable which cannot be examined by standard statistical methods because of its two specific features. First, real survival time can be more than study period and cannot be measured completely. Also in many clinical studies, the participants exit the study before it has completed. Such incomplete data are referred to as *censored data*. For the same reason using ordinary statistical methods is not efficient in survival time.

Second, this variable follows the skewed distribution rather than normal (Parker *et al* 2002). This is why Cox regression is applied herein.

After data preparation in Excel software, they were analyzed by SPSS ver.18.

### Bankruptcy Modeling

#### Model's Fit

Cox relative risk model was used as follows in order to indicate the effect of CG features on bankruptcy time.

$$\frac{h(t)}{h_0(t)} = \text{Exp}\{b_1x_1 + b_2x_2 + \dots + b_px_p\} \quad (2)$$

where  $h(t)$  is the risk rate indicating the probability of bankruptcy if not happened yet;  $h_0(t)$  is the baseline risk rate, determined when independent variables are zero. In fact, the risk rate equals the product of an exponential figure multiplied by  $h_0(t)$  function, which depends on regression factors and independent variables.

$$h(t) = h_0(t) \exp\{b_1x_1 + b_2x_2 + \dots + b_px_p\} \quad (3)$$

#### Model's Significance Test

Given the values (Chi-square=115.119 and Sig.=0.000) it is observed that the test statistic is in H0 rejection area. Thus, there is at least one influential variable and there is no reason to reject the entire model's significance.

The regressive method has been used in modeling that is, first all variables enter the model and then, insignificant ones exit thereof in various steps. This model forms three steps. Step one is as follows:

$$\frac{h(t)}{h_0(t)} = \text{liquidity } b_1 + \text{financial risk } b_2 \quad (4)$$

Results of the primary fit of Cox model show that only liquidity and financial risk variable are present in the model (sig<0.05) which will be final if possessing other conditions of Cox model.

**Table 2. Model significance test results Omnibus Tests of Model Coefficients<sup>a,b</sup>**

-2 Log Likelihood	Overall (score)			Change From Previous Step			Change From Previous Block		
	Chi-square	df	Sig.	Chi-square	Df	Sig.	Chi-square	Df	Sig.
368.140	115.199	9	.000	46.170	9	.000	46.170	9	.000

**Table 3. Results of the first step**

	B	SE	Wald	df	Sig.	Exp(B)
CEO's dual position	0.227	0.607	0.139	1.000	0.709	1.254
CEO replacement	0.230	0.122	3.532	1.000	0.060	1.258
Liquidity	-1.353	0.499	7.359	1.000	0.007	0.258
Operating risk	0.092	0.103	0.791	1.000	0.374	1.096
Interest coverage ratio	-0.001	0.001	0.495	1.000	0.482	0.999
Profitability	-0.009	0.045	0.041	1.000	0.840	0.991
Firm size	-0.104	0.131	0.630	1.000	0.427	0.901
Board size	-1.506	2.512	0.359	1.000	0.549	0.222
Financial risk	0.363	0.102	12.554	1.000	0.000	1.438

### Model Assumptions Control

#### Risks Proportionality Assumption

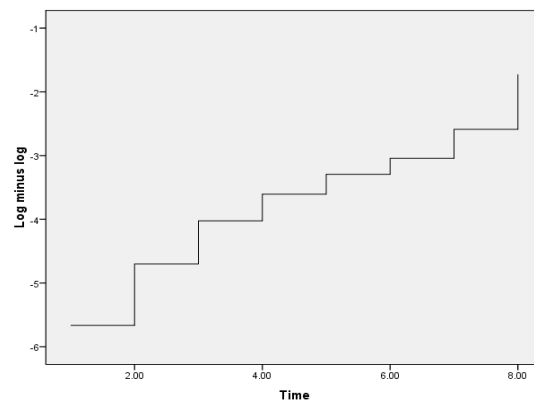
Since establishing the risks proportionality assumption is one of the most important fit assumptions of Cox model, the commonest way to verify it is the graphical method. Fig.1 and parallel lines illustrates the proportionality of the risks.

#### Marginal Data

The figure below indicates the dispersion of deviation residuals for Cox model. Given the form of the observations, three data are marginal.

#### Influential Data Detection

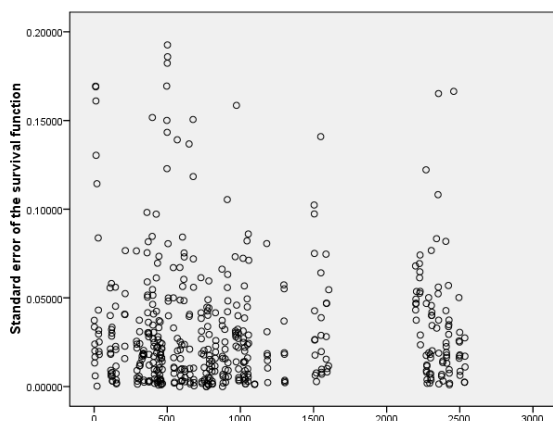
Fig.3 illustrates delta-beta graph for Cox model. It is clear that exclusion of marginal data changes the regression factor.



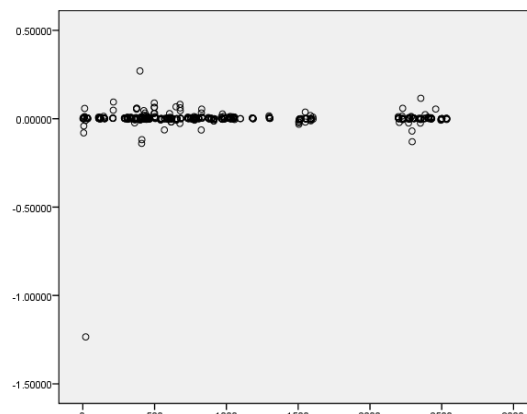
**Figure 1. Risks Proportionality Verification**

#### Finalized Model

Excluding the marginal data, the model is finalized as follows.  $\frac{h(t)}{h_0(t)} = b_1 \text{ CEO replacement} + b_2 \text{ liquidity} + b_3 \text{ profitability}$



**Figure 2. Deviation residuals**



**Figure 3. Delta-beta graph for influential data detection**

**Table 4. Final step information**

	B	SE	Wald	Df	Sig.	Exp (B)
CEO's dual position	0.159	0.622	0.065	1.000	0.799	1.172
CEO replacement	0.285	0.122	5.466	1.000	0.019	1.330
Liquidity	-1.634	0.613	7.095	1.000	0.008	0.195
Operating risk	0.129	0.164	0.614	1.000	0.433	1.138
Interest coverage ratio	-0.019	0.011	3.298	1.000	0.069	0.981
Profitability	-1.500	0.477	9.891	1.000	0.002	0.223
Firm size	0.116	0.147	0.623	1.000	0.430	1.123
Board size	-1.289	2.504	0.265	1.000	0.607	0.276
Financial risk	0.194	0.289	0.448	1.000	0.503	1.214

$$\frac{h(t)}{h.(t)} = 0.285 \text{ CEO replacement} - 1.613 \text{ liquidity} - 1.5 \text{ profitability}$$

The results of final fit of Cox model (Table 4) indicate that only CEO replacement, liquidity and profitability variables are present in the model (sig<0.05). Model coefficients show that by increasing the CEO replacement variable, the bankruptcy risk increases; and by increasing the liquidity and profitability, the risk of bankruptcy decreases. The relative risk>1 shows that by increasing the independent variable, the bankruptcy risk increases and relative risk <1 shows that by increasing the independent variable the bankruptcy risk decreases. For instance, the relative risk of CEO replacement is 1.330 which indicates that for each unit increase in this value, the bankruptcy risk will increase by 33.0%.

## Conclusions

In the first hypothesis, by examining the relationship between CEO replacement and bankruptcy, the results indicated a significant relationship which supports H1. Positive relationship existing between the aforesaid variables (CEO replacement and bankruptcy) indicates that firms experiencing CEO replacement successively are subject to bankruptcy more than others.

H2 verified the relationship between board size and bankruptcy. The results indicate that there is no significant relationship, thus H2 is rejected.

H3 verified the relationship between CEO's dual position and bankruptcy which the model estimations show an insignificant relationship thus rejecting H3 as well.

## Suggestions for further research

It is suggested that for a further use of the results herein and also to help clarify the relationship between CG mechanisms and FD in the future, the followings should be taken into consideration.

Examining the effect of macroeconomic variables on the relationship between CG mechanisms and FD

Examining and testing the relationships between CG mechanisms and FD using other models of FD determination

Replicating the present study using the time intervals and examining the effect of increased intervals on improved model prediction

Given the relatively high level of oscillations in economic, cultural and political factors affecting the firms in our country, it is suggested that future studies use a non-linear regression in determining the relationship between CG mechanisms and FD.

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