Predicting the Risk of Financial Distress using Corporate Governance Measures

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Abstract

Corporate governance is an important determinant of enterprise performance. Poor corporate governance can damage the interests of shareholders, and may lead to company collapse. This paper expands the literature on financial risk management by assessing the effectiveness of aspects of corporate governance for predicting financial distress in a dynamic discrete-time survival analysis model. It is the most comprehensive and thorough study to date, using a large selection of corporate governance measures, financial ratios and macroeconomic variables in a panel data structure over a ten-year period. Furthermore, the paper addresses the association of government ownership with the risk of financial distress in the largest emerging market in the world - China. The results suggest that although corporate governance alone is not sufficient to accurately predict financial distress, it adds to predictive power of financial ratios and macroeconomic factors. In addition, the model provides insights into the role of state ownership, independent directors and some personal characteristics of the Chair/CEO.

Keywords: Corporate Governance; Credit Risk; Financial Risk Management; Financial Distress; Ownership

JEL classification: G32, G33, G34, G21, C25, C41

1. Introduction

Predicting corporate bankruptcy or financial distress has been a vibrant topic in banking, business and finance because of its importance to creditors such as banks. For corporate debtors, management quality is a key factor in their performance. Firm's bankruptcy or financial performance will affect the investment and debt repayment, and therefore, needs to be predicted. It is not surprising that this topic has received a lot of attention in academic and practical work, for example Altman (2005). Risk-taking decisions of creditors will depend on their ability to analyze or predict the risk involved. There is a vast body of literature on bankruptcy prediction models that can be classified into accounting based models using financial ratios (e.g. Altman (1968) and Bonfim (2009)) and market based models using share prices (e.g. Milne (2014) and Campbell, Hilscher, and Szilagyi (2008)) respectively. Corporate governance measures are less common in bankruptcy prediction literature as they are not hard information like financial ratios but soft information, although behaviors such as default on debt, financial distress and bankruptcy have been found to be linked to corporate governance (see e.g. Daily, Dalton, and Cannella (2003)). The research that aims to understand the role of corporate governance and subsequent company performance is summarized in the next section of this paper. However, we would like to take a different perspective of risk management and in addition to determining measures of corporate governance that are statistically significant in explaining the financial distress (which is the main focus of previous studies), we instead assess their predictive value rather than testing hypotheses. We also take into account the findings from Shumway (2001) and Campbell, Hilscher, and Szilagyi (2008) who argue that cross-sectional static models miss important details in structures that can vary across time. Therefore, this paper applies a dynamic prediction model to assess the relationships between various corporate governance measures and distress risk. It is the most comprehensive and thorough study to date, using a large selection of corporate governance variables in a panel data structure over a ten-year period. Furthermore,

this paper addresses the association of government ownership with the risk of financial distress in the largest emerging market in the world. Since the data covers the period of the recent global financial crisis and we incorporate macroeconomic variables, it is believed that the established statistical relationships are robust over very different macroeconomic conditions, which is required by the Basel Accords for risk management (BCBS 2011). In this way, we go beyond very few studies that used the dynamic approach to explore the role of a limited number of corporate governance measures in modelling financial distress (Wilson, Wright, and Scholes 2013, Wilson, Wright, and Altanlar 2014).

We find that aspects of board composition, ownership structure, management compensation and personal characteristics can impact on the risk of financial distress of a company and so can be used to predict it. However, we establish that using corporate governance measures alone does not lead to sufficiently accurate predictions. If, however, they are assisted by financial ratios, models can generate satisfactory predictions in advance. The best predictive model combines corporate governance measures, financial ratios and macroeconomic factors.

This paper adds to the literature on corporate governance in three ways. First, we link corporate governance to risk management and examine the role and predictive power of a list of corporate governance measures from a different perspective of many previous governance studies. In the credit risk management paradigm, we focus on the predictive power rather than causality. Our business failure prediction model captures not only the symptoms but also the causes of business distress/failure rooted in the governance, so predicting more accurately. Second, we expand the empirical analysis into a new dimension - 35 governance variables in four groups and 1688 companies over 10 years, which indicates robustness in statistics. Basel Accord recommends that stress testing covers an economic cycle. Our data cover the recent financial crisis and the out-of-sample and out-of-time validation has been applied. Third, we built a dynamic model than which proves to be theoretically better than static models (Shumway,

2001). The governance in a company is not stationary but change over time. The dynamic model can catch the time effect.

In Section 2, the main findings from previous research on aspects of corporate governance in the prediction of bankruptcy or financial distress are reviewed. In Section 3 the econometric method including the model specification, the sample, corporate governance measures and other variables are presented. In Section 4 we present the results including the parameter estimates and predictive accuracy of four panel models. In Section 5 we discuss the empirical conclusions from our results and their implications for company owners and managers, practitioners and especially policy makers.

2. Literature review

Predicting corporate bankruptcy has a long history since Altman (1968) introduced multiple discriminant analysis to this area and various methods have been proposed to prevent potential losses for banks and detect financial crisis caused by financial risks. Although financial ratios have played a major role in the modelling, scholars such as Shumway (2001) and Bonfim (2009) keep looking for new methods and information to improve model performance. In recent years, the market price is seen as a forward looking indicator and frequently used to calculate the distance to default (Milne 2014). The influence of macroeconomic level factors on the performance of bank loan portfolios are also established (Memmel, Gündüz, and Raupach 2015) and addressed by the New Basel Accord (BCBS 2011). Credit risks at the individual level can also be assessed by soft information related to corporate governance (Daily and Dalton 1994b, Wilson, Wright, and Scholes 2013).

In this section we discuss the literature on credit management from the perspectives of board composition, ownership structure, management compensation and personal characteristics as generally corporate governance involves a set of relationships between a company's

management, its board, its shareholders and its stakeholders. It should be noted that corporate governance theories mainly relate to private companies; in State-Owned Enterprises (SOEs) the situation is likely to be different. Therefore, SOE issues are discussed separately.

2.1 Board Composition

The board of directors represent the top decision makers of a company and the CEO takes care of daily operations. In some companies the CEO and the Chair of the Board may be the same person (described as *duality*), even though their roles are very different. Daily and Dalton (1994b) studied 50 pairs of bankrupt and non-bankrupt firms in three and five year horizons and found that the interaction of CEO/Chair duality and independent directors is positively related to bankruptcy. The separation of the Chair and the CEO can reduce the risk of bankruptcy (De Maere, Jorissen, and Uhlaner 2014). On the other hand, Simpson and Gleason (1999) found duality can reduce the risk of financial distress and in a survey of boards of directors, Abdullah (2006) provided Malaysian evidence that board independence and CEO duality are not associated with financial distress status.

One can distinguish between inside directors (executive directors), grey directors (non-independent non-executive directors) and outside directors (independent directors) on the board (Hsu and Wu 2014). Some studies (Chaganti, Mahajan, and Sharma 1985, Fich and Slezak 2008, Salloum, Azoury, and Azzi 2013, Hsu and Wu 2014, Santen and Soppe 2009) have discussed the influence of various directors on corporate bankruptcy/financial distress. The role of independent or outside directors on the board has received considerable attention over many years since they are believed to strengthen the monitoring of firm performance and helpfully increase diversity. In the research of Li, Wang, and Deng (2008), independent directors turned out to be negatively associated with the probability of financial distress. Daily (1996) explained that an outside director in the negotiation process may assist the firm in “convincing creditor

groups to agree to a proposed reorganization plan prior to the formal bankruptcy filing". However, Chaganti, Mahajan, and Sharma (1985) argued that the influence of outside directors is not significant in corporate failure. Hsu and Wu (2014) even found that outside directors are unfavorable to firm survival and increase the likelihood of business failure and, instead, grey directors can do better at monitoring the board. Santen and Soppe (2009), in a case study relating to the Netherlands showed that distressed firms have a higher percentage of independent directors in general. In summary, the previous studies fail to reach a consensus on whether independent directors have a positive or negative effect on financial distress.

The effect of board size has been explored by Daily and Dalton (1994a) and Jensen (1993), who suggested that small boards are more efficient and have lower productivity costs during any coordination process. This argument was later supported by Simpson and Gleason (1999) and Santen and Soppe (2009) in their empirical results. However, in the retail sector, non-failed companies tend to have bigger boards (Chaganti, Mahajan, and Sharma 1985). Darrat et al. (2016) found a mixed effect of board size: having a larger board reduces the risk of bankruptcy for complex firms with diverse business segments but not for less diversified or single market oriented firms. In new IPO firms, Chancharat, Krishnamurti, and Tian (2012) using survival analysis found that either a small or a large board outperform those in a middle in their survival time. It seems the effect of board size is nonlinear.

2.2 Ownership structure

Ownership structure is a crucial aspect when judging corporate governance because it addresses the relationship between inside and outside investors. A great deal of research has addressed issues in ownership structure, for example the type of controller and institutional investor holding.

Lee and Yeh (2004) in a Taiwanese case suggested that a concentrated ownership environment such as family ownership will lead to a greater chance of distress. In Taiwan, family control is very common and this is also true in many other East Asian countries especially in emerging markets. Claessens, Djankov, and Lang (2000) and Salloum, Azoury, and Azzi (2013) have also addressed the issue of family control. In contrast to Lee and Yeh (2004), Wilson, Wright, and Scholes (2013) in their UK study documented that family businesses are more likely to survive than nonfamily companies. In Mainland China, family controlled companies do exist, but there is not enough information to determine whether a company is a family business or not. State control is more relevant here and will be discussed separately in Section 2.5.

In addition to the type of ownership, the role of institutional shareholders has received attention, with mixed results. Lee and Yeh (2004) and Ting, Yen, and Chiu (2008) found that institutional shareholding is lower in distressed companies than in healthy ones. This was confirmed by Campbell, Hilscher, and Szilagyi (2008), who also found distress risk to be negatively linked to institutional ownership, though Fich and Slezak (2008), Daily (1996) and Donker, Santen, and Zahir (2009) found institutional ownership has no relationship with bankruptcy. However, Liu, Uchida, and Yang (2012) found in China institutional shareholding has a nonlinear relationship to corporate performance and financial constraints.

From a deep view of how institutional shareholder participate in the board, Manzaneque, Priego and Merino (2016) found that directors appointed by pressure-resistant institutional shareholders have a negative impact on the likelihood of business failure. Institutional owners' impact on directorships can correct mistakes to prevent firms going wrong. This effect is strong particularly if they have concentrated ownership.

Apart from institutional shareholding, the shareholding of insider and block holders has also drawn academic attention. Abdullah (2006) found that outsider ownership had a negative

association with financial distress while Simpson and Gleason (1999) and Salloum, Azoury, and Azzi (2013) found no definite link between insider ownership and the probability of financial distress.

2.3 Management compensation

Salary, bonus and options are three common forms of compensation for managers. Mann (2005) investigated the relationship between CEO compensation and credit risk. He found that large, unexplained bonuses and option awards increased credit risk of a company while salary did not seem to have the same effect. He argued that executives tend to pursue short term profits rather than longer term financial benefits and have an incentive to adopt high risk business strategies.

Gilson and Vetsuypens (1993) found that in financially distressed firms a considerable number of CEOs were replaced or paid less than in normal times. Management compensation was suggested to be a potentially significant variable to predict financial distress. Li, Wang, and Deng (2008) also found that the administrative expense ratio was positively related to the likelihood of financial distress. However, using an equilibrium model, Cyert, Kang, and Kumar (2002) reported that CEO compensation including base salary, equity and discretionary compensation was negatively associated with default risk.

2.4 Personal characteristics

Santen and Soppe (2009) incorporated the personal characteristics of directors in their prediction models in six dimensions: workload, nationality, dependency, interlinked directorships, age and education. From another perspective, Wilson, Wright, and Altanlar (2014) described director characteristics from networks, proximity and involvement. Their survival model on a large dataset of six million observations provided evidence of strong links between

director characteristics and new business survival. In their data, having female board directors reduces the likelihood of insolvency because companies with female directors tend to have better cash flow and less debt. Khaw et al. (2016) added a comment that men were more likely to take excessive risks while women were more conservative.

Ruigrok, Peck, and Tacheva (2007) concluded that a foreigner on the board brought the positive influence of different perspectives, skills and knowledge on the one hand, but the negative influences of different values, norms and understanding on the other. Santen and Soppe (2009) found that a foreigner on the board would increase the probability of financial distress but the accumulated effect of these two aspects of foreign nationality remains to be fully investigated.

Educational background is likely to affect managerial performance. Higher education indicates a certain level of aptitude. Holding an MBA degree is evidence of both theoretical and practical experience in business management. D'Aveni (1990), Daily and Dalton (1994a) and Ruigrok, Peck, and Tacheva (2007) used education to partly represent the quality of a board. They agreed that business education might affect the prestige of a company but no study has yet linked education to the probability of financial distress directly.

Experience is hard to measure since it is personal and unique. Even so some results can be seen. Wilson, Wright, and Altanlar (2014) concluded that directors with previous insolvency experience or recent resignations have a higher insolvency risk while Salloum, Azoury, and Azzi (2013) found insufficient evidence to suggest that shortage of experience in terms of years served had any such effect.

For obvious reasons age is often used as a proxy for experience. Zahra and Pearce (1989) used age as one of the relevant characteristics in their study and found that it was linked to financial performance. Platt and Platt (2012) found an increase in both the CEO’s age and the average age of the board decreased the chance of bankruptcy, but Fich and Slezak (2008) found

that only the CEO's age is positively significant in one of their four bankruptcy prediction models.

2.5 State Owned Enterprises

Among the Chinese studies focused on corporate governance (e.g. Tang and Wang (2011) and Jiang, Feng, and Zhang (2012)), there are some which have addressed the issue of state ownership. Under a central planning system, for example in Mainland China, SOEs have dominated the economy in many important sectors such as banking, energy and transportation. SOEs have some inherent advantages: they do not have to fully cover expenses from sales and income; unprofitable SOEs and losses are subsidized; they receive funds from state-owned banks regardless of risks (Lin and Tan 1999). Particularly state ownership in China can mitigate financial constraints when suffering crisis (Liu, Uchida, and Yang 2012). While they reap advantages from being part of a planned economy and so rarely go bankrupt, agency theory implies that the interests of many levels of agents conflict with each other because the state is both the regulator and the manager. Khaw et al. (2016) found state controlled companies are less willing to take risk, which may lead to less chance of bankruptcy. Zeitun and Gang Tian (2007) suggested government ownership could be used as a predictor of probable default. However, their empirical results also showed that reducing government ownership could cause the bankruptcy of some companies in the short term.

Maximizing the value of shareholder benefits is the ultimate goal for most companies, and, therefore, appropriate corporate governance can ensure investors receive a return on their investment (Shleifer and Vishny 1997). Shleifer and Vishny (1997) also noticed that the agency problems in large companies in many countries were not only between investors and managers but also between outside investors and concentrated shareholders who have dominant full control over the managers. In state-owned companies where the government has large

concentrated shares, state ownership leads to problems of corruption, tax cheating and fraud (Tam 2002). Therefore, state ownership is a double-edged sword: advantages and disadvantages interact to influence firm performance. Further empirical evidence is required to establish the relationship between state ownership and financial distress.

From the above we can see that although previous research has examined the relationships between corporate governance measures and financial distress, no consensus has been reached as to whether, which and how corporate governance variables affect the chance of financial distress. Different countries have different regulatory systems of company structure, increasing the complexity of analysis. In contrast to the Chinse study by Wang and Deng (2006) which is limited to small samples, a few variables and a cross-sectional analysis, this paper reinvestigates the relationship between corporate governance measures and the risk of financial distress, with a large panel dataset of 1,688 companies over 10 years covering the recent financial crisis ensuring robustness of the modelling results. A wide range of corporate governance measures from board composition, ownership structure, management compensation and personal characteristics is represented by 35 potential predictive variables. The case of China provides an opportunity to address the issue of the role of state ownership, which has great impact on the access to finance and conflicts of agents.

3. Method and data

In terms of Econometric methodology, one can classify past studies into those that have used static cross-sectional models and those that have used survival analysis. Studies that have used cross sectional models and have include Platt and Platt (2012) who compared means of governance attributes between bankrupt and non-bankrupt companies. Zeitun and Gang Tian (2007) used linear regression to investigate the relationship between default risk and governance structure. But the majority, for example Ciampi (2015), Daily and Dalton (1994a),

Donker, Santen, and Zahir (2009), Hsu and Wu (2014), Lee and Yeh (2004), not surprisingly, have applied logistic regression which has worked well in this context.

However as noted by Shumway (2001), dynamic models such as survival analysis are superior to static models because dynamic models are able to employ multiple period data and time varying covariates (TVCs) and so enable the prediction of the probability of an event in a chosen future time period. Similar points are made by Bonfim (2009). Amendola, Restaino, and Sensini (2015) used survival analysis to predict the probability of financial distress and firm exits. In studies of corporate governance measures, De Maere, Jorissen, and Uhlaner (2014), Chancharat, Krishnamurti, and Tian (2012) and Parker, Peters, and Turetsky (2002) employ Cox Proportional Hazard models. But these studies do not make predictions and they treat time as continuous when data relating to the covariates is available only yearly and so discrete time survival modelling would be more appropriate. None of these studies relates to China.

In the literature, it is noted that generally predictive accuracy is improved by the incorporation of corporate governance measures (Fich and Slezak 2008, Lee and Yeh 2004). However, research has been inconsistent in the empirical findings or even controversial regarding whether a variable is positively or negatively, and to what degree, associated with the probability of financial distress. In a more practical way, this research considers predictive value of new corporate governance variables, in addition to reporting regression parameters. In this way the findings are more relevant for credit risk assessment (Reisz and Perlich 2007). To avoid the problem of overfitting, only the most significant and informative variables including financial ratios and macroeconomic factors are retained in the final model.

3.1 Model specification

Covariates can be time varying across multiple periods but most of them can only be observed at specific time when economic and financial reports are disclosed. In this sense, Cox

Proportional hazard model in Parker, Peters, and Turetsky (2002) may be not suitable. We follow Shumway (2001) and assume a discrete time setting in modelling. Shumway (2001) proved that parameter estimate is the same as multi-period logistic regression, which is the maximum likelihood method. Unlike Bonfim (2009) who assumed covariates act in the same period of the dependent variable, a horizon of two years in advance is applied in this research as it is more suitable for the context of prediction. The regression model uses covariates from year $t-2$ to predict whether a company is distressed in year t, marked as $d=1$. Therefore, the form of the survival model is specified as follows:

$$\text{logit}(h_{d=1}(t)) = \alpha + \beta_0^T h_0(t) + \boldsymbol{\beta}_1^T \mathbf{x}_{i,t-2}^g + \boldsymbol{\beta}_2^T \mathbf{x}_{i,t-2}^r + \boldsymbol{\beta}_3^T \mathbf{x}_{i,t-2}^m \quad , \qquad (1)$$

where t is the survival time;

$h_{d=1}(t)$ is the probability of distress at time t;

$h_0(t)$ is the baseline hazard in duration at time t and β_0 is its coefficient;

$\mathbf{x}_{i,t-2}^g$ is a column vector of corporate governance variables for company i at time $t-2$;

$\mathbf{x}_{i,t-2}^r$ is a column vector of financial ratios of predictive power;

$\mathbf{x}_{i,t-2}^m$ is a column vector of macroeconomic factors;

$\boldsymbol{\beta}_1, \boldsymbol{\beta}_2, \boldsymbol{\beta}_3$ are vectors of coefficients;

α is the constant.

It should be noted that, unlike an econometric approach, credit risk prediction models do not necessarily have to control other influences so no control variables are included in the regression equation of survival analysis. All the independent variable in Equation (1) are regarded as potentially predictive variables.

In the analytical process, first, we include four groups of corporate governance measures into the regression without any other covariates. In this way, significant corporate governance measures are identified and then enter the first prediction model (Model 1). The second model

uses financial ratios only (Model 2) and the third model combines both significant corporate governance measures and financial ratios (Model 3). Model 4 further incorporates macroeconomic factors. The predictive accuracy is assessed by Area Under the Receiver Operation Curve (AUC) (equivalent to the Gini coefficient to assess the inequality of sample distribution) which is commonly used in predictive modelling and credit risk management and ranged from 0 to 1 with higher value indicating better results (Reisz and Perlich 2007). Four groups of results of both in-sample and out-of-sample predictions are given for comparison (Table 1).

Table 1
Model specification

Model	Specification
Model 1	Survival model with corporate governance measures only
Model 2	Survival model with financial ratios only
Model 3	Survival model with governance measures and financial ratios
Model 4	Survival model with governance measures, financial ratios and macroeconomic variables.

3.2 Sample

'Special Treatment' is imposed by the regulator China Securities Regulatory Commission (CSRC) to give investors notice of potential risks. Therefore, it is an official indicator of financial distress of listed companies. A listed company can be filed in Special Treatment for any of these reasons: 1) negative net profit in the most recent two consecutive years; 2) failure to disclose its annual report; 3) likelihood of being dissolved; 4) reorganisation, settlement or bankruptcy liquidation. In over 80% of our cases, the companies in Special Treatment suffer net losses in two consecutive years. So it is a popular indicator of financial distress as in Zhang, Altman, and Yen (2010), Geng, Bose, and Chen (2015), Lin, Lo, and Wu (2016). Databases Wind and GTA provide access to annual statements including accounting and governance information. The original dataset contains 2,477 companies listed in China since 1991. Due to

the late disclosure of governance information only after 2002, the data is restricted to 2003 onwards. The final sample consists of 1,688 companies over 10 years between 2003 and 2012.

Predictions for financial distress are commonly verified in out-of-sample and out-of-time datasets (Lin, Lo, and Wu 2016, Shumway 2001). Therefore, the whole sample is randomly divided into two sub-samples in a 2:1 ratio (Sample One and Sample Two). Applying a stratified sampling strategy to both samples and distress/non-distress groups, it is broken down into the four panel datasets, as shown in Table 2. We use covariates in 2003-2008 to predict financial distress in 2005-2010 (Sample One Panel A and Sample Two Panel B) and covariates in 2009-2010 to predict financial distress in 2011-2012 (Sample One Panel C and Sample Two Panel D). In the time dimension, the first six years are the in-time period and the following two years are the out-of-time period. The average proportion of distressed cases across all years is very similar: 2.58% in Sample One and 2.57% in Sample Two.

Table 2
Subsamples

	Sample One						Sample Two				
	Year	Distress		Total	Distress rate		Year	Distress		Total	Distress rate
		0	1					0	1		
Panel A and C	2003	744	28	772	3.63%	Panel B and D	2003	379	11	390	2.82%
	2004	793	21	814	2.58%		2004	396	14	410	3.41%
	2005	785	18	803	2.24%		2005	392	8	400	2.00%
	2006	787	44	831	5.29%		2006	390	14	404	3.47%
	2007	827	33	860	3.84%		2007	407	22	429	5.13%
	2008	866	14	880	1.59%		2008	425	8	433	1.85%
	2009	907	17	924	1.84%		2009	452	10	462	2.16%
	2010	911	26	937	2.77%		2010	459	13	472	2.75%
	2011	904	7	911	0.77%		2011	455	4	459	0.87%
	2012	889	15	904	1.66%		2012	448	7	455	1.54%
	Total	8413	223	8636	2.58%		Total	4203	111	4314	2.57%

3.3 Corporate governance measures

Argenti (1976) summarized six structural defects indicated by the experts: one-man rule, non-participating board, unbalanced top team, lack of management depth, weak finance

function and combined chairman-chief executive. For instance, one-man rule is to describe a CEO who dominates their colleagues rather than lead them in making decisions or hear their advice. At some occasions, some of the functional directors who sit on main boards do not take their responsibilities. The 'top team' includes directors, senior executives and advisers may be not balanced in their backgrounds or abilities. These situations are rooted in the management of a company and we source the proxies of governance from them to describe the board, the ownership and the senior management team.

At last, as discussed in the literature review and according to availability of data in the database, corporate governance variables are classified into four groups and explained in Table 3. Lee and Yeh (2004) discussed the issue of ultimate control, which is very common in the emerging markets where highly concentrated shares are held by a family or the state. Claessens, Djankov, and Lang (2000) suggested that the controlling shareholder needs to be considered in bankruptcy prediction models. In our study, the ultimate controller is determined according to the CSRC regulations. Therefore, the ultimate controller is the indicator to denote whether a company is a SOE. We also consider the connection between large shareholders. According to Platt and Platt (2012), interlinked directorship provides benefits for the company.

Table 3

Corporate governance measures

Variable	Definition
Board composition (6)	
Board size	Number of total directors
Independent director	Proportion of independent board directors
Number of supervisors	Number of supervisors
Number of senior managers	Number of senior managers
Duality of Chair and CEO	1 if the Chair and the CEO is the same person
Independent director monitoring	1 if most independent directors work at the company address
Ownership Structure (10)	
State ownership	Proportion of state owned shares to total shares
SOE	1 if the ultimate controller is the state
Board shares	Shares held by the board to total shares

Supervisor shares	Shares held by the supervision board to total shares
Top 10 shareholders	Total shares of largest 10 shareholders to total shares
Institutional share holding	Total shares of institutional shares to total shares
Average share holding	Average shareholding to total shares
Listing somewhere else	1 if the company is listed on other exchanges outside China
Share capital change	1 if it changes from previous year
Connected top 10 shareholders	1 if any two top 10 shareholders are related
Management Compensation (5)	
Salary of senior management	Salary of directors, supervisors and senior managers to total salary cost
Salary of top 3 directors	Salary of top 3 directors to total salary cost
Salary of top 3 independent directors	Salary of top 3 independent directors to total salary cost
Salary of top 3 senior managers	Salary of top 3 senior managers to total salary cost
Number of non-paid seniors	Number of non-paid directors, supervisors and senior managers
Personal characteristics (14)	
Chair age	Age in the year
Chair gender	1 if female, 0 otherwise
Chair education	4 dummies (college, undergraduate, master, doctorate)
Chair professional qualification	1 if holding any professional qualification
Chair nationality	1 if not Chinese
Chair paid	1 if paid
Chair concurrent post	1 if holding a position in other companies
CEO age	Age in the year
CEO gender	1 if female, 0 otherwise
CEO education	4 dummies (college, undergraduate, master, doctorate)
CEO professional qualification	1 if holding any professional qualification
CEO nationality	1 if not Chinese
CEO paid	1 if paid
CEO concurrent post	1 if holding a position in other companies

Regarding management compensation, constrained by availability of data, the data source only provides a small fraction of option incentive information and the quality of very low. No option incentive is considered here. We have only access to the salaries of the management team. In China, most of bonuses are included in salaries in financial statements.

Whilst some papers (Fich and Slezak 2008, Platt and Platt 2012) are interested in the CEO and some (Santen and Soppe 2009) are interested in the board directors, this research takes both into account. Generally, the CEO is authorized by the board and is responsible for the overall management, decision making, execution and the daily operation of the company. Therefore, the personality and characteristics of the CEO will be reflected in the development of the business. In the situation that the Chair of the board has control of the company and is more

involved in the management and decision making, the Chair will have more influence on performance, which should not be ignored.

Personal information concerning both the Chair and the CEO for each company is recorded in the database including four types of personal demographic information: age, gender, nationality and education, and another three types of information regarding their professions: whether they have professional qualifications, whether they get paid by the company and whether they possess a position in any other organization.

3.4 Financial ratios and macroeconomic variables

As the BASEL Accord II addressed, macroeconomy as a systemic factor has an impact on the business cycle so banks are necessary to consider it in their Probability of Default models in Internal Rating-Based Approach (IRB). Though our focus is on governance variables, we still incorporate financial ratios and macroeconomic factors in analysis because they are not neglectable to credit risk management. For the selection of potential financial ratios and macroeconomic factors, out of a range of potential ones, we consider recommendation in literature, significance in preliminary analysis and correlation in collinearity diagnostics in the selection process.

The first group of TVCs are financial ratios covering different aspects of a company. In the literature, popular aspects to be assessed in financial ratio analysis are profitability, liability, gearing, operations etc. Therefore Return on Assets, Current liabilities / Total Liabilities, Tangible Assets / Total Assets, Cash Flow from Operating / Total Liabilities, Receivables Turnover and Total Assets Growth are selected with reference to literature and predictive power in preliminary analysis. In accordance with Shumway (2001) which also involves listed companies in the sample, duration time in survival analysis is determined as the time since

listing on the exchange and the natural logarithm of the duration is chosen to be the baseline function.

A series of macroeconomic factors are the other group of TVCs. However, unlike firm-specific covariates which affect individual cases, macroeconomic factors are systematic components that vary over time. For all companies existing in a period, macroeconomic conditions have the same impact on each and have been major driver of credit risk for banks (Memmel, Gündüz, and Raupach 2015). We incorporate lagged annualized values of GDP growth, the unemployment rate, the inflation rate and interest rates, which are extracted from World Databank, the database of the World Bank.

3.5 Data description

Table 4 shows descriptive statistics of the data. On average, there are 9.46 directors on the board, of which 3.31 (or 35%) are independent directors. There are on average 4.08 supervisors and 6.29 senior managers in each listed company. The government holds about one quarter of the total shares, which indicates the substantial influence of the government on Chinese listed companies is notable. Supervisors still own relatively small proportions of the shares (0.14%) because some of them are shareholder and employee representatives. On average, the top 10 shareholders own over half of total shares (58%) and so are often block holders who make important decisions. Institutional shareholders hold a large percentage of all shares, in some cases up to 93% of total shares.

Table 4
Description of corporate governance measures 1

Variable	N	Mean	Std. Dev.	Min	Max
Board composition					
Board size	10221	9.46	2	3	19
Independent director	10221	0.35	0.05	0	0.8
Number of supervisors	10221	4.08	1.37	0	13
Number of senior managers	10221	6.29	2.37	1	45
Ownership structure					

State ownership	10221	0.25	0.25	0	0.86
Board shares	10221	0.13	0.11	0.03	0.75
Supervisor shares	10221	0.0014	0.01	0	0.27
Top 10 shareholders	10221	0.58	0.15	0.07	0.99
Institutional share holding	10221	0.14	0.18	0	0.93
Average share holding	10221	0.0004	0.0004	0	0.005
Management compensation					
Salary of senior management	10221	0.5	0.11	0.03	0.85
Salary of top 3 directors	10221	0.17	0.07	0	0.51
Salary of top 3 independent directors	10221	0.05	0.04	0	0.33
Salary of top 3 senior managers	10221	0.2	0.07	0	0.65
Number of non-paid seniors	10221	4.29	3.17	0	19
Personal characteristics					
Chair Age	10221	50.08	7.28	28	84
CEO Age	10221	46.27	6.47	24	75

For categorical governance variables, we present only their frequencies and percentages in Table 5. It should be noted that the incidence in Table 5 is counted by company year but not company case, but it is still surprising to find that in over two thirds of observations (company-year), companies are state controlled. This may be because the Chinese exchanges were originally in service for SOEs.

Table 5
Description of corporate governance measures 2

Variable	N	Distress		0 (% of total)	1 (% of total)
		0	1		
Board composition					
Duality of Chair and CEO	10221	8835	1386	86.4	13.6
Independent director monitoring	10221	6390	3831	62.5	37.5
Ownership structure					
SOE	10221	3226	6995	31.6	68.4
Listing somewhere else	10221	9368	853	91.7	8.3
Share capital change	10221	3731	6490	36.5	63.5
Connected top 10 shareholders	10221	6058	4163	59.3	40.7
Personal characteristics					
Chair gender	10221	9833	388	96.2	3.8
Chair college	10221	8937	1284	87.4	12.6
Chair undergraduate	10221	7470	2751	73.1	26.9
Chair masters	10221	6936	3285	67.9	32.1
Chair doctorate	10221	9673	548	94.6	5.4
Chair qualification	10221	4374	5847	42.8	57.2

Chair nationality	10221	10130	91	99.1	0.9
Chair paid	10221	3487	6734	34.1	65.9
Chair concurrent position	10221	3951	6270	38.7	61.3
CEO gender	10221	9757	464	95.5	4.5
CEO college	10221	9036	1185	88.4	11.6
CEO undergraduate	10221	7367	2854	72.1	27.9
CEO masters	10221	6922	3299	67.7	32.3
CEO doctorate	10221	9830	391	96.2	3.8
CEO professional qualification	10221	4750	5471	46.5	53.5
CEO nationality	10221	10120	101	99	1
CEO paid	10221	321	9900	3.1	96.9
CEO concurrent position	10221	6589	3632	64.5	35.5

Financial ratios and macroeconomic factors (Table 6) are transformed into percentages for ease of interpretation and comparison. Generally, if only looking at the means, Chinese listed companies have been achieving positive returns and growing in the past few years. The Chinese economy has been growing comparatively quickly for decades while keeping inflation and unemployment rates at relatively low levels.

Collinearity between explanatory variables could lead to potential problems in testing the significance of covariates. In this study, there is no pair of variables with high correlation over 0.7, and between corporate governance and financial ratios all Variance Inflation Factors (VIFs) are smaller than 3, with an average of 1.57.

Table 6
Description of financial ratios and macroeconomic factors

Variable	N	Mean	SD	Min	Max
Financial ratios					
Return on Assets	10221	4.98	7.01	-18.94	28.64
Tangible Assets / Total Assets	10221	39.65	20.00	-35.64	96.53
Current Liabilities / Total Liabilities	10221	79.81	13.52	28.29	100.00
Net cash flow from operation / Total Liabilities	10221	9.64	24.18	-106.98	101.45
Receivables Turnover	10221	57.14	52.18	-8.42	244.66
Total Assets Growth	10221	15.45	31.00	-93.33	126.21
Macroeconomic factors					
GDP	10221	10.92	1.61	9.20	14.20
Inflation	10221	2.70	2.04	-0.70	5.86
Unemployment	10221	4.17	0.10	4.00	4.30
Interest	10221	5.81	0.68	5.31	7.47

4. Results

4.1 Model results

Measures of different aspects of corporate governance were entered into the models step by step and assessed by their significance. Only variables significant at the 5% level were retained. Model 1 consists of seven corporate governance measures, one from the board composition category, two from ownership structure, one from management compensation, and three from personal characteristics (Table 7). Model 2 includes six financial ratios and all appear to be significant in predicting financial difficulty and have their expected signs. In Model 3, all significant corporate governance measures and financial ratios are combined and all remain significant with the same signs as in Model 1 and Model 2. In Model 4, macroeconomic factors are added, and we find that the consumer price inflation rate is significant in the model.

We find that the monitoring of independent directors affects corporate performance. If they present on site and serve their duties well, the risk of poor managerial decisions can be reduced. This finding is similar to that in Wilson, Wright, and Scholes (2013), who found that if directors live close to companies, they are better able to monitor management. Long distance indicates loose control and monitoring. We also find that if the company is state controlled, it has a lower chance of becoming distressed. This may be taken as evidence that the government has provided abundant resources to support the company.

Table 7
Model results

	Model 1	Model 2	Model 3	Model 4
ln (duration)	1.670**	0.0466*	1.048**	0.482
	(5.49)	(1.62)	(3.02)	(1.20)
Independent director monitoring	-0.726**		-0.718**	-0.649**
	(-3.32)		(-3.08)	(-2.76)
SOE	-0.969**		-0.877**	-0.877**
	(-5.35)		(-4.50)	(-4.48)
Institutional share holding	-12.916**		-6.782**	-7.861**
	(-6.00)		(-3.38)	(-3.74)

Salary of top 3 independent directors	3.866**		3.649**	3.915**
	(6.42)		(5.53)	(5.79)
Chair age	-0.064**		-0.061**	-0.061**
	(-5.32)		(-4.61)	(-4.58)
CEO Masters	-0.827**		-0.836**	-0.863**
	(-3.02)		(-2.83)	(-2.91)
CEO concurrent position	-1.119**		-0.881**	-0.802**
	(-4.45)		(-3.26)	(-2.95)
Return on assets		-0.069**	-0.065**	-0.066**
		(-4.28)	(-3.70)	(-3.76)
Tangible assets / total assets		-0.028**	-0.028**	-0.029**
		(-5.85)	(-5.70)	(-5.79)
Current liabilities / total liabilities		0.078**	0.069**	0.069**
		(6.72)	(5.96)	(5.39)
Net cash flow from operation /		-0.025*	-0.020**	-0.019**
Total Liabilities		(-5.22)	(-3.86)	(-3.81)
Receivables turnover		0.007**	0.006**	0.006**
		(4.67)	(3.69)	(3.73)
Total assets growth		-0.026**	-0.022**	-0.022**
		(-4.68)	(-4.04)	(-4.09)
Inflation				0.197**
				(2.81)
Constant	-3.277**	-8.938**	-7.510**	-7.341**
	(-4.33)	(-7.64)	(-5.61)	(-5.46)
Log likelihood	-542.607	-505.959	-438.580	-434.551
Number of observations	4635	4635	4635	4635
LR Chi-sq	245.89	319.19	453.95	462.01
Prob > Chi-sq	0	0	0	0
Pseudo R^2	0.185	0.240	0.341	0.347

* *p*-value<0.05 ** *p*-value<0.01

The results also suggest that when the institutional investor has a stake in a listed company, the chances of distress are lower. The institutional investors have expertise and skills in detecting companies worthy of investment. According to Ting, Yen, and Chiu (2008), the existence of institutional investors particularly foreign institutional investors apply pressure to auditors so the auditing reports will release signals of creditworthiness. Further, if the salary cost of independent directors is large, the company has a high risk of financial distress. There may be two reasons for this. On one hand, the salary cost for an independent director places a burden on a company's financial condition. On the other hand, and more importantly, when independent directors are highly paid, they tend not to speak up when finding problems or disagree with management decisions. Of the fourteen characteristics for both the Chair and the CEO, only three are significant: the Chair's age, the CEO's education if they have a master

degree, and whether the CEO has a position in other organizations. As the Chair grows older, their experience increases and they become more cautious than young entrepreneurs. When the CEO has a Master's degree, our data shows it is beneficial for chief executives to improve their corporate performance. When the CEO has another position in other organizations, they presumably possess more social relationships and resources and so can bring extra benefits for the company.

4.2 Predictive accuracy

As discussed previously, predictive accuracy is the true focus of credit management and its measurement is presented in Table 8. Four panels are compared and Panel A gives results for the model training sample. Unsurprisingly, in-sample prediction produces the best results as compared to both out-of-sample and out-of-time predictions, followed by the within time out-of-sample predictions. Understandably, results in Panel D show the least accuracy because neither the sample nor the time is the same as in the model training.

AUC measures the ability of discriminant between the distress and non-distressed groups, which is equivalent to the Gini coefficient. The performance of Model 1 with only governance measures is acceptable in the in-time validation – Panel B (AUC=0.811). However, predictive accuracy declines dramatically when it is applied to the other period (Panel C). In Panels C and D, The AUC is only 0.694 and 0.768 respectively, which means using only corporate governance measures to predict financial distress is not practical. When combined with financial ratios in Model 3, the predictive accuracy is much improved.

The best performance comes from Model 4 where corporate governance measures, financial ratios and macroeconomic factors are all used in the model. In the within-time predictions (Panel A and B), the differences between Models 3 and 4 are trivial (AUC 0.915 to 0.916 and 0.902 to 0.903). But in the out-of-time predictions, macroeconomic factors give a significant

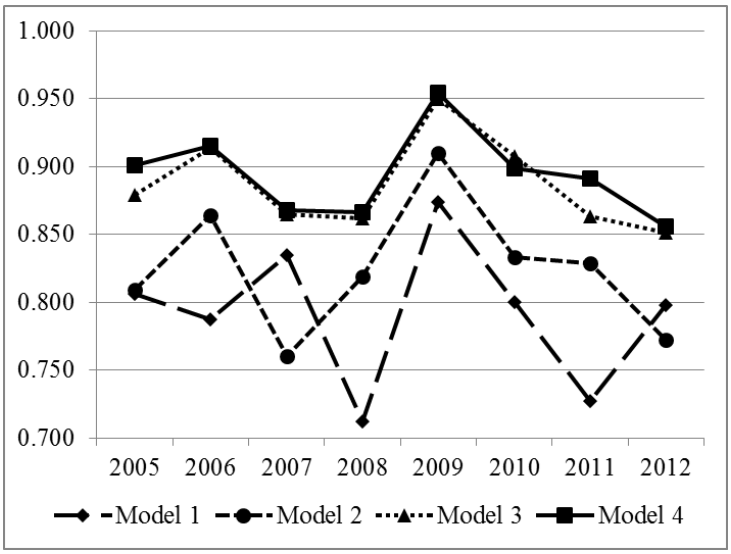
improvement to the predictive accuracy (AUC 0.868 to 0.876 and 0.852 to 0.860). Particularly, when considering the economic conditions, out-of-time predictions are significantly improved.

In a further analysis, the out-of-sample predictive accuracy (Panel B and D) in separate years is examined, taking AUC as an example (Figure 1). Model 3 & 4 are consistently better than Model 1 & 2 across all years. The power of extra information is evident in our empirical results.

Table 8
Predictive accuracy of models

	Panel A (training)	Panel B (in-time, out-of-sample)	Panel C (in-sample, out-of-time)	Panel D (out-of-time, out-of-sample)
Model 1	0.829	0.811	0.694	0.768
Model 2	0.871	0.833	0.826	0.785
Model 3	0.915	0.902	0.868	0.852
Model 4	**0.916**	**0.903**	**0.876**	**0.860**

Figure 1
Model performance (AUC) across years



5. Discussion and conclusion

Over the past 20 years corporate governance has attracted wide academic attention in many disciplines to find that certain aspects of the corporate governance of a company are linked to

its corporate performance or its financial position. From the perspective of bankruptcy/distress prediction, this paper has tested a wide range of corporate governance measures as predictors of corporate credit risk, using four panels of 10 years for 1,688 companies using survival models.

In search of the causes of corporate failure, Argenti (1976) did an in-depth survey and found a universal comment that bad management was the prime cause of failure. We regard what was described by 'bad management' as 'poor governance' due to the term 'governance' was not popular at the time of the book. Behaviors of bad governance include one-man rule, non-participating board, unbalanced top team, lack of management depth, weak finance function and combined chairman-CEO. These behaviors are captured by our corporate governance measures and results show consistent evidence. Argenti (1976) explained the channel from corporate governance to financial distress that poor governance leads to inability of the management team to correct the mistakes (due to one-man rule, chair-CEO duality, problematic board/management team etc.), and so finally cause the company fail. In the process of distress to bankruptcy, some symptoms are observed. For example, financial ratios behave worse compared to others. However financial ratios as symptoms are delayed in disclosure. In order to give early warning in advance, we have to go to the root – governance of a company. In our empirical result, though we do not focus on the hypothesis, the channel is well established as many empirical studies shown, for example, Daily and Dalton (1994) and Fich and Slezak (2008), etc.

In the dynamic prediction model, thirty-five corporate governance measures are considered that cover four aspects of a company management: board composition, ownership structure, management compensation, and director and manager characteristics. First, our results show that regarding the board composition, the monitoring of independent directors is significantly associated with the risk of financial distress. Independent directors are expected to carry out their duties so can effectively provide suggestions and improve performance based on

knowledge of other companies. Second, state ownership and institutional ownership reduce the risk of a company becoming financially distressed. Active investors such as institutional shareholders have the ability to detect potential risks to a company in which they have large investments. This is consistent with the literature in Campbell, Hilscher, and Szilagyi (2008), Lee and Yeh (2004) and Ting, Yen, and Chiu (2008). Third, in terms of management compensation, risks are greater with independent directors being more paid, indicating that independent directors are reluctant to comment negatively on their employers. Fourth, regarding personal characteristics, when the Chair is older, and when the CEO has a Masters degree or holds other positions in other organizations, the risk of distress is lower. Furthermore, conditional on six financial ratios, the macroeconomic factor affects the risk of distress.

In terms of predictive accuracy, corporate governance measures alone have limited capacity to detect financial distress. Financial ratios alone can do relatively better. However, when combining the two together, the predictive accuracy is significantly improved. The best predictive model comes from the combination of corporate governance measures, financial ratios and the macroeconomic factors. This outperforms the other three models in both out-of-sample and out-of-time predictions. In the performance separated by individual years, the ranking of models in most years remains the same.

In identifying measures of corporate governance which are significantly linked to financial distress these empirical results directly address issues of effective monitoring, business prosperity and prevention of corporate collapse and thus have important implications for financial stability in practice. Such information is helpful, first of all, for creditors in preventing potential losses, and also for owners and managers in identifying problems and implementing changes accordingly. It is also relevant to the corporate governance responsibilities of shareholders and stakeholders and those of regulators who supervise listed and other forms of companies, specifically regarding aspects of state ownership and independent directors. Finally,

corporate governance is closely linked to government policies and legal requirements that ensure financial prudence and stable economic performance so our results should also be of interest to policy makers and governments in the formulating of enterprise development strategy and its enforcement.

At last, China as the largest emerging market in the world is focused in this study. And China is highly unequal in economic development. Its stock market is relatively young with a history of less than 30 years. For this reason and it shares many common patterns in the capital market with many other emerging markets. It is believed that our findings will be insightful for the developing countries, particularly for those in Asia where some of the cultural and political issues are shared. For example, the SOEs in Vietnam also contribute to a significant portion to its economy. Our model can be also developed fit other developing countries.

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