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## Abstract

Corporate governance is an important determinant of corporate performance. Poor corporate governance can damage the interests of shareholders, and may lead to business collapse. This paper expands the literature on credit 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 a comprehensive, up-to-date and thorough study, which uses a large range of corporate governance measures, financial ratios and macroeconomic variables in a panel data structure over a 17-year period. Furthermore, the paper addresses the relationship between government ownership and the risk of financial distress in China. The results suggest that although corporate governance alone is not sufficient to accurately predict financial distress, it can add to the predictive power of financial ratios and macroeconomic factors. In addition, the model provides insights into the role of state ownership, independent directors, institutional investors and some personal characteristics of the Chair of the board. Implications are made regarding them and the debt and bankruptcy problem in China and Asia.



**Keywords**: Corporate Governance; Credit Risk; Survival Analysis; Financial Distress; Ownership structure

**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. A firm's bankruptcy or financial performance will affect investments and debt repayments, and therefore needs to be accurately predicted. It is not surprising that this topic has received a lot of attention in academic and practical work. 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 et al. (2008)) respectively. Corporate governance measures are less common in bankruptcy prediction literature, as they do not represent hard information such as financial ratios, but rather 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 et al. (2003)). The research which 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 on risk management, so that in addition to determining those measures of corporate governance that are statistically significant in explaining financial distress (whichhas been the main focus of previous studies), we will instead assess their predictive value rather than testing hypotheses. We have also taken into account the findings from Shumway (2001) and Campbell et al. (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 a comprehensive and thorough study to use a large selection of corporate governance variables in a panel data structure over a 17-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. We believe that the established statistical relationships are robust over very different macroeconomic conditions, which is a requirement of the Basel Accords for risk management. In this way, we go beyond those 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 et al., 2014; Wilson et al., 2013).

We find that aspects of board composition, ownership structure, management compensation and personal characteristics can have an impact on the risk of financial distress of a company and so can be used to predict it. But we establish that using corporate governance measures alone does not lead to sufficiently accurate predictions. If, however, they are bolstered 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 credit risk assesment and 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, taking a different perspective to many previous governance studies. In the credit risk management paradigm, we focus on 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 its governance, thus allowing us to predict more accurately. Second, we expand the empirical analysis into a new dimension - 33 governance variables in four groups and 2,824 companies over 17 years, which gives us great robustness in terms of statistics. The Basel Accord recommends that stress testing covers an economic cycle. Our data cover the recent financial crisis and out-of-sample validation has been applied. Third, we have built a dynamic model which has proven to be

theoretically better than static models (Shumway, 2001). The governance in a company is not stationary but changes 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, ever since Altman (1968) introduced multiple discriminant analysis to this subject area and various subsequent methods were proposed to prevent potential losses for banks and detect financial crisis caused by financial risks. Although financial ratios have played a major role in modelling, scholars such as Shumway (2001) and Bonfim (2009) have continued looking for new methods and information to improve model performance. In recent years, the market price has been regarded as a forward-looking indicator and is 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 and addressed by the New Basel Accord. Credit risks at the individual level can also be assessed by soft information related to corporate governance (Daily and Dalton, 1994b; Wilson et al., 2014).

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 and ownership structure

The board of directors represent the top decision makers of a company, while 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. De Maere et al. (2014) also suggest that the separation of the Chair and the CEO can reduce the risk of bankruptcy.

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 (Fich and Slezak, 2008; Hsu and Wu, 2014; Salloum et al., 2013; 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 help to increase diversity. In the research of Li et al. (2008), independent directors turned out to be negatively associated with the probability of financial distress. On the contary, Hsu and Wu (2014) found that outside directors are unfavorable to firm survival and increase the likelihood of business failure, while grey directors 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 Santen and Soppe (2009) in their empirical results. However, 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 et al. (2012) using survival analysis found that either a small or a large board outperforms those middle-sized boards in terms of their company's survival time. It seems the overall effect of board size is nonlinear.

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 Asian countries. Claessens et al. (2000) and Salloum et al. (2013) have also addressed the issue of family control. In contrast to Lee and Yeh (2004), Wilson et al. (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 2.3.

In addition to the type of ownership, the role of institutional shareholders has received attention, with mixed results. Lee and Yeh (2004) and Ting et al. (2008) found that institutional shareholding is lower in distressed companies than in healthy ones. This was confirmed by Campbell et al. (2008), who also found distress risk to be negatively linked to institutional ownership, though Fich and Slezak (2008) and Donker et al. (2009) found that institutional ownership has no relationship with bankruptcy. In their deep-dive study into how institutional shareholders 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. Thus, apart from institutional shareholding, the shareholding of insider and block holders has also been tested in our study.

### 2.2 Management compensation and personal characteristics

Salary, bonus and options are three common forms of compensation for managers. Management compensation on the one hand represents the cost of a company's human resource, while on the other hand, it is also an incentive for executives to pursue profits. Gilson and Vetsuypens (1993) found that in financially distressed firms a considerable number of CEOs were replaced or paid less than under normal circumstances. Management compensation was suggested to be a potentially significant variable in predicting financial distress. Li et al. (2008) also found that the administrative expense ratio was positively related to the likelihood of financial distress. However, using an equilibrium model, Cyert et al. (2002) reported that CEO compensation including base salary, equity and discretionary compensation was negatively associated with default risk. Basu et al. (2007) found that excess executive pay was negatively associated with accounting performance, which presents an agent problem.

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 et al. (2014) described director characteristics in terms of networks, proximity and involvement. Their survival model on a large dataset of six million observations provided evidence of strong links between a director's characteristics and the 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.

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) and Daily and Dalton (1994a) 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 gleaned. Wilson et al. (2014) concluded that directors with previous insolvency experience or recent resignations have a higher insolvency risk, while Salloum et al. (2013) found insufficient evidence to suggest that a 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 that 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.

### 2.3 State Owned Enterprises

Among the Chinese studies focused on corporate governance, there are some which have addressed the issue of state ownership. Under a central planning system, for example in Mainland China (McMillan, 2015), 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). While they reap all the advantages of 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 that state controlled companies are less willing to take risks, which may lead to a lower 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 or full control over the managers. In state-owned companies where the government has large concentrated shares, state ownership leads to problems of corruption and social responsibility. 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 Chinese 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 2,824 companies over 17 years covering the recent financial crisis, ensuring robustness of the modelling results. A wide range of corporate governance measures taken from board composition, ownership structure, management compensation and personal characteristics is represented by 33 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 both the access to finance and the potential 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 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 et al. (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). In studies of corporate governance measures, De Maere et al. (2014), Chancharat et al. (2012) and Parker et al. (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 in this case.

In the literature, it is noted that predictive accuracy is generally improved by the incorporation of corporate governance measures (Fich and Slezak, 2008; Lee and Yeh, 2004). However, research has been inconsistent or even controversial in the empirical findings, regarding whether a variable is positively or negatively associated with the probability of financial distress, and to what degree. In a more practical way, this research considers the 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.

### 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, the Cox Proportional hazard model as used in Parker et al. (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 three years in advance is applied in this research. It is important to note that in the context of prediction, we are using current information and are

making predictions about the future. Given the fact that financial statements and macroeconomic statistics are in reality generally late in disclosure, and that the indicator of distress is applied for two consecutive bad performances, a lag of three years is reasonable in our econometric model. Thus, the regression model uses covariates from year $t$-3 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:

$$\text{logit}(h_{d=1}(t)) = \alpha + \beta_0^T h_0(t) + \boldsymbol{\beta}_1^T \mathbf{x}_{i,t-3}^g + \boldsymbol{\beta}_2^T \mathbf{x}_{i,t-3}^r + \boldsymbol{\beta}_3^T \mathbf{x}_{i,t-3}^m \quad , \qquad (1)$$

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 $\beta_0$ is its coefficient;

$\mathbf{x}_{i,t-3}^g$ is a column vector of corporate governance variables for company $i$ at time $t-3$;

$\mathbf{x}_{i,t-3}^r$ is a column vector of financial ratios of predictive power;

$\mathbf{x}_{i,t-3}^m$ is a column vector of macroeconomic factors;

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

$\alpha$ is the constant.

It should be noted that 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 variables in Equation (1) are regarded as potentially predictive variables.

In the analytical process, first, considering the potential collinearity between governance measures, we include each group of corporate governance measures separately into the regression without any other covariates. In this way, significant corporate governance measures are identified and retained in 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 the Receiver Operation Characteristics (ROC) curves, the Area Under the ROC Curve (AUC) and the Kolmogorov–Smirnov (KS) statistic, the latter two of which are both commonly used in predictive modelling and credit risk management and range from 0 to 1, with a higher value indicating better results. 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. This therefore represents 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 suffered net losses in two consecutive years. So it is a popular indicator of financial distress, as in Geng et al. (2015), Lin et al. (2016) etc.. The Wind and GTA databases provide access to annual statements including accounting and governance information. The original dataset contains 3,647 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 2,824 companies over 17 years between 2003 and 2019.

Predictions for financial distress are commonly validated by an independent sample to avoid overfitting (Lin et al., 2016). Therefore, the whole sample is randomly divided into a training set and a test set in a 2:1 ratio. Applying a stratified sampling strategy to both distress and non-distress groups to ensure that both samples have similar distress rates (1.60% and 1.59%), as shown in Table 2. There are 19,844 observations for the training sample and 9,919 observations for the test sample, 29,763 firm-years in total.

**Table 2**
**Sample description**

| Training Sample | | | | | Test Sample | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Year | Distress | | No. of | Distress | Year | Distress | | No. of | Distress |
| | 0 | 1 | Obs. | rate | | 0 | 1 | Obs. | rate |
| 2003 | 670 | 28 | 698 | 4.01% | 2003 | 341 | 14 | 355 | 3.94% |
| 2004 | 717 | 18 | 735 | 2.45% | 2004 | 363 | 9 | 372 | 2.42% |
| 2005 | 708 | 19 | 727 | 2.61% | 2005 | 361 | 6 | 367 | 1.63% |
| 2006 | 721 | 32 | 753 | 4.25% | 2006 | 365 | 14 | 379 | 3.69% |
| 2007 | 771 | 35 | 806 | 4.34% | 2007 | 381 | 13 | 394 | 3.30% |
| 2008 | 814 | 9 | 823 | 1.09% | 2008 | 399 | 7 | 406 | 1.72% |
| 2009 | 863 | 14 | 877 | 1.60% | 2009 | 424 | 5 | 429 | 1.17% |
| 2010 | 1068 | 23 | 1091 | 2.11% | 2010 | 528 | 8 | 536 | 1.49% |
| 2011 | 1234 | 7 | 1241 | 0.56% | 2011 | 626 | 3 | 629 | 0.48% |
| 2012 | 1318 | 14 | 1332 | 1.05% | 2012 | 668 | 8 | 676 | 1.18% |
| 2013 | 1312 | 7 | 1319 | 0.53% | 2013 | 662 | 7 | 669 | 1.05% |
| 2014 | 1383 | 12 | 1395 | 0.86% | 2014 | 687 | 13 | 700 | 1.86% |
| 2015 | 1516 | 12 | 1528 | 0.79% | 2015 | 751 | 8 | 759 | 1.05% |
| 2016 | 1637 | 15 | 1652 | 0.91% | 2016 | 816 | 11 | 827 | 1.33% |
| 2017 | 1623 | 14 | 1637 | 0.86% | 2017 | 808 | 8 | 816 | 0.98% |
| 2018 | 1607 | 16 | 1623 | 0.99% | 2018 | 797 | 11 | 808 | 1.36% |
| 2019 | 1570 | 37 | 1607 | 2.30% | 2019 | 787 | 10 | 797 | 1.25% |
| Total | 19532 | 312 | 19844 | 1.60% | Total | 9764 | 155 | 9919 | 1.59% |

### 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 used to describe a CEO who dominates their colleagues rather than leading them in making decisions

or listening to their advice. On some occasions, some of the functional directors who sit on main boards do not carry out their responsibilities. The ‘top team' includes directors, senior executives and advisors who may be not evenly balanced in terms of 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.

Finally, as discussed in the literature review and according to the 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 et al. (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 acts as the indicator to denote whether a company is an 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 | Total number of all 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 government or state agencies |
| Board shares | Proportion of shares held by the board to total shares |
| Supervisor shares | Proportion of shares held by the supervision board to total shares |
| Top 10 shareholders | Proportion of shares held by ten largest shareholders to total shares |
| Institutional share holding | Proportion of institutional shares to total shares |
| Average share holding | Average shareholding to total shares |

| | |
|---|---|
| Listing elsewhere | 1 if the company is listed on other exchanges |
| Share capital change | 1 if it has changed from the previous year |
| Large shareholder connection | 1 if ten largest shareholders are related |
| *Management Compensation (5)* | |
| Salary of seniors | Proportion of salary of directors, supervisors and senior managers to total salary costs |
| Salary of top 3 directors | Proportion of salary of top 3 directors to total salary costs |
| Salary of top 3 seniors | Proportion of salary of top 3 directors, supervisors and senior managers to total salary costs |
| Salary of top 3 senior managers | Proportion of salary of top 3 senior managers to total salary costs |
| Number of non-paid seniors | Number of non-paid directors, supervisors and senior managers |
| *Personal characteristics (12)* | |
| Chair age | Age in the year |
| Chair female | 1 if female, 0 otherwise |
| Chair postgraduate | 1 if postgraduate, 0 otherwise |
| Chair professional qualification | 1 if holding any professional qualification |
| Chair paid | 1 if paid |
| Chair concurrent post | 1 if holding a position in other companies |
| CEO age | Age in the year |
| CEO female | 1 if female, 0 otherwise |
| CEO postgraduate | 1 if postgraduate, 0 otherwise |
| CEO professional qualification | 1 if holding any professional qualification |
| CEO paid | 1 if paid |
| CEO concurrent post | 1 if holding a position in other companies |

Regarding management compensation, constrained by the availability of data, the data source only provides a small fraction of option incentive information, the quality of which is very low. No option incentive is considered here. We only have access to the salaries of the management team. In China, most bonuses are included within 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 case that the Chair of the board has control of the company and is more involved in management and decision making, the Chair will have more influence on performance, a fact which should not be ignored.

Personal information concerning both the Chair and the CEO for each company is recorded in the database, including information regarding demographics (age, gender, and education) and 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 it is necessary for banks to consider it in their Probability of Default models with the Internal Rating-Based Approach (IRB). Though our focus is on governance variables, we have still incorporated financial ratios and macroeconomic factors in our analysis because they are significant to credit risk assessment (Wang, 2019). For the selection of potential financial ratios and macroeconomic factors, out of a range of potential ones, we consider the recommendations in the literature, the significance in preliminary analysis and the 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, Tangible Assets / Total Assets, Current Liabilities / Total Liabilities, Cash Flow from Operation / Total Liabilities, Receivables Turnover and Total Assets Growth are selected with reference to their predictive power in the preliminary analysis. A series of macroeconomic factors make up the other group of TVCs. However, unlike firm-specific covariates which affect individual cases, macroeconomic factors are systematic components which vary over time. For all companies existing in a period, macroeconomic conditions have the same impact on each and have been a major driver of credit risk for banks. We incorporate lagged annualized values of GDP growth, the unemployment rate, the inflation rate and the base borrowing interest rate, which are extracted from the World

Databank (the database of the World Bank). The Stock Index of CSI300 is included as we are focusing on listed companies. 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.

### 3.5 Data description

Table 4 shows the descriptive statistics of the continuous variables. On average, there are 9.12 directors on the board, of which 36% are independent directors. There are on average 3.81 supervisors and 7.14 senior managers in each listed company. The government holds about 12.75% of the total shares, which has gradually decreased after years of reform, though many of them are still SOEs, even if the state processes only a small proportion of shares in a company. Supervisors still own relatively small proportions of the shares (0.45%) because some of them are shareholder and employee representatives. On average, the top 10 shareholders own over half of the total shares (58.76%) and so are often block holders who make important decisions. Institutional shareholders hold a large percentage of all shares (31.3%), in some cases up to 98.63% of the total shares. In terms of age, the Chair is on average older than the CEO by four years.

**Table 4**
**Description of corporate governance measures 1**

| Variable | No. of Obs. | Mean | Std. Dev. | Min | Max |
|---|---|---|---|---|---|
| *Board composition* | | | | | |
| Board size | 22475 | 9.12 | 1.91 | 3.00 | 19.00 |
| Independent director (%) | 22475 | 36.09 | 5.01 | 6.67 | 50.00 |
| Number of supervisors | 22475 | 3.81 | 1.27 | 1.00 | 14.00 |
| Number of senior managers | 22475 | 7.14 | 2.48 | 1.00 | 44.00 |
| *Ownership structure* | | | | | |
| State ownership (%) | 22475 | 12.75 | 21.47 | 0.00 | 92.19 |
| Board shares (%) | 22475 | 3.01 | 6.33 | 0.00 | 98.97 |

| | | | | | |
|---|---|---|---|---|---|
| Supervisor shares (%) | 22475 | 0.45 | 0.40 | 0.00 | 13.23 |
| Top 10 shareholders (%) | 22475 | 58.76 | 15.16 | 11.26 | 99.48 |
| Institutional share holding (%) | 22475 | 31.30 | 24.56 | 0.00 | 98.63 |
| Average share holding (%) | 22475 | 0.11 | 1.48 | 0.00 | 84.70 |
| *Management compensation* | | | | | |
| Salary of seniors (%) | 22475 | 22.24 | 18.29 | 0.00 | 60.00 |
| Salary of top 3 directors (%) | 22475 | 12.00 | 11.17 | 0.00 | 35.00 |
| Salary of top 3 seniors (%) | 22475 | 10.45 | 11.59 | 0.00 | 39.99 |
| Salary of top 3 senior managers (%) | 22475 | 11.43 | 13.03 | 0.00 | 49.96 |
| Number of non-paid seniors | 22475 | 3.42 | 3.02 | 0.00 | 19.00 |
| *Personal characteristics* | | | | | |
| Chair Age | 22475 | 51.59 | 7.26 | 26 | 85 |
| CEO Age | 22475 | 47.82 | 6.56 | 24 | 79 |

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 firm year but not company case, however it is still surprising to find that in over two thirds of observations (firm-year), companies are state controlled.

**Table 5**
**Description of corporate governance measures 2**

| Variable | No. of Obs. | Dummy | | 0 (% of total) | 1 (% of total) |
|---|---|---|---|---|---|
| | | 0 | 1 | | |
| *Board composition* | | | | | |
| Duality of Chair and CEO | 22475 | 17705 | 4770 | 78.78 | 21.22 |
| Independent director monitoring | 22475 | 12089 | 10386 | 53.79 | 46.21 |
| *Ownership structure* | | | | | |
| SOE | 22475 | 14094 | 8381 | 62.71 | 37.29 |
| Listing elsewhere | 22475 | 18180 | 4295 | 80.89 | 19.11 |
| Large shareholder connection | 22475 | 11746 | 10729 | 52.26 | 47.74 |
| *Personal characteristics* | | | | | |
| Chair female | 22475 | 21514 | 961 | 95.72 | 4.28 |
| Chair postgraduate | 22475 | 13480 | 8995 | 59.98 | 40.02 |
| Chair qualification | 22475 | 8761 | 13714 | 38.98 | 61.02 |
| Chair paid | 22475 | 6327 | 16148 | 28.15 | 71.85 |
| Chair concurrent position | 22475 | 4856 | 17619 | 21.61 | 78.39 |
| CEO female | 22475 | 21264 | 1211 | 94.61 | 5.39 |
| CEO postgraduate | 22475 | 21999 | 476 | 97.88 | 2.12 |
| CEO professional qualification | 22475 | 9689 | 12786 | 43.11 | 56.89 |
| CEO paid | 22475 | 483 | 21992 | 2.15 | 97.85 |
| CEO concurrent position | 22475 | 10967 | 11508 | 48.80 | 51.20 |

Financial ratios and macroeconomic factors (Table 6) are transformed into percentages for ease of interpretation and comparison. Generally, if looking exclusively 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 a high correlation over 0.6, 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 Time Varying Covariates**

| Variable | No. of Obs. | Mean | SD | Min | Max |
|---|---|---|---|---|---|
| *Financial ratios* | | | | | |
| Return on Assets | 22475 | 6.28 | 6.24 | -16.83 | 29.14 |
| Tangible Assets / Total Assets | 22475 | 46.33 | 22.59 | -29.99 | 97.04 |
| Current Assets / Current Liabilities | 22475 | 81.71 | 17.35 | 4.24 | 100 |
| Cash Flow from Operation / Total Liabilities | 22475 | 17.17 | 32.95 | -128.42 | 164.55 |
| Receivables Turnover | 22475 | 27.74 | 59.23 | 0.95 | 299.69 |
| Total Assets Growth | 22475 | 21.52 | 34.81 | -69.41 | 150.78 |
| *Macroeconomic factors* | | | | | |
| GDP Growth | 22475 | 0.09 | 0.02 | 0.07 | 0.14 |
| Inflation Rate | 22475 | 2.65 | 1.65 | -0.73 | 5.93 |
| Unemployment Rate | 22475 | 4.11 | 0.09 | 4.00 | 4.30 |
| Interest Rate | 22475 | 4.05 | 0.75 | 2.93 | 5.81 |
| Stock Index | 22475 | 17.70 | 54.46 | -66.95 | 161.55 |

# 4. Results

## 4.1 Model results

Measures of different aspects of corporate governance were entered into the models block by block and assessed by their significance. Only significant variables were retained. Model 1 consists of eight corporate governance measures, one from the board composition category,

four from ownership structure, one from management compensation, and two from personal characteristics (Table 7). Model 2 includes six financial ratios, and all appear to be significant in predicting financial difficulty and are showing 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 significant except GDP Growth.

We find that the monitoring of independent directors affects corporate performance. If they are 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 et al. (2013), who found that if directors live close to their companies, they are better able to monitor management. Long distances indicate loose control and monitoring. The proportion held by the board is positively associated with the risk of distress. It is also evident that if the large shareholders are interlinked, it damages overall performance. The company needs diverse information to make the right decisions, and effective monitoring is thus essential for a company's health.

**Table 7**
**Model results**

| | Model 1 | Model 2 | Model 3 | Model 4 |
|---|---|---|---|---|
| ln (duration) | 2.248*** | 1.288** | 1.072*** | 1.020*** |
| | (6.39) | (2.30) | (2.93) | (2.70) |
| Independent director monitoring | -0.477*** | | -0.457*** | -0.453*** |
| | (-2.85) | | (-3.00) | (-2.97) |
| SOE | -0.689*** | | -0.487*** | -0.653*** |
| | (-3.43) | | (-2.62) | (-3.28) |
| Board shares (%) | 0.029* | | 0.019* | 0.021** |
| | (1.68) | | (1.82) | (2.08) |
| Institutional share holding (%) | -0.024*** | | -0.017*** | -0.013*** |
| | (-5.37) | | (-4.15) | (-3.21) |
| Large shareholder connection | 0.395** | | 0.330** | 0.297* |
| | (2.25) | | (2.09) | (1.88) |
| Salary of top 3 seniors (%) | 0.027*** | | 0.026*** | 0.027*** |
| | (3.46) | | (3.73) | (3.80) |
| Chair age | -0.046*** | | -0.036*** | -0.032*** |
| | (-3.79) | | (-3.33) | (-2.97) |
| Chair concurrent post | -7.615** | | -0.355** | -0.361** |
| | (-1.96) | | (-2.09) | (-2.15) |
| Return on assets | | -0.054*** | -0.046*** | -0.048*** |
| | | (-3.26) | (-3.00) | (-3.19) |
| Tangible assets / total assets | | -0.019*** | -0.021*** | -0.019*** |

| | | | | |
|---|---|---|---|---|
| | | (-3.77) | (-4.72) | (-4.39) |
| Current liabilities / total liabilities | | 0.024*** | 0.015*** | 0.013** |
| | | (3.49) | (2.69) | (2.44) |
| Cash Flow from Operation / Total Liabilities | | -0.014** | -0.011*** | -0.012*** |
| | | (-3.85) | (-3.40) | (-3.56) |
| Receivables turnover | | -0.011*** | 0.008*** | 0.008*** |
| | | (-3.36) | (2.97) | (2.94) |
| Total assets growth | | -0.006* | -0.006* | -0.006* |
| | | (-1.83) | (-1.86) | (-1.88) |
| GDP Growth | | | | 2.694 |
| | | | | (0.40) |
| Inflation Rate | | | | 0.182* |
| | | | | (2.18) |
| Unemployment Rate | | | | 1.969*** |
| | | | | (1.87) |
| Interest Rate | | | | -0.451** |
| | | | | (-2.71) |
| Stock Index | | | | 0.713*** |
| | | | | (2.81) |
| Constant | -7.615*** | -8.752** | -4.573** | -11.69** |
| | (-6.61) | (-4.03) | (-3.21) | (-2.69) |
| Log likelihood | -1160.09 | -1157.02 | -1117.32 | -1109.54 |
| Number of observations | 14272 | 14272 | 14272 | 14272 |
| LR Chi-sq | 94.99 | 79.26 | 142.51 | 154.75 |
| Prob > Chi-sq | 0.00 | 0.00 | 0.00 | 0.00 |

* $p$-value<0.1, ** $p$-value<0.05, *** $p$-value<0.01

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. Interestingly, the significant variable is the indicator of SOE but not the proportion of state-owned shares to total shares. In China, the reform of SOEs has been implemented over the last thirty years. The state has gradually exited the SOEs by restructuring and returning them to the market. Though ownership and management is separated, we can still see that the state controls some larger firms and those in key sectors, even though their ownership is low. The positive effects are still there, particularly when the market is declining. SOEs in general rarely suffer financial hardship.

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 et al. (2008), the existence of

institutional investors, particularly foreign institutional investors, exerts pressure on auditors so the auditing reports will show signs of creditworthiness. Further, if the salary cost of top seniors is great, the company has a high risk of financial distress. There may be two reasons for this. On the one hand, the salary cost for senior staff places a burden on a company's financial condition. On the other hand, high incentives may lead the managers to pay more attention to short term profits rather than long term benefits. Of the six characteristics identified for both the Chair and the CEO, only two are truly significant: the Chair's age and the indicator of the Chair's concurrent post. As the Chair grows older, their experience increases and they become more cautious than young entrepreneurs. When the Chair holds 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 the out-of-sample predictions.

AUC measures the discriminant power between the distress and non-distressed groups, which is equivalent to the Gini coefficient. The performance of Model 1 with only governance measures is insufficient in the training sample (AUC=0.678) and the test sample (AUC=0.655). An AUC larger than 0.7 indicates a good predition on a binary outcome. This means that using only corporate governance measures to predict financial distress is not practical. As only six ratios are selected into the predictive model, their performance (Model 1) are only slightly better than governance measures (Model 2). When these two groups of variables are combined in Model 3, predictive accuracy is much improved. A significant increase is recorded in AUC,

from 0.707 to 0.766 in the training sample, and a marginal improvement from 0.697 to 0.717 in the test sample. The best performance comes from Model 4, where corporate governance measures, financial ratios and macroeconomic factors are all used in the model. The differences between Models 3 and 4 are trivial but still noticeable. The AUC in the training sample increases from 0.766 to 0.771 and that of the the test sample increases from 0.714 to 0.717.

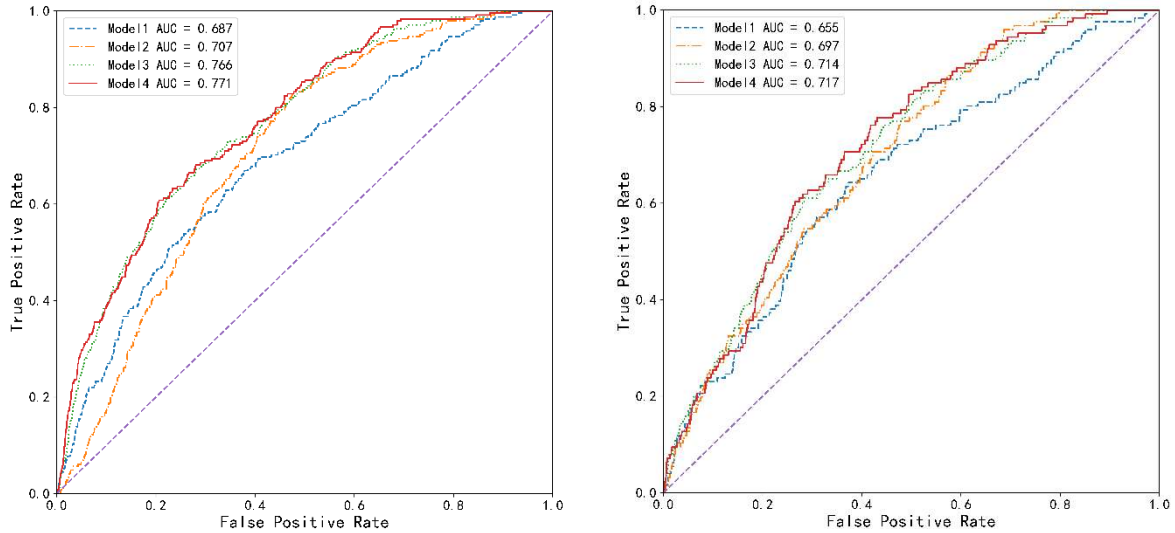
**Table 8**
**Predictive accuracy of models**

| | Panel A | | Panel B | |
|---|---|---|---|---|
| | AUC | KS | AUC | KS |
| Model 1 | 0.687 | 0.291 | 0.655 | 0.270 |
| Model 2 | 0.707 | 0.355 | 0.697 | 0.293 |
| Model 3 | 0.766 | 0.393 | 0.714 | 0.327 |
| Model 4 | 0.771 | 0.402 | 0.717 | 0.347 |

The KS statistic is also a measure of discriminant power, but it is distinct from AUC in that the KS indicates the best difference between the True Positive Rate and the False Positive Rate when the cutoff varies from the minimum to the maximum possible values. We find that the trends of performance from Model 1 to Model 4 remain the same.

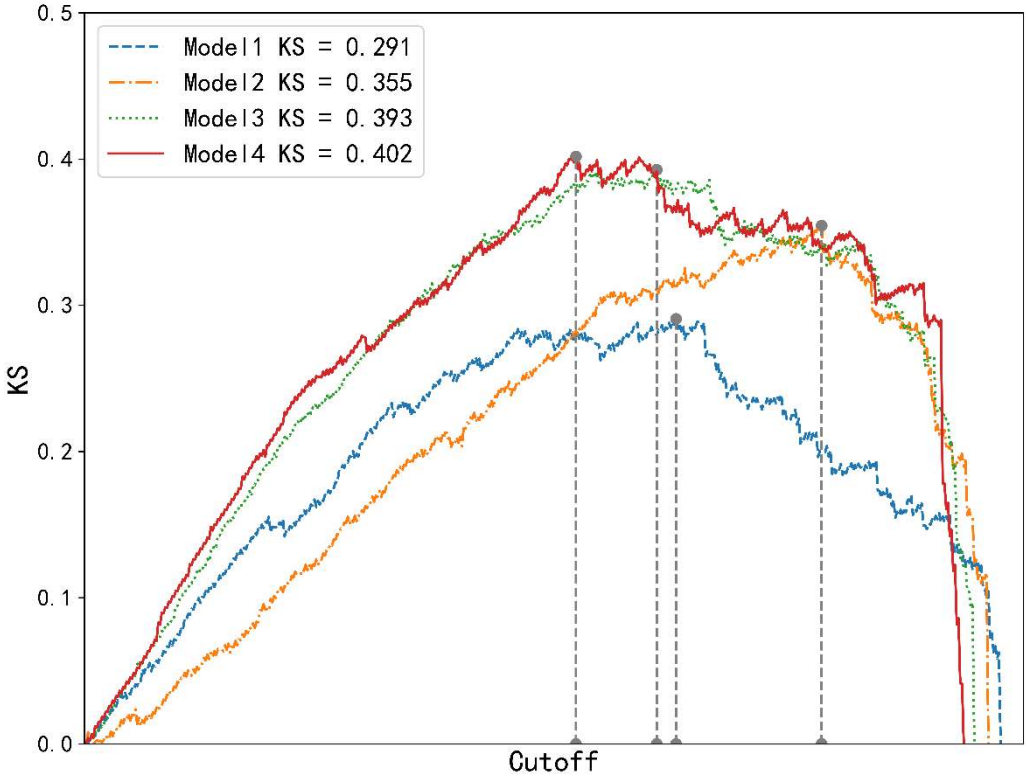
In a further graphic analysis, we can see that in Figure 1, though the lines of models cross each other, generally Models 3 & 4 outperform Models 1 & 2 in the training sample. In the test sample, the lines of four models are rather compact. Nevertheless Model 4, which takes into consideration governance measures, financial ratios and macroeconomic factors is clearly the best. Models 3 & 4 are consistently better than Models 1 & 2 across all years. The graphs of KS are displayed when all potential cutoffs change, and the differences of the True Positive Rate and the False Positive Rate peak at different points. From the distances of vertical lines in Figure 2, the power of extra information is evident in our empirical results.

**Figure 1**
**Model performance: ROC curves**

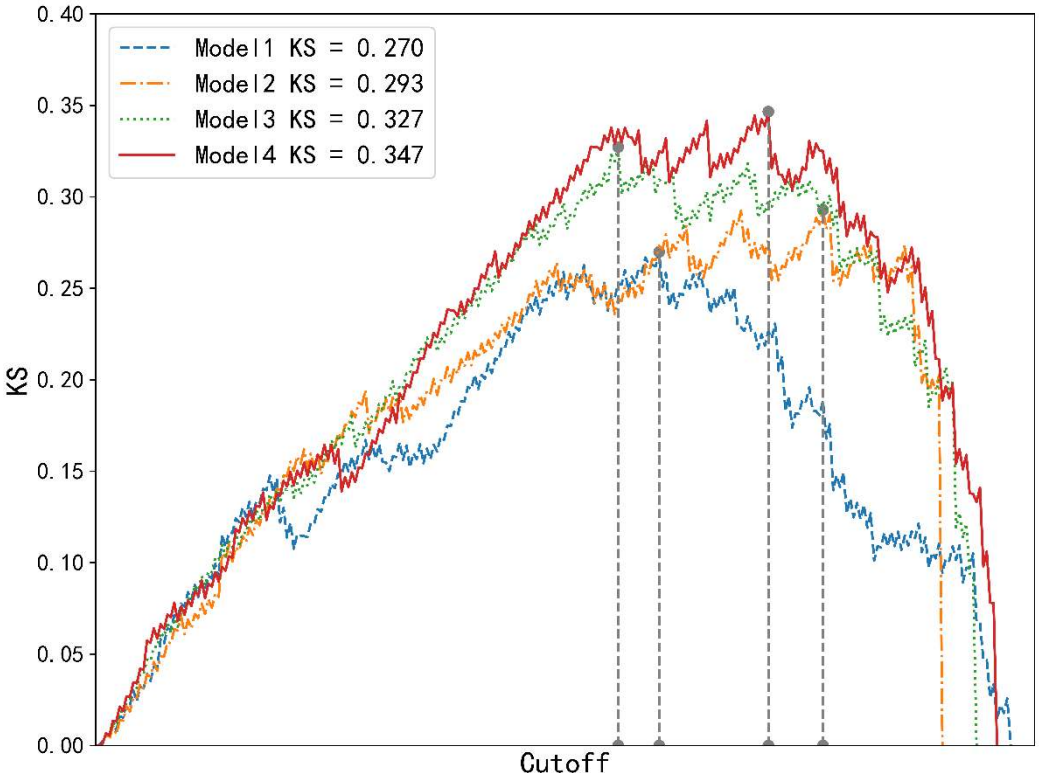



(a) Training sample (b) Test sample

**Figure 2**
**Model performance: KS statistic**




(a) Training sample



(b) Test sample

## 5. Discussion and conclusion

Over the past 20 years corporate governance has attracted wide academic attention in many disciplines, most of which have found 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 17 years for 2,824 companies using discrete time survival models.

In search of the causes of corporate failure, Argenti (1976) did an in-depth survey and unearthed a universal truth, that bad management is the prime cause of failure. We regard what was described as 'bad management' to be 'poor governance', as the term 'governance' was not popular at the time of the book. Traits of bad governance include one-man rule, a non-participating board, an unbalanced top team, lack of management depth, weak finance function and a combined chairman-CEO. These behaviors are captured by our corporate governance

measures and results show consistent evidence. Argenti (1976) described the channel from corporate governance to financial distress, so that poor governance leads to the inability of the management team to correct mistakes (due to one-man rule, chair-CEO duality, problematic board/management team etc.), and so finally causes the company to fail. In the process of distress to bankruptcy, some common symptoms are observed. For example, financial ratios behave worse compared to others. However, financial ratios as symptoms may be delayed in disclosure. In order to be able to give early warning, we have to go to the root – the governance of a company. In our empirical results, though we do not focus on this hypothesis, the channel is well-established, as many empirical studies have shown, for example, Daily and Dalton (1994) and Fich and Slezak (2008), etc.

In the dynamic prediction model, thirty-three corporate governance measures are considered, which cover four aspects of a company management: board composition, ownership structure, management compensation, and director and manager characteristics. First, our results show that in terms of 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 they can effectively provide suggestions and improve performance based on their 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 et al. (2008), Lee and Yeh (2004) and Ting et al. (2008). However the connection of large shareholders and too many shares held by the board do not benefit the creditors. Third, in terms of management compensation, the risks are greater when senior staff are more highly paid, because this indicates that salaries have become burdens to firms. Fourth, regarding personal characteristics, when the Chair is older,

and when the Chair holds other positions in other organizations, the risk of distress is lower. Furthermore, depending on six financial ratios, macroeconomic factors affect the risk of distress.

In terms of predictive accuracy, corporate governance measures alone have limited capacity to detect financial distress. Financial ratios alone do relatively better. However, when wecombine the two, the predictive accuracy is significantly improved. The best predictive model comes from the combination of corporate governance measures, financial ratios and macroeconomic factors. This outperforms the other three models in the out-of-sample prediction. The differences are clear in the figures of ROC and KS.

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 the 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 types 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.

Finally we have focused on China in this study, since it represents the largest emerging market in the world. China is unequalled in terms of economic development. Its stock market is relatively young, going back less than 30 years. For this reason it shares many common patterns in the capital market with many other emerging markets. We believe that our findings will provide insight for all developing countries, particularly for those in Asia, where some of

the cultural and political issues are shared. For example, SOEs in Vietnam also contribute a significant portion to its economy. We also understand the fact that in the past few years, China has accumulated more and more debt in nearly all markets, such as municiple bonds, corporate debts and home loans. We have seen many defaults in the bonds market, even for state-owned agencies. Given this potential debt problem, we urgently need an early warning system, i.e. a predictive model to help protect creditors. Our model framework can be also developed to assess the risk in the bond market and prevent the debt crisis.

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