

# Early Warning System of Financial Distress Based On Credit Cycle Index

Bi-Huei Tsai

**Abstract**—Previous studies on financial distress prediction choose the conventional failing and non-failing dichotomy; however, the distressed extent differs substantially among different financial distress events. To solve the problem, “non-distressed”, “slightly-distressed” and “reorganization and bankruptcy” are used in our article to approximate the continuum of corporate financial health. This paper explains different financial distress events using the two-stage method. First, this investigation adopts firm-specific financial ratios, corporate governance and market factors to measure the probability of various financial distress events based on multinomial logit models. Specifically, the bootstrapping simulation is performed to examine the difference of estimated misclassifying cost (EMC). Second, this work further applies macroeconomic factors to establish the credit cycle index and determines the distressed cut-off indicator of the two-stage models using such index. Two different models, one-stage and two-stage prediction models are developed to forecast financial distress, and the results acquired from different models are compared with each other, and with the collected data. The findings show that the one-stage model has the lower misclassification error rate than the two-stage model. The one-stage model is more accurate than the two-stage model.

**Keywords**—Multinomial logit model, corporate governance, company failure, reorganization, bankruptcy.

## I. INTRODUCTION

THE study makes three unique contributions to the field. First, this study classifies various distressed events to predict the likelihood of financial distress. Three states- “non-distressed”, “slightly-distressed”, “reorganization and bankruptcy” states, are used in our article to approximate the continuum of corporate financial health. Second, this study applies corporate governance variables to capture the characteristics of “non-distressed”, “slightly-distressed”, “reorganization and bankruptcy” events. Differential financial distress prediction are related to corporate governance indicators, financial ratios and market variables to different extent, so this investigation compares the different extent among various financial states. Third, the study applies macroeconomic factor to form a credit cycle index and employ such index to adjust the cut-off point, which distinguishes distressed firms from non-distressed firms.

As for the corporate financial health, previous articles choose the conventional failing and non-failing dichotomy [1]-[5]. However, the distressed extent differs dramatically among different financial distress events. To solve the problem, three states- “non-distressed”, “slightly-distressed”, “reorganization

and bankruptcy” states, - are used in our article to approximate the continuum of corporate financial health. “Slightly-distressed” events in our research are delisting, government takeovers of enterprises, factory shut downs and the occurrence of bounced checks. Our multinomial logit model is able to investigate the different critical factors that enhance the prediction of “slightly-distressed”, “reorganization and bankruptcy” events, so we can distinguish whether financial ratios, corporate governance and market variables are suitable to foresee the occurrence of financial events. Next, our multinomial logit model estimates the probabilities that a firm will encounter one of the three financial states, so risk managers can take necessary actions based upon our investigation.

The usefulness of corporate governance factors in credit risk management and firm value is addressed [6], [7]. Johnson et al. [6] note that poor corporate governance devaluated firm value and triggered the financial crisis. Since corporate governance has been regarded as one of the key factors that caused the Asian financial crisis in 1997, this paper employs the corporate governance to forecast financial distress events. According to agency theory of [8], the more the insiders hold corporate ownership, the greater efforts these insiders tend to make in firm operation, and lower the possibility of financial distress. As for deviation ratio between voting and cash flow rights, we traced voting and cash flow rights proposed by [9] and [10]. Great deviation ratio between voting and cash flow rights represents that this related-party group control the firms at the lower cost of obtaining the firm ownership, which thus strengthen the conflicts between minor shareholders and controlling shareholders. Thus, the probability for financial distress, either “slightly-distressed” or “reorganization and bankruptcy” event, is expected to increase. Since corporate governance in emerging countries is poorer than that in developed countries, it is worthwhile to explore the relevance between financial distress and corporate governance. This investigation employs the multinomial logit model to precisely capture the differential extent to which corporate governance indicators are related to different financial states.

The reason that we separates the financial distress events in the “slightly-distressed” and “reorganization and bankruptcy” is that managers are more capable of dressing up operational difficulties in financial statements before suffering “slightly-distressed” events than before suffering “reorganization and bankruptcy” events. They are more likely to manipulate financial ratios in accounting reports to cover up slightly-distressed difficulties. The purpose of this investigation is to assess whether financial ratios reveal less information about the occurrence of slightly-distressed events

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than that of “reorganization and bankruptcy” events. Since financial ratios are less relevant to the occurrence of “slightly-distressed” events, corporate governance indicators are more likely to signal the information about these events. The contribution of this paper is to confirm that financial ratios are less relevant to the occurrence of “slightly-distressed” events than corporate governance variables, but are more related to the “reorganization and bankruptcy” events.

Referring to the adjusted distressed cut-off points, this study applies macroeconomic factor to determine the cut-off point, which distinguishes distressed firms from non-distressed firms. Prior studies have emphasized that financial distress is closely related to economic environment [11]-[13]. Kim [13], Belkin, Forest and Suchower [14], [15] observe that the indicators of changes in credit ratings are not fixed, but changes with macroeconomic prosperity. Wilson [16], [17] as well as Gupton, Finger and Bhatia [18] also propose a credit portfolio perspective for adjusting credit change indicators. Since the discriminative function of a credit change indicator is the same as that of a distressed cut-off indicator, a constant cut-off indicator is not a reliable method for differentiating distressed and non-distressed firms. Therefore, it is worthwhile employing economic prosperity as an essential element for measuring the distressed cut-off indicator. This investigation deals with the macroeconomic and firm-specific factors separately and constructs a two-stage model. In the first stage, this work employs the firm-specific financial ratios, market variables and corporate governance factors to measure the probability of multiple financial distress events using multinomial logit models. The cut-off point, which distinguishes distressed firms from non-distressed firms, is measured based on external economic conditions. Distressed firms include both “slightly-distressed and “reorganization and bankruptcy” firms. Owing to the relationship between macroeconomic factors and the movement of cut-off point, this investigation further applies macroeconomic factors during the second stage to determine the Kim [13] credit cycle index and revises the distressed cut-off point based on this macroeconomic-related index.

This study employs data of publicly listed companies that traded on the Taiwan Stock Exchange from 2003 to 2008, with the period from 2003 to 2006 being designated as the training period, and the period from 2007 to 2008 as the test period. This study employs Hopwood, McKeown, and Mutchler [19] estimated misclassifying cost (EMC) to compare the accuracy between the hazard models and macroeconomic models. By comparing the prediction ability of the two-stage and the one-stage models, this study investigates the usefulness of the cut-off indicator that changes with external economic environment in predicting financial distress.

The results show that financial ratios are less relevant to the occurrence of “slightly-distressed” events than corporate governance variables, but are more related to the “reorganization and bankruptcy” events. This implies the differential extent to which financial ratios and corporate governance signal the occurrence of “slightly-distressed” and “reorganization and bankruptcy” events. Finally, we find

prediction performance improves as the distressed cut-off indicators are adjusted according to the macroeconomic factors in the two-stage models. However, the performance deteriorates if macroeconomic factors are directly included in the one-stage models for forecasting financial distress. Specifically, the two-stage model incorporating financial ratios, corporate governance and market factors has the lowest classification error rate. This suggests the incremental usefulness of this two-stage model in predicting financial distress, particularly in the politically-operated emerging markets.

The paper is organized as follows: Section II describes the sample and data, then Section III explains the study methodology. Section IV discusses empirical results. Finally, conclusions are drawn in Section V.

## II. SAMPLE AND DATA

When testing prediction indicators of financial distress, earlier studies noted that bankruptcy was criticized as a measure of financial distress [20], [21]. For the reasons, this study defines financial distress as all default events and divides financial distress events into “slightly distressed” and “reorganization and bankruptcy”. The study sample comprises Taiwan-listed companies excluding the firms in the financial industry and firms without sufficient data. Data in 2003 to 2006 is defined as the training sample, consisting of 147 slightly distressed firms, 40 reorganization and bankruptcy firms and 4,158 non-distressed firm-year observations. Data in 2007 and 2008 is defined as the test sample. The annual variables that are incorporated into our models are financial ratio, market, and corporate governance. Information used to establish credit cycle index (macroeconomic factors) is collected monthly. The annual financial ratio, market, corporate governance, company financial distress event and monthly macroeconomic factors are collected from various sources in the Taiwan Economic Journal (TEJ) database.

## III. METHODOLOGY

### A. Multinomial Logit Model

Multi-period multinomial logit model is used to estimate parameters based on data from each observation as if they constituted a separate observation. Unlike the Binary Logit model, this paper distinguishes sample firms into three sub-samples: non-distressed firms ( $j=1$ ), “slightly-distressed” firms ( $j=2$ ) and “reorganization and bankruptcy” firms ( $j=3$ ). Under multinomial logit model, the probability that firms suffer “slightly-distressed” events and “reorganization and bankruptcy” events can be expressed as (1) and (2), respectively:

$$\pi_{ij,t} = \frac{e^{\beta_j X_{it}}}{1 + \sum_{j=2}^3 e^{\beta_j X_{it}}}, \quad j=2,3 \quad (1)$$

$$\pi_{ij,t} = \frac{1}{1 + \sum_{j=2}^3 e^{\beta_j X_{it}}}, \quad j=1 \quad (2)$$

where  $i$  the firm on year  $t$  suffers  $j$  distressed events,  $j=1,2,3$ .

$$i=1,2,\dots,n \quad j=1,2,3 \quad t=1,2,\dots,T$$

$\pi_{ij,t}$  is the probability that  $i$ th firm suffer distressed events,  $j=1,2,3$  and  $\sum_{j=1}^3 \sum_{i=1}^n \pi_{ij,t} = 1$ . Our multinomial logit model incorporates time-varying covariates by using  $x$  time-dependent, and thus provides more consistent and unbiased estimates of parameters. This article applies the logarithm of the number of calendar years that sample firms have been existed in Taiwan as firm age variable; the model is an accelerated failure-time model [22]. Parameters are estimated using the maximum likelihood estimation (MLE) method.

The annual variables that are incorporated into our models are financial ratio, market, and corporate governance variables. Financial ratio variables are those proposed by [23], which are working capital to total assets, retained earnings to total assets, earnings before interest and taxes to total assets, market equity to total liabilities, sales to total assets, net income to total assets, total liabilities to total assets, and current assets to current liabilities. Three market variables adopted by this work are also from [23] excess returns, logarithm of size of each firm relative to the total size of the Taiwan Stock Exchange, and idiosyncratic standard deviation of the stock return of each firm. The macroeconomic variables are change ratios of Stock price index, Taiwanese real GDP, and Taiwanese trade surplus to China and Hong Kong. Firm age is defined as the number of calendar years that the firm has existed in Taiwan.

The corporate governance variables include ownership ratio of the insiders, pledge ownership ratio of the insiders, and deviation ratio between voting and cash flow rights. Insiders are directors, supervisors, managers and large shareholders (that own 10 percent or more of a company's outstanding share). According to agency theory in [8], the ownership ratio of the insiders is expected to be negatively related to the occurrence of financial distress. On the other hand, since the pledge ownership ratio of the insiders, and deviation ratio between voting and cash flow rights exacerbate agency problems and weaken corporate governance, these two ratios are positively related to the probability of financial distress events, including both "slightly-distressed" and "reorganization and bankruptcy" events.

### B. Estimated Misclassification Cost

Estimated misclassification cost (EMC) is used to measure models' prediction abilities. There are no theoretical distributions existing for describing EMC. Bootstrapping is used to estimate the empirical distributions of EMC and to determine the critical values for hypotheses testing [19]. Specifically, to construct the statistical tests for the difference of EMC between the conventional hazard model, which does not consider macroeconomic factors, and macroeconomic models, the bootstrapping procedure is performed. Hazard model is multinomial logit model which does not consider macroeconomic factors, while macroeconomic mode is multinomial logit model incorporating macroeconomic factors.

EMC is computed for each of the 1,000 holdout resamples using the randomly assigned predictions for each model. Then for the two compared models, 1,000 pairs of EMCs are formed and 1,000 differences in EMC are calculated.

### C. Cut-Off Indicator of Financial Distress

The coefficients of the hazard models are initially estimated using the training sample under the likelihood function. Then, this paper employs the estimated parameters to measure the probability that a sample firm suffers "slightly-distressed" and "reorganization and bankruptcy". Because investors and debtors all suffer huge loss either in "slightly-distressed" and "reorganization and bankruptcy" event, "slightly-distressed" firms and "reorganization and bankruptcy" firms are defined as distressed firms in this research. We choose the distressed cut-off indicator as the threshold which distinguishes distressed and non-distressed firms. If the sum of the estimated probability of "slightly-distressed" or "reorganization and bankruptcy" of the sample firm exceeds the cut-off indicator, then the firm is classified as distressed; otherwise the firm is classified as non-distressed. Under such classification, a Type I error occurs when a firm suffers financial distress but is misclassified as non-distressed. A Type II error occurs if a firm is non-distressed but misclassified as distressed. This paper follows the method proposed by [24] to calculate the optimal cut-off scores, which minimize the sum of Type I and Type II errors in the training sample. With respect to the one-stage models, the optimal cut-off scores are used as the distressed cut-off indicators to distinguish between distressed and non-distressed companies during the test period.

The two-stage model herein uses the credit cycle index approach of [13] to set the cut-off point of financial distress, which differentiates distressed from non-distressed firms. The Probit-AR(1)-GARCH(1,1) model is initially employed to predict economic status during the test period, and this predicted status is further utilized to determine the credit cycle index. Since the number of bounced checks due to "non-sufficient funds" (NSF) reflects the national default status, the Probit-AR(1)-GARCH(1,1) model utilizes it as a proxy of economic status in (3):

$$\begin{cases} RP_t = \Phi \left[ \lambda_0 + \sum_{h=1}^3 X_{h,t-1} \lambda_h + \varepsilon_t \right] \\ \varepsilon_t = \phi_1 \varepsilon_{t-1} + e_t \\ e_t = \sqrt{h_t} v_t, v_t \sim N(0,1) \\ h_t = \varpi_0 + \varpi_1 e_{t-1}^2 + \varpi_2 h_{t-1}, \end{cases} \quad (3)$$

where  $RP_t$  denotes the proportion of bounced NSF checks (to all checks) at time  $t$ . The proportion of bounced NSF checks is defined as the number of bounced NSF checks divided by the number of total valid checks.  $X_{h,t-1}$  includes the monthly macroeconomic variables (change ratios of Stock price index, Taiwanese real GDP, and Taiwanese trade surplus to China and Hong Kong). The parameters and the macroeconomic factors

for the one month prior to the test period  $X_{h,t-1}$  can be applied to estimate the forecast inverse normal CDF of the proportion of bounced NSF checks  $E_{t-1}(\Phi^{-1}(RP_t))$  over the test period. The  $\Phi^{-1}(\cdot)$  term is the inverse normal CDF, and  $\bar{E}$  represents the expected value. Next, the mean ( $\mu_{\Phi^{-1}(RP_t)}$ ) and the standard deviation ( $\sigma_{\Phi^{-1}(RP_t)}$ ) of the proportion of bounced NSF checks are calculated for the training sample. The credit cycle index  $Z_t$  is given as (4):

$$Z_t = -\frac{\Phi^{-1}(RP_t) - \mu_{\Phi^{-1}(RP_t)}}{\sigma_{\Phi^{-1}(RP_t)}} \quad (4)$$

Following the estimation of the credit cycle index  $Z_t$ , the distressed cut-off point, which is based on credit cycle index  $Z_t$  is adjusted. This work assumes that  $\ell_t$  represents the inverse normal CDF of the optimal cut-off scores  $\rho$  such that  $\ell_t = \Phi^{-1}(\rho)$ . The inverse normal CDF of the distressed cut-off point  $W_t$  is expressed as:

$$W_t = \frac{\ell_t + \gamma Z_t}{\sqrt{1 - \gamma^2}} \quad (5)$$

where  $\gamma$  is an unknown coefficient to be estimated, and  $Z_t$  is the credit cycle index. The credit cycle index  $Z_t$  is designed to be positive during prosperous economic times, indicating a low likelihood of financial distress. The index tends to be negative during difficult economic times, so the cut-off point of financial distress is reduced. Thus, more enterprises are classified as distressed.

The unknown parameter  $\gamma$  is computed by minimizing the sum of squares of the probabilities of financial distress minus the corresponding values estimated using the model. Two kinds of rating transitions involving the conversion of non-distressed firms into distressed ones and the conversion of distressed firms into non-distressed ones are expressed in this study, and this paper solves the least square formula

$$\min_{\gamma} \left\{ \begin{array}{l} \frac{n_{t,ns} [P_t(ns, S) - \Delta(L_{s+1}^{ns}, L_s^{ns}, Z_t)]^2}{\Delta(L_{s+1}^{ns}, L_s^{ns}, Z_t) [1 - \Delta(L_{s+1}^{ns}, L_s^{ns}, Z_t)]} \\ + \frac{n_{t,s} [P_t(S, ns) - \Delta(L_{ns+1}^s, L_{ns}^s, Z_t)]^2}{\Delta(L_{ns+1}^s, L_{ns}^s, Z_t) [1 - \Delta(L_{ns+1}^s, L_{ns}^s, Z_t)]} \end{array} \right\} \quad (6)$$

where  $P_t(ns, S)$  ( $P_t(S, ns)$ ) represents the non-distressed firms to distressed firms (distressed firms to non-distressed firms) transition rate observed in the year  $t$  during the training time,  $n_{t,ns}$  ( $n_{t,s}$ ) is the number of transitions from the initial non-distressed firm (distressed firms) to distressed firms (non-distressed firms) observed in year  $t$  during the training time and  $\Delta(L_{s+1}^{ns}, L_s^{ns}, Z_t)$  ( $\Delta(L_{ns+1}^s, L_{ns}^s, Z_t)$ ) is the model value for

the non-distressed firm to distressed firm (distressed firm to non-distressed firm) transition rate in the year  $t$  during the training time. After the cut-off indicators have been individually determined using the one-stage and two-stage models, the two error rates, Types I and II, of the one-stage and two-stage models are compared.

#### IV. EMPIRICAL RESULTS

##### A. Estimation Results Using the Multinomial Logit Models

ANOVA analysis examines the difference in firm age, financial ratios and market variables among “non-distressed”, “slightly-distressed” and “reorganization and bankruptcy” sample firms. Non-distressed firms champion in ratios of current asset to current liability, working capital to total assets, retained earnings to total assets, sales to total assets, and net income to total assets. Slightly-distressed firms take the second place, while “reorganization and bankruptcy” firms are the last. The ranking is the same in terms of firm solvency and profitability.

F statistics further reveal significant differences among “non-distressed”, “slightly-distressed” and “reorganization and bankruptcy” sample firms. In terms of financial ratios, market variables and corporate governance variables, differences in the financial ratios suggest that firms can avoid the financial distress through the improvement of corporate insolvency or probability and reduction of debt leverage. Differences in the market variables and corporate governance variables suggest that the approach of this study, choosing corporate governance and market variables as analyzing items, is suitable for the prediction of corporation’s financial status.

The results of multinomial logit models are developed using different combinations of financial ratios, market variables, corporate governance variables and macroeconomic factors. As for the corporate governance variables of “slightly-distressed” firms, the coefficients of corporate governance variables, including ownership ratios of the insiders and pledge ownership ratio of the insiders, are significant for “slightly-distress” firms, while financial ratios are insignificant, except for net income to total assets. Financial ratios are less relevant to the occurrence of “slightly-distressed” events than corporate governance variables. This indicates that the managers have more incentive to manipulate financial ratios in accounting reports to cover up slightly-distressed difficulties. Thus, financial ratios reveal less information than corporate governance concerning “slightly-distressed” events.

On the other hand, four of the six financial ratios and two of the three market variables are substantially relevant to the “reorganization and bankruptcy” events, while none of the coefficients of the three corporate governance variables are statistically significant. Financial ratios are more related to the “reorganization and bankruptcy” events. This suggests that managers are hardly capable of dressing up operational deteriorations before suffering “reorganization and bankruptcy” events. The financial ratios in accounting statements truly reflect such events, and investors timely react to their devaluation of the reorganized and bankrupt firms,

inducing the negative association between financial distress and abnormal returns. Financial ratios and market variables dominate corporate governance information in predicting financial distress.

*B. Comparison between Macroeconomic Model and Hazard Model*

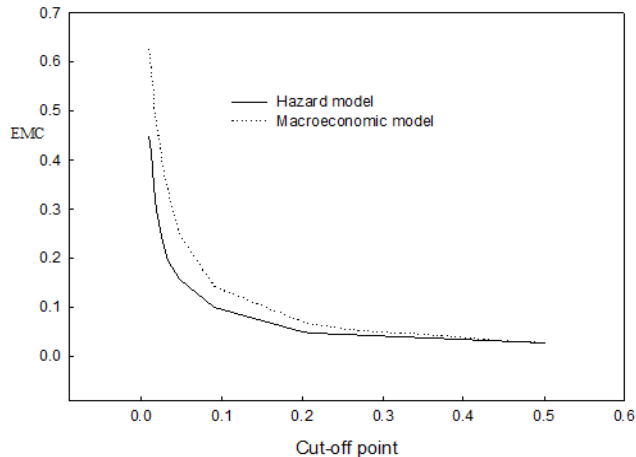


Fig. 1 EMC comparison between hazard models and macroeconomic models for test sample in 2007

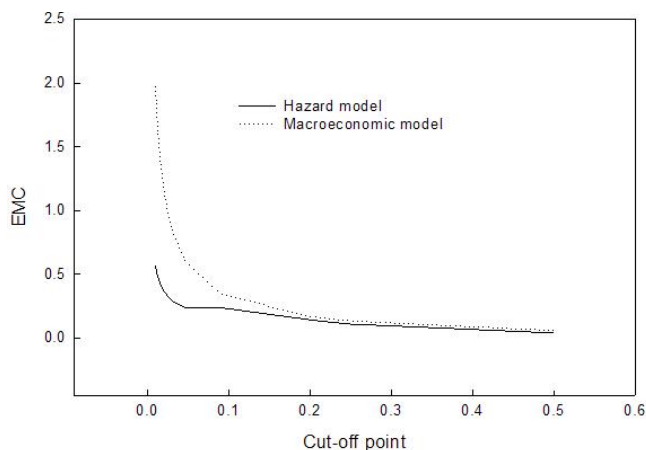


Fig. 2 EMC comparison between hazard models and macroeconomic models for test sample in 2008

Hazard model is multinomial logit model which does not consider macroeconomic factors, while macroeconomic model is multinomial logit model incorporating macroeconomic factors in Figs. 1 to 3. Hazard model is one-stage model, while macroeconomic model is two-stage model. Besides, Figs. 1 and 2 depict the EMC graph at each cut-off point for test sample in 2007 and 2008 respectively. It is clearly to observe the substantial difference between these two models at various cut-off points for test sample in 2007 (Fig. 1). EMC of hazard model is dramatically smaller than that of macroeconomic model in 2008, except for the cut-off point 0.5. For each cut-off point, the EMC is higher for macroeconomic model, which incorporates both macroeconomic and firm-specific factors, than conventional hazard model. It implies that conventional hazard model performs superior to macroeconomic model in

both 2007 and 2008. The misclassification loss decreases if we employ hazard model.

Fig. 3 further depicts sum of Type I and Type II errors for hazard models and macroeconomic models for test sample in 2007. For the cut-off points which are lower than 0.1, the EMC is higher for macroeconomic hazard model, which incorporate both macroeconomic and firm-specific factors, than the hazard model. It implies that conventional hazard model performs superior to macroeconomic model if the cut-off point is lower than 0.1. In general, the cut-off point is lower than 0.1 and the optimal cut-off scores, which minimize the Type I and Type II error rates, is less than 0.1 in our investigation. The misclassification loss reduces if we employ discrete-time hazard model.

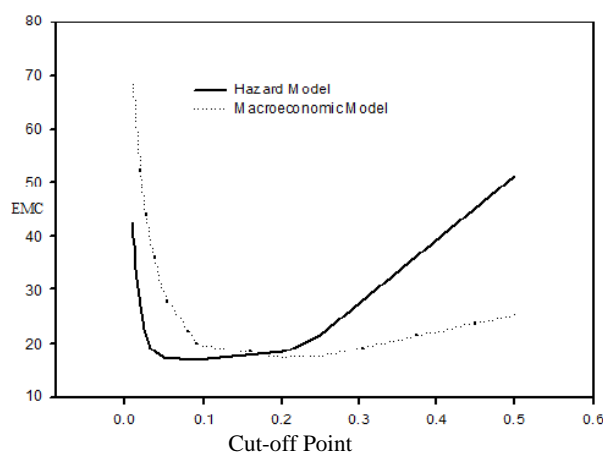


Fig. 3 Comparisons of the sum of Type I and Type II errors between hazard models and macroeconomic models for test sample in 2007

*C. Prediction Accuracy of the Test Sample*

If the difference of the error rate is positive, it suggests the superior performance of two-stage model to the one stage model. In one-stage models, the cut-off indicator is the optimal cut-off scores, and in two-stage models, it is the distressed cut-off point, adjusted by credit cycle index,  $Z_t$ . As for the forecasting result of the test sample in 2007, the number of Type II error of the one-stage model with macroeconomic factors is much larger than that without macroeconomic factors. However, they both have the same Type I error rate. Since the one-stage macroeconomic model has larger Type II error rates than the one-stage model without macroeconomic factors, the former do not outperform the latter. The findings exhibit that the misclassification error rate of our model is smaller in 2007 than that in 2008, which suggests that the model performs better in short-term.

Comparing the one-stage and two-stage models for the test sample in 2007, the sum of Type I and Type II error rate of the two-stage model incorporating financial ratios is lower than that of the two one-stage models. Particularly, the two-stage model has the lowest Type I error rate. It also claims the lowest sum of Type I and Type II error rate. Misclassification of distressed firms as non-distressed firms can be reduced if the firm-specific and macroeconomic factors are separated in the financial prediction.

Comparing the one-stage and two-stage models for the test sample in 2008, the sum of Type I and Type II error rate of the two-stage model incorporating financial ratios is lower than that of the two one-stage models. Particularly for the test sample in 2008, the one-stage multinomial logit model which incorporates macroeconomic factors predicts one "reorganization and bankruptcy" firms as non-distressed firm. On the other hand, none of "reorganization and bankruptcy" firms are misclassified as non-distressed ones for two-stage models. Since misclassification of "reorganization and bankruptcy" firms into non-distressed firms induces more losses than other types of misclassifications, the evidence implies the better forecast quality for the two-stage models. Specifically, the two-stage model has the lowest Type I error rate. It also claims the lowest sum of Type I and Type II error rate. Misclassification of distressed firms as non-distressed firms can be reduced if the firm-specific and macroeconomic factors are separated in the financial prediction.

#### V. CONCLUSIONS

Previous studies on financial distress prediction choose the conventional failing and non-failing dichotomy; however, the distressed extent differs substantially among different financial distress events. To solve the problem, three states, "non-distressed", "slightly-distressed" and "reorganization and bankruptcy", are used in our article to approximate the continuum of corporate financial health. The other unique contribution is that this study employs macroeconomic factor to determine the cut-off point, which distinguishes distressed firms from non-distressed ones. This paper explains multiple financial states of Taiwanese listing firms using the two-stage method. First, this investigation adopts firm-specific financial ratios, corporate governance and market factors to measure the probability of multiple financial status based on multinomial logit models. Second, this work further applies macroeconomic factors to establish the Kim [13] credit cycle index and determine the distressed cut-off indicator of the two-stage models using such index. Two different models, namely: one-stage and two-stage prediction models are developed to forecast the occurrence of "slightly-distressed" and "reorganization and bankruptcy" events. The results of various models are compared with each other, as well as with the collected data. The results show that the managers of these reorganization and bankruptcy firms truly disclose such events in financial statements. Hence, financial ratios explain the occurrence of reorganization and bankruptcy more precisely than explaining slightly-distressed events.

Our findings suggest that investors in emerging areas can hardly detect "slightly-distressed" events, which may develop into more serious situations. When the financial statements are bad, the corporation may already be on the verge of bankruptcy and reorganization. Investor or creditors cannot respond immediately and terminate their loans or investments before firm's situation becomes worse. Therefore, when investigating "slightly-distressed" events in emerging markets, corporate governance is a better choice, which is confirmed by the study." If investors could also pay attention to changes in corporate

governance variables, they could effectively detect these slightly distressed events and prevent suffering huge losses. Our multinomial logit model captures critical factors that cause the slightly-distressed, reorganization and bankruptcy events, respectively. And it further estimates the probabilities that a firm will enter each of the three financial states. Thus, credit risk management can be executed based upon our investigation, especially for firms in emerging markets, whose financial statements are not as transparent as those of developed area firms. In addition, the EMC results demonstrate that the performance deteriorates if macroeconomic factors are included in the two-stage models for forecasting financial distress. Comparing the accuracy between one-stage and two-stage models, prediction model performance does not improve as the distressed cut-off indicators are adjusted according to the macroeconomic factors in the two-stage models.

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