Predicting Financial Distress: Evidence from Thailand

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ABSTRACT

The objective of this study is to develop the reliable model in predicting the financial distress of nonfinancial firms listed on the Stock Exchange of Thailand (SET). The stepwise logistic regression analysis is employed to a data set of 45 matched pairs of financially distressed and healthy firms over the period of January 2000–March 2009. Results indicate that the final model includes four financial ratios, the return on assets, debt-to-equity ratio, current ratio, and cash flow from operation-to-net income, and three corporate governance variables, the CEO duality, managerial ownership, and institutional ownership. In addition, the final model provides the impressive results in which it demonstrates excellent classification accuracies in one-year prior to the financial distress with the overall classification rate of 95.6%. However, the finding shows that there is no significant impact of macroeconomic variables on the future financial distress.

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1. INTRODUCTION

The failure of firm entails great loss to all stakeholders. It definitely destroys the firm's value and poses the long lasting consequences to the wealth of the suppliers of capital, management, and employees. The suppliers of capital are likely to lose their investment, the management is likely to lose their positions and reputation, and ultimately the employees are likely to lose their jobs. However, the degree of the negative impact of firm's failure to all interested parties depends upon the effectiveness of the adopted turnaround strategies to escape from the failure event. The degree also depends on the severity of failure event, such as the negative cumulative earnings, nonpayment of a preferred stock dividend, the default on loan principal/interest payment, the loan renegotiation, the formal liquidation, and the bankruptcy petition.

As the matter of fact, the failure of firm does not frequently occur. Nonetheless, when taking place, it rocks the market. The series of US firms' failure, e.g. Lehman Brothers, Washington Mutual, Merrill Lynch, and American International Groups have led to a substantial decline in major indexes. These events have been claimed to be the worst collapse in the financial history for the US since the attacks on September 11, 2001 and this turmoil of stock market is likely to continue and spill over throughout the world. In case of Thailand, the well-known financial scandal was taken place during the 1997, namely as the Asian financial crisis. At that time, Thai Baht currency was attacked and had been weakened. The Thai stock market was immediately hit by this crisis and dropped suddenly. Thailand was forced to accept a financial rescue package from the International Monetary Fund. Consequently, many Thai firms went bankrupt, particularly for firms in financial industry; approximately fifty-six finance companies were out of business.

Obviously, the consequences of these financial scandals severely affect the health of the nation, industries, firms, and specific individuals. An early warning of impending failure is imperative to predict the firm's failure promptly and accurately. This will enable a number of concerned parties such as investors, creditors, managers, auditors and government authorities to take either preventive or corrective actions to avoid or mitigate the potential losses which would be incurred (Keasey & Watson, 1991).

Therefore, the proper failure prediction model should be developed. This model should accumulate the possible causes of firm's failure. However, the causes that lead firms to fail vary greatly. One possible cause of failure is the firm's misconduct that can be

analyzed through the financial ratios of the firms. Since the 1960s, there has been a number of studies examining the financial ratios simply as the indicators of the failure (Altman, 1968; Beaver, 1966, 1968; Blum, 1974; Casey & Bartczak, 1985; Gilbert, Menon, & Schwartz, 1990; Nam & Jinn, 2000; Ohlson, 1980). The ratio analysis then becomes the basis in refining and developing the failure prediction models.

Another main cause of the firm's failure investigated from the prior financial scandals is perhaps the firm's mismanagement which is the consequence of the management decision heavily reflecting self-serving behavior. In general, the action of management could be seen through the firm's corporate governance practices. For example, the failure of Enron in 2001 was due to weak corporate governance mechanisms that provided an opportunity to the firm's executives to commit the fraud. WorldCom had also reported that its earnings were subject to earning management, indicating the problems of the accounting irregularities and lack of good monitoring system. Hence, these two events have raised the attention of individuals about the corporate governance; the trend is toward better corporate governance.

According to the concerns of good corporate governance, the US senate had passed the Sarbanes-Oxley Act (SOX), causing many changes to the US stock exchanges' regulations. The SOX is mandatory for all listed firms in the US stock markets. The primary purpose of the SOX is to reduce the divergence of interests of management and those of capital suppliers and to mitigate the possibility of mismanagement and fraud commitment through the effective internal controls. Thus, the application of SOX can enhance the reliability and accuracy of the financial reporting and the efficiency of management to pursue the interest of owners (Sarbanes-Oxley Act, 2002).

Moreover, for Thailand, since the corporate governance has been recognized as one of causes of Asian financial crisis in 1997 (Johnson, Boone, Breach, & Friedman, 2000), in early 1998, the Stock Exchange of Thailand (SET) tended to improve the corporate governance of Thai listed firms. At that time, the SET required all listed firms to have an audit committee and established the guideline, namely "Code of Best Practices for Directors of Listed Companies" to be used with such requirements. Furthermore, in 2002, the SET proposed the 15 principles of good corporate governance for listed firms to comply to promote firm responsibility, increase public disclosure, and improve the quality and transparency of financial reporting and auditing. This is viewed as an important step to enhance the effectiveness of corporate governance in Thailand. However, unlike the SOX,

these principals are not compulsory; they are based on the apply-or-explain basis. It means that the listed firms are required to disclose how they apply the 15 principles in their annual registration statement (Form *"56-1"*) and annual reports; however, if they do not follow any of these principles, they are just required to explain the reasons. Therefore, it is likely that the recent global financial scandals and the Asian financial crisis in 1997 have raised the concerns on the importance of good corporate governance for the survival of firms in the long-term.

The other factor that may cause the firm to be out of business may be viewed through the macroeconomics. Many economists have believed that the macroeconomic phenomenon, such as a tight monetary policy (Altman, 1971), high interest rates (Charitou, Neophytou, & Charalambous, 2004), the state of economy (Dambolena & Khoury, 1980; Mensah, 1984), high inflation (Liou & Smith, 2007; Tirapat & Nittayakasetwat, 1999), attribute to the failure of firms. Even though the impact of macroeconomic conditions on the firm's failure has not been examined popularly, comparing to those studied on the ratio analysis or corporate governance, it seems likely that the macroeconomic factors can influence the firm's failure.

Recently, the ample of research globally have investigated the usefulness of ratio analysis, corporate governance, or macroeconomic variables in predicting firm's failure. Many events, e.g. bankruptcy (Altman, 1968; Casey & Bartczak, 1985; Charitou et al., 2004), the loan default/accommodation (Ward & Foster, 1997), and the market value of a firm below half of its capital stocks (Lee & Yeh, 2004), have been used as the proxy event of failure. However, in this study, the financial distress or the inability to settlement the obligation is mainly referred as the proxy of failure's event.

Considering prior financial distress studies, it is found that many of them provide impressive results in predicting financial distress. However, the primary problem of those studies is that these models developed previously could not be directly employed to predict the financial distress of firms in Thailand due to the differences in environment, such as regulations, sample selection, and methodology. Even though prior evidence shows that several researchers developed the predictive models for Thailand, many of these existing models are used for the purpose of indicating the firm's performance, which may be further useful to predict the financial distress. For instance, Jinarat and Quang (2003) examined the relationship between the corporate governance and firm's performance and suggested that strong corporate governance policies, procedures, and mechanisms at the

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corporate level can enhance the good corporate governance at the functional level and finally lead to an increase in firm's performance. Dhnadirek and Tang (2003) investigated the corporate governance system in finance industry in Thailand before the 1997 financial crisis and documented that ownership concentration is the primary cause of corporate governance problems. In addition, Limpaphayom and Polwitoon (2004) empirically studied the effects of corporate governance before the 1997 financial crisis. They emphasized on the relationship between bank relations, as lending and equity ownership, and firm's performance and reported that these relationships have a significant impact on the firm's value.

However, some researchers developed the models directly predicting the financial distress in Thailand. The fact is that these studies were limited to the investigation of the Thai financial institutions failed during 1997. Jaikengkit (2004) examined the relationship between the corporate governance and the probability of financial distress and reported the positive relationship between the managerial ownership and probability of financial distress. In addition, Tirapat and Nittayagasetwat (1999) investigated the financial distress using macroeconomic variables and suggested that inflation was the most influencer of Thai financial firms failed during 1997. Nonetheless, the evidence on the relationship between the corporate governance and financial distress is relatively limited in Thailand.

Furthermore, it is observed that none of prior empirical studies proposes a model that uses the vital causes of failure, which are the financial ratio, corporate governance, and macroeconomic factors, to predict the financial distress of firms in Thailand. In addition, some models are not generalized and could be employed only by the particular Thai industry, e.g. financial sectors. Hence, there is a need of an integrated model used to predict the possibility of financial distress of Thai firms. Such model should incorporate all three primary indicators of financial distress and could be applied in all Thai industries, except the financial industry.

Therefore, the primary purpose of this study is to develop a model as an early warning tool to predict the financial distress of firms. Once the stakeholders can detect in advance whether a firm enters to the financial distress condition, they can take actions to prevent the occurrence of ultimate failure as early as possible to reduce the substantial losses of failure. Moreover, since many firms are now affected by the World financial crisis, the model proposed in this study, which is of particular relevance in today' Thai financial market, can help firms reduce the probability of financial distress. In addition,

results in this study will contribute toward important findings on non-US empirical test on the relation between three primary variables, which are the financial ratios, corporate governance, and macroeconomic variables, and the possibility of financial distress. They also add to the growing literature on the applicability of the corporate governance in Thai capital market to enhance the firm's value and avoid the financial distress. They also contribute to the existing literature that studies the ability of financial ratios and macroeconomic variables to predict the possibility of financial distress.

The paper is organized as follows. Section 2 discusses prior literature related to the study. Section 3 explains data collection, variable measurements, and statistical methods. Section 4 presents empirical results. Lastly, section 5 is the conclusion.

2. RELATED LITERATURE

The substantial volume of researchers developing the financial distress prediction models admits that the financial ratio is one of major predictors of the financial distress because the financial ratio can reflect the financial conditions of firms. The earlier work of Beaver (1966) indicated that the financial ratios can predict the likelihood of bankruptcy. His univariate study evidenced that the financial ratios of bankrupt firms generally differ from those of nonbankrupt firms and pointed out that the cash flow-to-debt ratio, out of thirty ratios examined, is the best single predictor. Even though Beaver (1966) found that different ratios will provide different levels of success in predicting the bankruptcy, the financial ratios can significantly convey useful information and signal the financial conditions of firms well before the bankruptcy. In addition, Altman (1968) believed that financial ratio measurements of a bankrupt firm and a nonbankrupt firm are significantly different. Because of this, he developed a mutivariate discriminant model to classify the bankrupt firms from the nonbankrupt ones. His discriminant model contains five ratios representing five distinguish financial dimensions; profitability, liquidity, solvency, leverage, and activity ratio. His discriminant model yielded an excellent accurate classification for the first year prior to bankruptcy. Furthermore, Ohlson (1980) applied the logit analysis to predict the likelihood of bankruptcy. He concluded that with the logit technique and selected variables, the best outcome is to predict the probability of bankruptcy one year before the actual failure with four primary factors. Three of the four

factors are financial ratios, which are the total liability-to-total asset ratio, the net income-to- total asset ratio, and the working capital-to-total asset ratio.

The well-known studies of Beaver (1966), Altman (1968) and Ohlson (1980) have prompted many researchers to further investigate the roles of financial ratios in the prediction of financial distress context. For example, Nam and Jinn (2000) included thirty-three traditional financial ratios when developing the statistical model as an early warning sign of impending financial distress. Their investigations covered the financial ratios that measure profitability, turnover, growth, productivity, fixed charge coverage, solvency, leverage, and liquidity. They found that the measures of firms' ability of serving short-term debts, financial expense to sales ratio, and receivable turnover ratio comprise the prediction model. In addition, Ang, Cole, and Lin (2000) deployed the two financial ratios, the operating expense-to-sales ratio and the annual sales-to-total assets ratio, as the measurements of the agency costs. The two ratios can help indicate how effectively the firm can control operating expenses, and how well the firm can utilize its assets, respectively. Ang et al (2000) found that poor performance firm will generally have a high (low) ratio of expense-to-sales (sales-to-asset) because the managers are unable to control the costs and make the appropriate investment decisions e.g. the purchase of unproductive assets, implying the existence of significant agency problems.

However, the use of financial ratios alone in prior studies is subject to one serious criticism. That is, the financial ratios previously deployed are accrual accounting financial ratios (accrual ratios hereafter) that cannot reflect the ability of a firm to manage its future cash flows. Because of this, many researchers have been interested in investigating whether the cash flow data can provide incremental predictive power over accrual ratios in the financial distress studies. Examining the cash flow ratios through a cash flow statement may allow researchers to have better information content in assessing better the amount, timing, and uncertainty of future cash flows. Gombola and Ketz (1983) reported that cash flow from operation ratios provide certain information that is not explained by other accrual ratios. Thus, they argued that the Altman (1968)'s bankruptcy model should be used with care because it lacks the inclusion of the cash flow ratios. Moreover, Gentry, Newbold, and Whitford (1987) asserted that in addition to the accrual ratios, the cash flow ratios can be accounted for in order to explain the financial health or illness of a particular firm. Next, Gilbert et al. (1990) noted that the cash flow variables have a significantly predictive ability in the financial distress models. Furthermore, Charitou et al. (2004)

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evidenced that the bankruptcy prediction model containing the three financial variables: a cash flow ratio, profitability variables, and a financial leverage variable, provides a relatively high accuracy rate of classification one year prior to the actual bankruptcy. Hence, they concluded that the operating cash flow ratios should be considered when developing the financial distress prediction model because they can convey important information. As firms face difficulty in generating cash from day-to-day operations, firms will encounter insolvency.

Hence, the study presents the financial distress prediction model that incorporates accrual-based and cash flow-based ratios as its core. For the accrual-based and cash-flow based ratios, each covers four dimensions of financial measurements; profitability, leverage, liquidity, and asset utilization. In terms of financial ratio analysis, it is often expected that firms that are less profitable, high leveraged, less liquid, and less ability to utilize assets are those who are unable to settlement their obligations. Once these adverse conditions exist, the probability of financial distress is more likely to increase.

Although the financial ratios, both accrual-based and cash flow-based ratios, are claimed to be decent variables comprised in the financial distress models, they have been criticized. Firstly, the financial ratios, derived from financial statements, may be subject to earning management; the management manipulates the firm's financial results to meet predetermined earnings targets (Lee & Yeh, 2004). Particularly, some financially distressed firms may improperly change their underlying accounting policies to temporarily increase operating income and prevent firms from defaults and bankruptcy (Opler & Titman, 1994). In addition, different firms may apply differing accounting treatments; thus the identical ratios from different firms may not be compared. Next, the financial ratios are calculated using the financial data over a fixed period, but the financial distress is dynamic event representing the inability of firms to meet the obligations. Hence, it is questionable whether it is useful to include only the financial ratios in predicting the financial distress (Johnson, 1970). Moreover, Gilbert et al. (1990) argued that using the financial ratios alone may lead to the lack of information content and model misspecifications for prediction purposes. Because of these, it is suggested that perhaps the nonfinancial variables, not reflecting in financial statements, can alternatively explain the financial distress. These nonfinancial variables should be related to the incentives of particular parties who concern in the performance of firms and involve in decision-making. Keasey and Watson (1987) indicated that for the context of financial distress prediction,

the models including nonfinancial ratios significantly outperformed the models solely containing the financial ratios.

Recently, financial researchers have been increasingly applied the nonfinancial variables for prediction purposes. One of nonfinancial variables, widely recognized, is the corporate governance variable. Simpson and Gleason (1999) indicated that understanding the internal processes behind the firm's decisions through the corporate governance mechanisms is to assess the reasonableness of financial distress. However, to efficiently explain the relationship between the corporate governance and financial distress, the agency theory is addressed.

Agency theory explains the conflict of interests between the agents and principals. As a firm is view as an intermediate function presenting the contractual relationships between the agents and principals, those agents obtain the decision making authorities from the principals and then act on behalf of principals (Jensen and Meckling, 1976). In general, the principals expect that the agents will make business decision to pursue the principal's interest, but at the same time, the agents want to have their own interests. If both parties tend to maximize their utilities, it can be presumably believed that the agents will not always have the same goals with those of principals, leading to the agency problems. Moreover, the agency problem tends to arise when the managers are less willing to comply with the governance roles (Walsh & Seward, 1990). Without the compliance made by the agents, the principals might be doubtful on the actions of the agents, resulting in the greater agency costs. As the agency costs increase, the value of the firm declines. The reduction of a firm's value can lead to an increase in the probability of financial distress (Johnson et al., 2000). As a result, it can be concluded that the financial distress is related to corporate governance mechanisms via the explanation of the agency theory.

To mitigate the agency problems, broadly speaking, the primary internal and external corporate governance mechanisms are to assure that the agents are acting in line with the interests of principals (Cremers & Nair, 2005; Fama, 1980; Fama & Jensen, 1983; Denis & McConnell, 2003; Shleifer & Vishny, 1986, 1997). However, this study emphasizes on the roles of internal corporate governance mechanisms, which can be categorized into two primary types; the board of directors compositions and ownership structures.

The structure of board of directors (board hereafter) is an important internal corporate governance mechanism. The shareholders, delegate their authorities about internal control and other decision to board (Fama, 1980). Hence, the board is accountable

to the shareholders due to their commissions to represent shareholders' interests. In many cases, the board is responsible to incorporate a corporate governance role in monitoring, controlling, and regulating of management to enhance the effectiveness (Goodstein, Gautam, & Boeker, 1994). The board is also empowered by the shareholders to appoint, dismiss, monitor, evaluate and compensate management, the chief executives, with the purpose of shareholder's value maximization (Denis & McConnell, 2003). In addition, the board involves in establishing the firm's strategies to increase the firm's growth. The board also determines the firm's strategic direction, establishes productivity objectives, attempts to accomplish the desired objectives, and enhances business success (Goodstein et al., 1994; Hambrick & Mason, 1984; Mizruchi, 1983). Thus, it becomes clear evidence that the board activities are directly related to the corporate governance roles, which further enhance the performance and hence affect the survival of the firm. Although the board is responsible for the performance of the firm, an uninformed, dysfunctional, inefficient board, such as one that fails to oversee and monitor the management activities, inadequately complies with internal policies, lacks honestly and integrity value, ineffectively utilizes the firm's assets, and establishes the policies aligning with its own benefits, leads to the firm's failure (Argenti, 1976; Jensen, 1993).

Many empirical studies have shown that the corporate governance mechanisms can enhance a quality board via the effective board structure. Jensen and Meckling (1976) addressed that the board directors should not be dominated by the CEO or executive management since the primary responsibility of the board is to monitor the activities of management. Then, it is suggested that the boards include the outside directors, independent from management, in order to create the effective boards (Zahra & Pearce, 1989). These outside directors can represent the interests of principals rather than inside directors (Fama, 1980; Pearce & Zahra, 1992; Rechner, 1989; Walsh & Seward, 1990; Weisbach, 1988), help resolve the conflicts among internal managers and make decisions to reduce the agency problems (Fama & Jensen, 1983), use aggressive strategies to encourage the necessary changes to improve performance (Judge & Zeithaml, 1992), and participate intensively in a firm's restructuring to prevent further performance declines and bankruptcy (Johnson, Hoskisson, & Hitt, 1993). Hence, boards dominated by many outsiders may be superior to other boards in contributing to managerial effectiveness (Wagner, Stimpert, & Fubara, 1998) and reducing the probability of financial distress.

Moreover, an effective board should be truly independent from the CEO (Fama & Jensen, 1983). To be independent, the chairman of board should not be the same person as the CEO, implying that decision control and decision management functions are separated (Jensen, 1993). If the CEO also serves as the chairman of board, namely as CEO duality, he will be too powerful and he can significantly control and overpower the board monitoring and incentive mechanisms. He is thus more likely to pursue personal interests, e.g. increasing his compensation (Hill & Phan, 1991) rather than the owners' interests. A CEO with overriding control can mitigate the effectiveness of board's monitoring, creating serious agency problems. Hence, to limit the managerial opportunisms and dilute the power of CEO to override the monitoring systems, the CEO and board chairman positions should be held by different individuals (Baliga, Moyer, & Rao, 1996; Dalton & Kesner, 1987; Fama & Jensen, 1983; Jensen, 1993; Mizruchi, 1983; Molz, 1988; Zahra & Pearce, 1989). Several prior empirical studies have provided evidence to support the benefit of the separation of CEO and board chairman to the firm's performance. Pi and Timme (1993) reported that firms with separated leadership structure consistently outperform those with combined structure. Rechner and Dalton (1991) evidenced that the adoption of the separation of CEO and chairman functions increases accounting returns. Furthermore, Wang, Jeng, and Peng (2007) found that when the CEO is not the same person as the board chairman, the firm's performance increases. Hence, it is reasonable to believe that the probability of financial distress tends to increase with the presence of CEO duality.

Furthermore, the size of the board can determine the quality of managerial monitoring and controlling. Jensen (1993) proposed that the board should be small containing about seven to eight members so that the board can incorporate effectively and can play a controlling function efficiently, resulting in the improvement of performance. Although many empirical studies provided the findings that a smaller board is more efficient than a larger one, others found that large boards are valuable to the firm. Chaganti, Mahajan, and Sharma (1985) reported that a larger board can prevent firms from corporate bankruptcy. They found that the bankrupt firms, on average, exhibit smaller boards than the nonbankrupt ones. Dalton, Daily, Johnson, and Ellstrand (1999) asserted that the larger board has more capabilities to solve the problems and positively affects the firm's performance. Hence, it can be stated that the larger board can enhance firm's performance, whereas the smaller board can increase the probability of financial distress.

Besides the board structure, the ownership structure is an effective internal control as it is found that the agency costs increase when the agents have no financial interests in the outcomes of their decisions (Fama & Jensen, 1983). The typical financial interest of the agents reflects the substantial proportion of firm's equity ownership. The absence or minimum of ownership creates an incentive for the agents to pursue different goals from the principals and use their discretion to act in self-maximizing interests at the expense of principals (Boyd, 1994; Fama, 1980). As the divergence in interests between the agents and principals increases, the value of firm is likely to reduce (Jensen & Mecking, 1976). Hence, to mitigate the conflict of interest between the agents and principals, the agents should receive sufficient ownership of firm's equity or financial attachment in their firms; thereby they would behave like the owners and focus on maximizing both their own wealth and that of the firm (Jensen, 1993; Jensen & Meckling. 1976).

Prior literature of corporate ownership has discussed the several types of ownership that may reduce the incentive of the agents to maximize their own interests. Hill and Snell (1989) reported that ownership structure significantly affects performance. Fama and Jensen (1983) and Morck, Shleifer, and Vishny (1988) proposed that management, together with directors and officers should hold a substantial proportion of their firm's equity. Those managers owned their firm's shares can better align their goals with those of the firm's stakeholders (Denis & McConnell, 2003). Because of these, it can be expected that the substantial shareholdings of insiders, e.g. management, mitigate the probability of financial distress.

In addition to the shareholdings by insiders, the share ownership of outsiders, such as outside directors, institutions, and blockholders (via the concentrated ownership) affects the firm's performance through the effective monitoring. Evidence shows that a substantial increase of shareholdings by outside directors provides greater incentives for monitoring management (Jensen, 1993) and diminishes the likelihood of financial fraud (Beaver, 1966). Moreover, institutional investors, such as financial institutions, money and pension funds, can enhance an effective monitoring system. They can better pressure and discipline the management; hence this can reduce the ability of management to pursue their own benefits (Shleifer & Vishny, 1997). Furthermore, the blockholders play an important role in monitoring and influencing the management to behave in the ways that increase the shareholders' wealth (Denis & McConnell, 2003). The role of blockholders also mitigates the free-rider problem arising because of a widely dispersed share ownership (Grossman &

Hart, 1980). As shareholders hold very small proportions of their firm's equity, they are less likely to monitor management or influence decision making within the firm due to additional costs of doing so. With this free-rider problem, the management is more likely to act against of the stockholders' interests. As a result, it can be presumed that the ownership structures, such as managerial ownership, outside director's ownership, institutional ownership, and blockholder's ownership can be determined as the important internal governance tool to reduce the agency costs and lessen the probability of falling into financial distress.

Aside from the corporate governance variables, the macroeconomic factors, the other nonfinancial ratio-based data, has been examined in the prior financial distress studies. Even though the macroeconomic variables are less pronounced in financial distress prediction models, the inclusive of the macroeconomic variables in addition to the financial ratios and corporate governance variables is likely to improve the predictability of models seeking the firms' financial distress.

Altman (1971) was among the first who evidenced the relationship between the macroeconomic variables and financial distress. He found that a tight monetary policy is positively related to the probability of financial distress and pointed out that the negative expectations of investors about economic events cause the financial distress about to occur. Dambolena and Khoury (1980) indicated that the financial distress is linked to the state of economy. In addition, Charitou et al. (2004) suggested that high interest rates, recession-squeezed profits, and high debt burden can contribute to the financially distressed firms. Mensah (1984) reported that the probability of financial distress substantially increases during economic recession and that the incidence of financial distress is apparent at least three years before the event. Liou and Smith (2007) examined the relationship between financial distress and macroeconomic factors for UK manufacturing industry. They found that several macroeconomics variables such as interest rate, industrial production index, and producer price index are significant and related to the financial distress. Keasey and Watson (1991) suggested that the firm's performance, the probability of financial distress, and the macroeconomic conditions are correlated. They recommended that the researchers develop the financial distress model with the macroeconomic variables incorporated as one of important predictors. Moreover, Tirapat and Nittayakasetwat (1999) suggested the significant relationship between inflation and probability of financial distress in Thailand during the Asian economic crisis.

Overall, prior empirical evidence points out many effects of macroeconomics on the occurrence of financial distress. Firstly, during the adverse economy, e.g. recession, the probability of financial distress increases. Moreover, as the firms cannot raise their selling prices at the time the costs of the production increases, the profitability of firm reduces. This will increase the chance of insolvency of firms, leading to financial distress. Furthermore, in period of rising price, high inflation, the consumption is likely to decline. This makes the profit margin of firms reduce. As firms are less profitable, the probability of financial distress increases. Finally, once the interest rate increases, the firms that are inefficient in managing the assets tend to have a high chance of default, increasing the probability of financial distress.

3. METHODOLOGY

3.1. Data Collection

In this study, the sample firms are drawn from firms listed on the Stock Exchange of Thailand (SET). They are in nonfinancial industry, classified by the SET regulators. The reasons the sample excluding firms in financial industry are because the financial firms are structurally different from the others on the general accounting policies (Gilbert et al., 1990) and the financial firms have different failure environment (Ohlson, 1980).

A one-to-one basis of matching the financially distressed and healthy firms is adopted. The financially distressed firms are those who were delisted and/or were under the rehabilitation (REHABCO) or non-performing group (NPG) during the period of January 2000 to March 2009. For the delisted firms, only the firms that were under the REHABCO sector before delisted are included in the sample. For the REHABCO firms, they are those that have the value of their stockholders' equity section as shown in the audited balance sheet is below zero. Generally, to inform the investors that the firms are under the REHABCO section, the SET regularly posts the signs NC (Non-compliance) and/or SP (Suspension) on their stocks.

Hence, in this study, there are 45 financially distressed firms in the sample, in which a total of 37 out of 45, financially distressed firms are under the REHABCO sectors, as shown in Table 1. The 45 financially distressed firms are paired with the healthy ones in terms of industry, size, and failure year, meaning that the financially distressed firms are

those who are in the same industry group and approximately the same size, measured by total assets. This matching design is consistent with the vast variety of prior financial distress prediction studies (Altman, 1968; Aziz & Lawson, 1989; Beaver, 1968; Casey & Bartczak, 1985; Charitou et al., 2004; Wilcox, 1973). In addition, the matched firm must have data available for the same year as financially distressed firm up to two years prior to the actual failure. Therefore, as shown in Table 1, this matching design creates a total of 90 firms in this study's sample over the period January 2000 – March 2009.

Even though the study intends to employ a nonrandom matched sample, violating the random sampling assumption and ultimately causing the biases in both parameters and probability estimates, this nonramdom sample designs do not affect the statistical inferences and overall classification accuracy rates (Zmijewski, 1984).

[Insert Table 1 Here]

3.2. Selection and Measurement of Variables

Table 2 presents all selected variables in this study with their measurements, symbols and expected signs. The dependent variable is the financial distress, which is the binary variable where equals to 1 for a financially distressed firm and 0 for otherwise. The proposed independent variables in this study are factors that contribute to a financially distressed condition in prior financial distress literature. The selection of these variables is based on the data availability, frequency of citation, significance, and supporting theories and concepts. Hence, a total of 19 independent variables comprising of three groups of variables are proposed. The first group of the independent variables contains a total of 8 traditional financial ratios. They are return on assets *(ROA)*, debt-to-equity ratio *(DE)*, current ratio *(CURRENT)*, asset turnover ratio *(TATURN)*, cash flow from operation-to-net income ratio *(CFNI)*, cash flow from operation-to-liabilities ratio *(CFLT)*, cash flow from operation-to-current liabilities ratio *(CFCL)*, and cash flow from operation-to-assets *(CFTA)*. The first four variables represent accrual-based ratios and the remaining variables are the cash flow-based ratios. The financial data 1-year prior to financial distress, used to calculate these ratios, is obtained from the SETSMART database. The 1-year lagged of financial ratios is consistent with prior studies reporting its usefulness in classifying the failed/nonfailed firms (Altman, 1968; Ohlson, 1980).

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The second group of the independent variables is the corporate governance data that are drawn from the firm's registration statement "*56-1*" forms. The 1-year lagged corporate governance variables are preferable. There are a total of 7 corporate governance variables which are classified into two groups. First is the composition of board of director which is proxied by the proportion of outsiders serving on the board *(OUT)*, the CEO duality *(DUAL)*, and the board size *(BSIZE)*. Second is the ownership structure which is proxied by managerial ownership *(MOWN)*, outside director's ownership *(ODOWN)*, institutional ownership *(IOWN)*, and concentrated ownership *(COWN)*.

The last group of independent variable is the macroeconomics obtained from the Bank of Thailand. These macroeconomics variables are also assigned to be 1-year lagged. This study purposes four macroeconomic variables. First is the gross domestic product as the measure of overall economic performance. Second is the manufacturing production index as the measure of the industrial performance. Third is consumer price index as the measure of inflation. The final is the interbank rate as the measure of interest rate.

[Insert Table 2 Here]

3.3. Statistical Methods

To develop the prediction model, all variables are examined by using two statistical methods; the univariate analysis and logistic regression analysis. The univariate analysis is an important initial step to determine any possible differences between the financially distressed and healthy firms. To achieve this, the test of mean difference, the *t-test* is implemented. Moreover, given a binary dependent variable and a series of independent variables, the stepwise logistic regression analysis is applied. The logit analysis is preferable because (i) it is appropriate procedure when the dependent variable is a binary variable, purposely testing on the different values between two groups (Aziz & Lawson, 1989), (ii) it provides the significance of parameter estimate (Ward & Foster, 1997), (iii) it allows the researchers to obtain the probabilities of financial distress for classification purpose (Ohlson, 1980), and (iv) it is frequently employed in the prior studies of bankruptcy or related events (Casey & Bartczak, 1985). In addition, a maximum likelihood estimation approach is applied to estimate the logistic model. This approach is appropriate because it does not require any distribution on the independent variables (Nam & Jinn,

2000) and it provides the parameter values that maximize the likelihood function, identical to a minimizing the sum of squared residuals (Diebold, 2004). The -2log likelihood statistic, distributed as a chi-square (χ^2) distribution, together with the Pseudo R square are employed to test the significance of overall model (Simpson & Gleason, 1999). Moreover, the stepwise procedure is executed because this study proposes a number of independent variables and the *Pearson* pair-wise correlation, as shown in Table 3, shows that many variables are significantly correlated. Hence, using the stepwise procedure, the problem of muticollinerity can be resolved and the "reliable" model for distressed prediction can be obtained (Dielman, 1996).

[Insert Table 3 Here]

4. EMPIRICAL RESULTS

4.1. Univariate Test

Table 4 presents the means and mean differences with their respective *t*-values of all independent variables for the 45 financially distressed firms and the 45 healthy firms for the year prior to financial distress. It can be clearly observed that the financially distressed firms underperform the healthy firms in terms of financial ratio analysis. Evidence shows that the mean differences of the return on assets *(ROA)* and cash flow from operation-to-net income ratio *(CFNI)* are significantly negative in which the *ROA* is about -1.12 and the *CFNI* is about -0.06 for the financially distressed firms vs. 0.06 and 3.48, respectively for healthy firms. As the *ROA* and the *CFNI*, measured profitability, are significantly lower for the financially distressed firms than for the healthy ones, it can be stated that the financially distressed firms have less ability to generate the profit than the healthy firms. Moreover, the mean differences of the current ratio *(CURRENT)* and the cash flow from operation-to-current liabilities ratio *(CFCL)* are significantly negative. It is found that the *CURRENT* is about 1.33 and the *CFCL* is about −0.02 for the financially distressed firms vs. 2.49 and 0.61, respectively for the healthy firms, implying that the ability to meet the short-term obligations are less for the financially distressed firms. Next, the mean difference of the cash flow from operation-to-total liabilities ratio *(CFLT)* is significantly positive in which the *CFLT* is about -0.06 for the financially distressed firms vs. 0.40 for

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the healthy ones. This means that the financially distressed firms have a relative high debt to cash flow, resulting in less ability to generate cash directly from its operation to pay off the long-term obligations, comparing to the healthy firms. Furthermore, the mean difference of the cash flow from operation-to- assets *(CFTA)* is significantly negative. This result indicates that the *CFTA* is less than 0 for the financially distressed firms vs. about 1 for healthy firms. As the *CFTA* is the proxy of asset utilization, it means that the financially distressed firms demonstrate a much lower ability to utilize the assets to generate the cash flow. However, it is observed that there is no statistical difference between financially distressed and healthy firms when considering the debt-to-equity ratio *(DE)* and asset turnover ratio *(TATURN)*. Hence, based on the financial ratio analysis above, it is not surprisingly that the financially distressed firms are less profitable, high leveraged, less liquid, and less ability to utilize assets efficiently.

For the corporate governance variables, it is found that the mean difference of the CEO duality *(DUAL)*, where the CEO also holds the board chairman position, is significantly positive. This means that there exists the difference between the financially distressed and healthy firms in terms of a leadership structure in which the CEO duality are more practiced in the financially distressed firms than the healthy ones. Evidence shows that 14 out of 45 financially distressed firms allow the dual leadership structure, whereas only 4 out of 45 healthy firms exhibit the separated leadership function. Moreover, the mean difference of the board size *(BSIZE)* is significantly negative in which the average board size of financial distressed firms and of healthy firms is about 9 and 12, respectively. Therefore, this initial evidence demonstrates that the financially distressed firms establish smaller board than the healthy ones. Finally, the mean difference of the percentage of outside directors' ownership *(ODOWN)* is significantly negative in which the outside directors' ownership of the financial distressed firms, about 1.25%, is lower than that of healthy ones, about 5.13%. Hence, it can be initially concluded that the financially distressed firms demonstrate smaller board size, establish CEO duality, and have lower percentage of outside directors' ownership. Note that the proportion of outside directors to board members *(OUT)*, managerial ownership *(MOWN)*, concentrated ownership *(COWN)*, and institutional ownership *(IOWN)* are found to be indifferent between two groups.

[Insert Table 4 Here]

4.2. Stepwise Logistic Regression

Although the results of the univariate analysis indicate that only *ROA, CUREENT, CFNI, CFLT, CFTA, DUAL, BSIZE, and ODOWN* are statistically different between financially distressed and healthy firms, it cannot be concluded that only this group variables would have a strong predictive ability or a strong discriminatory power for the multivariate logistic regression model. Hence, all independent variables would be re-considered and re-entered into model when applying the stepwise logistic regression procedure. Table 5 demonstrates the results for the data of one year before financial distress[1].

[Insert Table 5 Here]

Results show that the independent variables that are entered the final model are the return on asset *(ROA)*, debt-to-equity ratio *(DE)*, current ratio *(CURRENT)*, cash flow from operation-to-net income *(CFNI)*, CEO duality *(DUAL)*, managerial ownership *(MOWN)*, and institutional ownership *(IOWN)*. The signs of all parameter estimates are expected. All variables are statistically significant, except the *IOWN* variable. Interestingly, the final prediction model includes only seven independent variables, which represent two main categories of variables, financial ratios and corporate governance variables. The macroeconomics variables do not appear to be an important influence on the probability of financial distress one year prior to the financial distress. In other words, there is no improvement to the model by adding the macroeconomic variables. This is not surprising because Table 3 indicates that there exists the high correlation among the selected macroeconomic variables and no correlation between the financial distress and macroeconomic variables. Hence, they are excluded from the final model.

Considering the financial ratio variables comprised in the model, the *ROA* and *CFNI,* which are the measurements of firm's profitability, are negatively related to the probability of financial distress. In terms of *ROA*, this means that the firms with a relative low *ROA* are inefficient use of their business assets in generating profit back to the firms. These low *ROA* firms tend to have high probability of falling into financial distress. Also, in terms of

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[1] As the stepwise regression is employed, only independent variables that highly contribute to the predictive ability of the final model are comprised; other variables are omitted.

CFNI, it implies that the firms with a relative low *CFNI* cannot generate high cash flow from the net income prepared on an accrual basis. These firms are more likely to have the cash flow problems, enhancing the probability of financial distress. Hence, the logistic regression results confirm the results of the univariate test above in which financially distressed firms are often less profitable. In addition, consistent with the expectations, the *DE* ratio is positively associated with the probability of financial distress. The higher the *DE* ratio, the greater the probability of financial distress is. With high amounts of liabilities in relation to total equity, the firm has more financial risk. With high financial risk, the firm can run into trouble. Particularly, during adverse conditions, the firm is more likely to be exposed to potential losses and is less likely to generate cash flow to pay off the existing liabilities. Hence, it is reasonable to conclude that the financially distressed firms are high leveraged which can be seen via the high *DE* ratio. Moreover, the *CURRENT* ratio is also negatively related to the probability of financial distress. This implies that with low *CURRENT* ratio, the probability of financial distress increases. As the current ratio points out the ability of a firm to match its liquid assets with its short-term liabilities, low current ratio can indicate the liquidity problem. Hence, it can be stated that the financially distressed firms are more likely to have a relatively low current ratio because of the risk of insolvency in the short-term. This is consistent with the univariate results above.

In terms of corporate governance variables, the parameter estimate of *DUAL* indicates that CEO duality has a significantly positive effect on the probability of financial distress in nonfinancial firms. This means that the financially distressed firms are more likely to have CEOs serving also as board chairmen, confirming the results of univariate analysis above. As the CEO holds the board chairman position, he is more likely to have the ability to pursue personal interests and less likely to be aligned with the interest of shareholders (Fama, 1980; Jensen, 1993; Jensen & Meckling, 1976). Moreover, the CEO holding the title of chairman of the board of directors may override the control. This can mitigate the effectiveness of board's monitoring, creating serious agency problems and ultimately enhancing the probability of financial distress. Furthermore, the parameter estimate of *MOWN* indicates the negative relationship between managerial ownership and the probability of financial distress. The result points out that once the management holds no-to-less shares of firm they serve, they have less incentive to align their goals with those of owners (Fama, 1980; Jensen, 1993; Jensen & Meckling, 1976). It is due to the fact that they do not involve in the financial outcomes which are the results of their decision. They

do not act like the owners; thereby they are more likely to pursue their self interests at the expense of owners' well-being. Because of these, the agency costs increase with the probability of financial distress. Moreover, it is observed that the *IOWN* is included in the final model with the expected sign, but it is statistically insignificant. This implies there is no influence of outside shareholders' ownership on the occurrence of financial distress. However, the inclusion of this *IOWN* can enhance the predictive ability of financial distress prediction model.

For the goodness-of-fit of the final model, the model chi-square and -2log likelihood are presented in Table 6. They are used to test the null hypothesis that all regression coefficients in the equation are zero. The results confirm that the null is rejected at a high significant level. This indicates that the model fits data very well. Also, to explain whether the set of variables included in the final model can explain a significant portion of the variability in the data, the Pseudo *R* Square is reported. The Cox & Snell *R* square of 0.671 and Nagelkerke *R* square of 0.895 indicate the good explanatory power of the final model.

[Insert Table 6 Here]

4.3. Classification Accuracy

To ensure that the financial distress prediction model obtained above is the "reliable" prediction model, the classification accuracy test is employed by using the Type I and Type II analysis (Altman, 1968; Casey & Bartczak, 1985; Gilbert et al., 1990; Nam & Jinn, 2000; Ohlson, 1980). Type I refers to the probability of accurate classification of financially distressed firm, while Type II refers to the probability of accurate classification of healthy firms. Hence, in this study the "reliable" financial distress prediction model should have the joint maximization of Type I and Type II.

To classify and predict a firm, the probability of financial distress for each firm is calculated from the cumulative probability function as in the following.

$$P = 1/\{1 + \exp[-(\beta_0 + \beta_1 X_1 + \beta_2 X_2 + ... + \beta_n X_n)]\}$$

Where, P = the probability of financial distress for firm i;

exp = exponential function;

$\beta_1, \beta_2, ... \beta_n$ = slope coefficients;

$X_1, X_2, ... X_n$ = independent variables;

Once the probability of financial distress is obtained, each firm is classified into financial distress or healthy based on a cutoff estimated probability of 0.5. As the estimated probability is more than 0.5, the firm is classified as financial distress and if less than 0.5, the firm is classified as healthy (Casey & Bartczak, 1985, Gilbert et al., 1990; Lee & Yeh, 2004; Nam & Jinn, 2000; Ohlson, 1980). Table 7 presents the classification accuracy for the prediction model based on data within the sample one-year prior to the financial distress. Results show that the Type I and Type II accuracy rates are overwhelming. This means that the final prediction model have the discriminating power to classify correctly the financially distressed firms about 97.8% (only 1 misclassification out of 45) and to classify correctly the healthy firms about 93.3% (only 3 misclassification out of 45). The results show the overall accurate classification rate of the model for the first year before financial distress is of about 95.6%.

[Insert Table 7 Here]

5. CONCLUSIONS

The study is aimed at developing a financial distress prediction model for nonfinancial firms listed on the SET via the stepwise logistic regression analysis. Using a sample of 45 financially distressed firms over the period of January 2000 to March 2009 and matched sample of healthy firms, the final prediction model combined measures of financial ratios and corporate governance variables. Other basic indicators of the macroeconomics are not found to be significant. However, this final model provides an impressive result in which it yields an overall correct classification accuracy of 95.6% one year prior to financial distress.

The financial ratios comprised in the final model are return on assets, cash flow from operation-to-net income, debt-to-equity ratio, and current ratio. The first two variables are the measurement of profitability, next is leverage, and last is liquidity. Results indicate that the financial distressed firms tend to be less profitable, high leveraged, and less liquid. The results also confirm the prior findings that the accrual-based ratios are persistently claimed to be significant as predictors of financial distress and the cash flow-based ratio can be decent predictors of financial distress because they can provide information on the ability of firm to manage future cash flow (Altman, 1968; Beaver, 1966; Charitou et al., 2004; Ohlson, 1980; Gentry et al., 1987).

For the corporate governance practices, it is found that CEO duality, managerial ownership, and institutional ownership are included in the final model, implying that they are good predictors of financial distress. However, the institutional ownership is found to be statistically insignificant. In addition, results indicate that the financially distressed firms heavily rely on the dual leadership structure, CEO duality. Also, the key management of the financially distress firms tend to less involve in the financial benefits of the outcomes as the results of their decision. They would have less incentive to align their goals with those of owners, leading to the agency problems and finally increasing the probability of financial distress.

Hence, for the corporate governance policy implementation, to enhance the performance of the firms and mitigate the probability of financial distress, the firms should employ the separated leadership structure, where the CEO and the chairman of board are different persons (Jensen, 1993; Jensen & Meckling, 1976). Such corporate governance practice can allow the board chairman to be independent from the CEO, prevent the CEO overriding the control, and ultimately enhance the effectiveness of monitoring and controlling system. In addition, to encourage the key decision management to pursue the interests of the owners, the firms should offer the benefit packages, e.g., stock options, to that management so that they would behave like the owners and act in line with the interests of the owners (Jensen, 1993; Jensen & Meckling, 1976).

Although this study provides impressive results in terms of the accuracy classification rate, it has two major limitations. Since, our sample is quite small and it is the relative up-to-date sample, this study needs to use all of these 45 distressed firms in developing the models. Hence, the validity of the results can not be examined via the independent "holdout" sample. Moreover, this study only examines the linear relationship

between the managerial ownership and firm's performance. However, Morck et al. (1988) have found a curvilinear relationship between managerial ownership and firm's performance, measured by Tobin's Q. They reported that performance first increases as director ownership increases from 0 to 5%, then declines as director ownership increases from 5 to 25%, and ultimately, increases slightly as director ownership increases beyond 25%. In addition, McConnell and Servaes (1990) addressed the non-monotonic relationship. They found that performance increases as managerial ownership increases up to 50%, and then reduces as managerial ownership beyond 50%. Interestingly, in the case of Thailand, Dhnadirek and Tang (2003) evidenced a positive relationship between firm performance and managerial ownership up to 25% and a negative relationship when managerial ownership beyond 25%. Hence, a curvilinear relationship implies that the increase in managerial ownership of up to a certain level creates the incentives of management to pursue their interests (become entrenched), not alignment with those of owners. Because of these, future research should make efforts to investigate more on this issue to view the curvilinear relationship between the managerial ownership and probability of financial distress and to better understand the complex dynamics of corporate decisions.

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Table 1: Sample of financially distressed and healthy firms in Thailand over the period January 2000- March 2009

| | | Financially distressed firms (n = 45) | | | | Healthy firms (n = 45) | |
| | | | Asset size* (million baht) | T** | | | Asset size* (million baht) |
Year	Symbol	Name			Symbol	Name	
2000	O-LAP	Oriental Lapidary	1,006	D	SAWANG	Sawang Export	849
	TMP	Thai Melon Polyester	6,634	D	TR	Thai Rayon	4,849
	CMG	Chaophya Marble-Granite	546	D	KWH	Wiik & Hoeglund	687
	GJS	G J Steel	27,632	R	SSI	Sahaviriya Steel Industries	24,027
	STEC	Sino-Thai Engineering & Construction	5,092	R	NWR	Nawarat Patanakarn	4,218
	TPROP	Thai Property	1,383	R	SAMCO	Sammakorn	1,848
	PF	Property Perfect	157	R	HEMRAJ	Hemaraj Land & Development	6,843
	ROBINS	Robinson Department Store	12,024	R	BJC	Berli Jucker	14,724
	SKR	Sikarin	628	R	NTV	Nonthavej Hospital	583
	MEDIAS	Media of Medias	802	R	SE-ED	SE-Education	709
2001	USC	Universal Starch	7,818	R	SSF	Surapon Foods	2,950
	TCC	Thai Capital Corporation	521	R	IRC	Inoue Rubber (Thailand)	1,413
	AMAC	Agro Industry Machinery	565	R	TLI	Thai Lift Industries	852
	CPICO	Central Paper Industry	2,617	R	PPPC	Phoenix Pulp & Paper	7,798
	IRPC	IRPC	137,706	R	TCB	Thai Carbon Black	4,398
	NEP	NEP Realty & Industry	2,175	R	APSP	Alcan Packaging Strongpack	1,573
	TM	Thai Modern Plastic Industry	703	D	TCOAT	Thai Coating Industrial	528
	PRECHA	Preecha Group	2,987	R	ROJNA	Rojana Industrial Park	3,026
	TYONG	Tanayong	72,906	R	LH	Land and Houses	25,896
	PYT	Prasit Patana	4,448	R	BGH	Bangkok Dusit Medical Services	4,379
	SUE	Sanyo Universal Electric	7,622	D	HANA	Hana Microelectronics	8,652
2002	NTS	N.T.S. Steel Group	8,813	D	VNG	Vanachai Group	5,768
	RCI	The Royal Ceramic Industry	1,663	R	ASTL	American Standard Sanitaryware	1,573
	ASIA	Asia Hotel	4,239	R	GENCO	General Environmental Conservation	1,095

*Last fiscal year, which is available prior to the distress. **Type of failure: R = Rehabco/Non-performing group, D = Delisted

Table 1(con't) : Sample of financially distressed and healthy firms in Thailand over the period January 2000- March 2009

Year		Financially distressed firms (n = 45)				Healthy firms (n = 45)	
	Symbol	Name	Asset size* (million baht)	T**	Symbol	Name	Asset size* (million baht)
2003	WFC	Wongpaitoon Group	985	D	TTTM	Thai Toray Textile Mills	1,433
	TCJ	T.C.J. Asia	741	R	PATKL	Patkol	1,410
	NFC	NFC Fertilizer	12,825	R	VNT	Vinythai	11,574
	TWP	Thai Wire Products	1,018	R	TCMC	Thailand Carpet Manufacturing	943
	S-VARA	Srivara Real Estate Group	301	D	TFD	Thai Factory Development	972
	WIN	Wyncoast Industrial Park	478	R	DRACO	Draco PCB	912
2004	SRI	Srithaifood & Beverage	1,527	R	CPI	Chumporn Palm Oil Industry	1,739
	BRC	Bangkok Rubber	3,176	R	PRANDA	Pranda Jewelry	2,992
	IPI	Indorama Polyester Industries	15,779	R	SUC	Saha-Union	19,880
2005	D-MARK	Thai-Denmark Swine Breeder	1,048	R	UVAN	Univanich Palm Oil	1,333
	POMPUI	Kuang Pei San Food Products	1,089	R	SORKON	S.Khonkaen Food Industry	850
	LL	Living Land Capital	481	R	UPF	Union Pioneer	497
	NPK	New Plus Knitting	348	R	BNC	The Bangkok Nylon	367
	CIRKIT	Circuit Electronic Industries	2,384	R	MSC	Metro Systems	2,473
2007	POWER	Power-P	436	R	PAE	PAE (Thailand)	610
	ITV	ITV	4,209	R	GMMM	GMM Media	2,810
	SAFARI	Safari World	2,623	R	GENCO	General Environmental Conservation	1,208
2008	SUN	Sunwood Industries	873	R	CEI	Compass East Industry (Thailand)	826
	KTECH	K-Tech Construction	2,467	R	SAMCO	Sammakorn	2,245
2009	MALEE	Malee Sampran	1,974	R	PR	President Rice Products	1,894
	PSAAP	Pongsaap	1,007	R	SPORT	Siam Sport Syndicate	1,164

* Last fiscal year which is available prior to the distress. **Type of failure: R = Rehabco/Non-performing group, D = Delisted

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Table 2: List of variable measurements

Categories	Measurements	Proxy	Symbol	Expected sign
Dependent variables				
Financial distress		Binary variable: 1 = financial distress, 0 = otherwise	DIST	
Independent variables				
1. Financial variables				
1.1. Accrual-based	Profitability	Net income/Total assets	ROA	-
	Leverage	Total liabilities/Total equity	DE	+
	Liquidity	Current assets/Current liabilities	CURRENT	-
	Asset utilization	Revenue/Total assets	TATURN	-
1.2.Cash flow-based	Profitability	Cash flow from operation/Net Income	CFNI	-
	Leverage	Cash flow from operation/Liabilities	CFLT	-
	Liquidity	Cash flow from operation/Current liabilities	CFCL	-
	Asset utilization	Cash flow from operation/Total assets	CFTA	-
2. Corporate governance variables				
2.1.Composition of Board of Directors	Outside director	Number of outside directors/total directors	OUT	-
	CEO duality	Binary variable: 1 = CEO duality, 0 = otherwise	DUAL	+
	Board size	Number of board directors	BSIZE	-
2.2. Ownership Structure	Managerial ownership	Percentage of shares owned by inside directors and management	MOWN	-
	Outside director ownership	Percentage of shares owned by outside directors	ODOWN	-
	Concentrated ownership	Percentage of shares owned by ultimate major shareholders	COWN	-
	Institutional ownership	Percentage of shares owned by ultimate institutions	IOWN	-
3. Macroeconomic variables				
	Economic performance	Ln(Gross domestic product)	GDP	-
	Industrial performance	Manufacturing production index	MPI	+
	Inflation	Consumer price index	CPI	+
	Interest rate	Interbank rate	ITR	+

Table 3: Pearson correlation matrix; the number in parenthesis is the probability.

Variables	ROA	DE	CURRENT	TATURN	CFNI	CFLT	CFCL	CFTA	OUT	DUAL	BSIZE	MOWN	ODOWN	COWN	IOWN	GDP	MPI	CPI	ITR
Y	**-0.22 (0.04)**	-0.12 (0.27)	**-0.19 (0.06)**	**-0.18 (0.08)**	**-0.21 (0.04)**	**-0.36 (0.00)**	**-0.41 (0.00)**	**-0.24 (0.02)**	-0.06 (0.54)	**0.28 (0.01)**	**-0.36 (0.00)**	0.05 (0.59)	**-0.30 (0.00)**	-0.07 (0.47)	-0.05 (0.65)	0.00 (1.00)	0.00 (1.00)	0.00 (1.00)	0.00 (1.00)
ROA	1.00	-0.01 (0.97)	-0.15 (0.15)	**-0.45 (0.00)**	0.04 (0.68)	0.11 (0.31)	0.08 (0.45)	**0.51 (0.00)**	**0.24 (0.02)**	-0.05 (0.65)	0.02 (0.85)	-0.11 (0.31)	0.10 (0.34)	-0.04 (0.68)	-0.06 (0.59)	0.13 (0.21)	0.12 (0.26)	0.12 (0.25)	0.09 (0.40)
DE		1.00	0.07 (0.52)	0.13 (0.21)	0.02 (0.82)	0.03 (0.76)	0.04 (0.68)	0.03 (0.76)	0.10 (0.34)	0.04 (0.66)	0.11 (0.26)	-0.04 (0.67)	0.05 (0.60)	0.10 (0.31)	0.06 (0.57)	0.10 (0.34)	0.08 (0.41)	0.08 (0.43)	0.07 (0.46)
CURRENT			1.00	-0.07 (0.47)	0.02 (0.81)	0.10 (0.32)	**0.22 (0.03)**	0.03 (0.75)	-0.01 (0.87)	0.01 (0.90)	0.07 (0.54)	0.01 (0.91)	-0.02 (0.82)	-0.02 (0.83)	0.01 (0.94)	-0.03 (0.74)	-0.04 (0.69)	-0.05 (0.63)	-0.02 (0.85)
TATURN				1.00	0.06 (0.52)	**0.21 (0.04)**	0.16 (0.11)	-0.12 (0.25)	-0.01 (0.87)	-0.03 (0.75)	0.12 (0.26)	0.06 (0.52)	0.06 (0.57)	-0.03 (0.75)	-0.05 (0.63)	**0.18 (0.08)**	**0.17 (0.09)**	**0.19 (0.06)**	-0.03 (0.75)
CFNI					1.00	0.07 (0.46)	0.09 (0.36)	0.11 (0.29)	0.06 (0.55)	-0.08 (0.44)	0.16 (0.11)	-0.07 (0.49)	0.05 (0.62)	0.00 (0.99)	0.04 (0.68)	-0.10 (0.33)	-0.09 (0.37)	-0.08 (0.40)	-0.09 (0.38)
CFLT						1.00	**0.92 (0.00)**	**0.69 (0.00)**	**0.21 (0.04)**	-0.09 (0.35)	0.05 (0.62)	-0.06 (0.57)	**0.22 (0.03)**	0.05 (0.64)	0.04 (0.69)	-0.06 (0.55)	-0.05 (0.61)	-0.04 (0.66)	-0.07 (0.49)
CFCL							1.00	**0.65 (0.00)**	0.15 (0.13)	-0.10 (0.34)	0.13 (0.19)	-0.05 (0.60)	**0.27 (0.01)**	0.05 (0.63)	0.06 (0.60)	-0.09 (0.41)	-0.08 (0.42)	-0.07 (0.47)	-0.08 (0.41)
CFTA								1.00	**0.28 (0.00)**	-0.03 (0.71)	0.04 (0.66)	-0.09 (0.38)	0.09 (0.37)	0.15 (0.15)	**0.18 (0.09)**	-0.01 (0.89)	-0.02 (0.84)	-0.02 (0.88)	-0.00 (0.96)
OUT									1.00	**-0.21 (0.04)**	**-0.20 (0.05)**	**-0.35 (0.00)**	0.15 (0.13)	0.03 (0.71)	0.05 (0.59)	0.16 (0.12)	0.15 (0.14)	0.16 (0.11)	0.14 (0.18)
DUAL										1.00	**-0.19 (0.06)**	**0.19 (0.06)**	-0.14 (0.16)	0.12 (0.23)	0.10 (0.31)	0.07 (0.51)	0.06 (0.56)	0.05 (0.60)	0.07 (0.49)
BSIZE											1.00	-0.10 (0.34)	0.10 (0.32)	-0.13 (0.19)	0.01 (0.91)	-0.06 (0.54)	-0.07 (0.46)	-0.07 (0.48)	-0.20 (0.05)
MOWN												1.00	0.03 (0.72)	0.00 (1.00)	**-0.27 (0.01)**	-0.82 (0.44)	-0.07 (0.51)	-0.08 (0.42)	-0.05 (0.63)
ODOWN													1.00	-0.12 (0.26)	**-0.25 (0.01)**	-0.02 (0.84)	-0.01 (0.88)	-0.01 (0.90)	-0.02 (0.78)
COWN														1.00	**0.74 (0.00)**	0.00 (0.97)	0.00 (0.94)	-0.00 (0.97)	0.06 (0.55)
IOWN															1.00	-0.01 (0.85)	-0.03 (0.72)	-0.03 (0.78)	0.03 (0.75)
GDP																1.00	**0.99 (0.00)**	**0.99 (0.00)**	**0.70 (0.00)**
MPI																	1.00	**0.99 (0.00)**	**0.71 (0.00)**
CPI																		1.00	**0.69 (0.00)**

Table 4: Test of mean differences between financially distressed and healthy firms one year prior to the distress

Variables	Mean		Mean Difference	T-value
	Financially distressed firms	Healthy firms		
ROA	-1.1159	0.0580	-1.1739	-2.16**
DE	-46.0530	0.6742	-46.7272	-1.12
CURRENT	1.3273	2.4898	-1.1624	-1.84*
TATURN	0.6422	0.8617	-0.2195	-1 63
CFNI	-0.0624	3.4840	-3.5464	-2.07**
CFLT	-0.0600	0.4017	-0.4617	3.54***
CFCL	-0.0241	0.6117	-0.6359	-4.27***
CFTA	0.0004	0.9887	-0.0984	-2.26**
OUT	0.6009	0.6272	-0.0262	-0.58
DUAL	0.3111	0.0889	0.2222	2.88***
BSIZE	9.4889	12.044	-2.5556	-3.92***
MOWN	12.7803	11.0514	1.7289	0.57
ODOWN	1.2596	5.1354	-3.8758	-2.89***
COWN	33.3291	35.9029	-2.5738	-0.82
IOWN	26.9287	28.8360	-1.9073	-0.48
GDP[1]	28.8174	28.8174	0.0000	n/a
MPI[1]	119.0235	119.0235	0.0000	n/a
CPI[1]	107.6562	107.6562	0.0000	n/a
ITR[1]	1.8971	1.8971	0.0000	n/a

[1]The t-value cannot be computed because the standard error of the difference is zero.
*Denotes 10% significant level (2-tailed)
**Denotes 5% significant level (2-tailed)
***Denotes 1% significant level (2-tailed)

Table 5: Variables comprised in the final model as the results of stepwise logistic regression

Given a binary dependent variable and nineteen independent variables, a stepwise logistic regression is employed for an equal sample of financially distressed and healthy firms during the period of January 2000 – March 2009. Using a maximum likelihood ratio method, the parameters in the "reliable" prediction model are maximum likelihood estimators with chi-square distribution.

Variables	Parameter estimates[1]
Constant	2.557*
	(2.927)
Return on assets (*ROA*)	-16.382***
	(8.127)
Debt-to-equity ratio (*DE*)	0.151*
	(3.090)
Current ratio (*CURRENT*)	-1.183**
	(6.301)
Cash flow from operation to net income (*CFNI*)	-0.913*
	(3.220)
CEO duality (*DUAL*)	4.169**
	(5.592)
Managerial ownership (*MOWN*)	-0.092*
	(2.828)
Institutional ownership (*IOWN*)	-0.058
	(2.589)

Note that the number in parenthesis the Wald chi-square value.
[1]Based on maximum likelihood estimates
*Denotes 10% significant level
**Denotes 5% significant level,
***Denotes 1% significant level

Table 6: Model statistics of the stepwise logistic regression model

Model chi-square   = 100.078 with 7 degree of freedom ($p < 0.001$)
-2 log likelihood   = 24.688
Cox & Snell R square   = 0.671
Nagelkerke R square   = 0.895

Table 7: Classification accuracy for financially distressed and healthy firms within sample

Using in-the-sample data, to classify a firm whether it is financially distressed or healthy, the probability of financial distress for each firm is calculated from the cumulative probability function $P = 1/\{1+e^{-\text{logit function}}\}$. Once the probability of financial distress for each firm within sample is obtained, each firm is then classified into financial distress or healthy based on a cutoff estimated probability of 0.5. As the estimated probability is more than 0.5, the firm is classified as financial distress and if less than 0.5, the firm is classified as healthy.

		Observed outcome		
		Financial distress	Healthy	Total
Predicted outcome	Financial distress	44 (97.8%)	1 (2.2%)	45 (100%)
	Healthy	3 (6.7%)	42 (93.3%)	45 (100%)

Overall accurate classification rate = 95.6% (86 firms out of 90 firms)