รายงานการวิจัย

เรื่อง

Corporate Distress Prediction Models using Financial and Governance Variables

(แบบจำลองทำนายความอ่อนแอของกิจการโดยใช้ตัวแปรด้านการเงิน และด้านการกำกับดูแลกิจการ)

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บทคัดย่อ

การพยากรณ์ความอ่อนแอของกิจการที่แม่นยำสามารถก่อให้เกิดผลดีอย่างมากต่อเศรษฐกิจของประเทศได้ โดยการใช้การพยากรณ์ดังกล่าวสร้างระบบเตือนภัยล่วงหน้าสำหรับกิจการต่างๆ งานวิจัยชิ้นนี้ศึกษาผลกระทบของปัจจัยที่สำคัญด้านการกำกับดูแลกิจการอันได้แก่ โครงสร้างการถือหุ้นและโครงสร้างคณะกรรมการที่มีต่อความน่าจะเป็นที่กิจการจะเกิดความอ่อนแอ และพัฒนาแบบจำลองเพื่อการพยากรณ์ความอ่อนแอ ซึ่งประกอบด้วยตัวแปรทางด้านการกำกับดูแลกิจการและตัวแปรทางด้านการเงิน โดยใช้วิธีลอจิทและโครงข่ายประสาทเทียม ผู้วิจัยได้แสดงให้เห็นว่าในประเทศตลาดเกิดใหม่ที่มีมักมีโครงสร้างการถือหุ้นแบบกระจุกตัว ไม่เพียงแต่ปัจจัยด้านการเงินเท่านั้นที่สามารถอธิบายความน่าจะเป็นที่กิจการจะเกิดความอ่อนแอ แต่ปัจจัยด้านการกำกับดูแลกิจการก็มีความสำคัญเช่นกัน แบบจำลองพยากรณ์ความอ่อนแอของกิจการที่ผู้วิจัยได้พัฒนาขึ้นนี้มีความแม่นยำในการพยากรณ์ค่อนข้างสูงกล่าวคือ วิธีลอจิทสามารถ

พยากรณ์ได้อย่างถูกต้องมากกว่าร้อยละ 85 ของบริษัททั้งหมดในกลุ่มตัวอย่าง โดยมีค่าความคลาดเคลื่อนชนิดที่ 1 ประมาณร้อยละ 9 ส่วนวิธีโครงข่ายประสาทเทียมก็เช่นกันสามารถพยากรณ์ได้อย่างถูกต้องโดยเฉลี่ยประมาณร้อยละ 84 ถึงร้อยละ 87 โดยมีค่าความคลาดเคลื่อนชนิดที่ 1 อยู่ระหว่างร้อยละ 10 ถึงร้อยละ 16 ผลการวิจัยดังกล่าวนี้แสดงให้เห็นว่า แบบจำลองที่ผู้วิจัยพัฒนาสมารถใช้ในการเตือนภัยล่วงหน้าได้ และยังอาจนำไปใช้เป็นเครื่องมืออย่างหนึ่งสำหรับหน่วยงานที่เกี่ยวข้องกับการตรวจสอบดูแลบริษัทในประเทศไทย นอกจากนี้ผู้วิจัยยังพบว่าการมีผู้ถือหุ้นที่มีอำนาจควบคุมและการมีส่วนร่วมของผู้ถือหุ้นที่มีอำนาจควบคุมในคณะกรรมการบริษัท ช่วยลดความน่าจะเป็นที่กิจการจะเกิดความอ่อนแอ ซึ่งหลักฐานชิ้นนี้สนับสนุนสมมติฐานที่ว่า ผู้ถือหุ้นที่มีอำนาจควบคุมมีแรงจูงใจที่จะตรวจสอบผู้บริหารเพื่อให้เกิดการตัดสินใจที่เป็นประโยชน์ต่อกิจการ ผู้วิจัยยังพบหลักฐานที่สนับสนุนข้อดีของการเป็นบริษัทในเครือของกลุ่มธุรกิจขนาดใหญ่ ในการลดความน่าจะเป็นที่กิจการจะเกิดความอ่อนแอในช่วงวิกฤตเศรษฐกิจเอเชียตะวันออกที่ผ่านมาด้วย

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Abstract

Predicting corporate distress can have a significant impact on the economy because it serves as an efficient early warning signal. This study examines the impact of major corporate governance attributes, i.e., ownership and board structures, on the likelihood of distress, and develops distress prediction models incorporating both governance and financial variables. The two widely documented methods, i.e., logit and neural network approaches are used. For an emerging market economy where ownership concentration is common, we show that not only financial factors but also corporate governance factors help determine the likelihood that a company will be in distress. Our prediction models perform relatively well. Specifically, in our logit models that incorporate governance and financial variables, more than 85% of non-financial listed firms are correctly classified in our models. When we consider the Type I error, on average the models have the Type I error of about 9%. Likewise, the neural network prediction models appear to have good results. Specifically, the average accuracy of the neural network prediction models ranges from approximately 84% to 87% with the average Type I error raging from about 10% to 16%. Such evidence indicates that the models serve as sound early warning signals and could thus be useful tools adding to supervisory resources. We also find that the presence of controlling shareholders and the board involvement by controlling shareholders reduce the probability of corporate financial distress. This evidence supports the *monitoring/alignment hypothesis*. Finally, our results suggest evidence of the benefits of business group affiliation in reducing the distress likelihood of member firms during the East Asian financial crisis.

Chapter 1

Introduction

Predicting corporate distress and business failure can contribute significantly to the economy. Early-warning systems developed from financial distress and/or failure prediction models have proven to reduce the chance that a company gets into corporate distress or even goes bankrupt. This should in turn prevent the systemic collapse of a country's economy.

A good example that a lack of effective early warning systems may lead to a catastrophe of the history is the collapse of the Thai financial and banking sector in 1997-1998. During the recent East Asian economic crisis, 58 out of 91 finance companies were suspended in the second half of 1997, and a further 12 finance companies in 1998. After all, 56 finance companies were closed in 1997. In relation to banking, six banks were suspended in 1998, followed by one more in 1999. Out of the 15 domestic banks operating in 1994, one was closed down, three were merged into government owned banks, two were taken over by the government and three became foreign owned during the crisis. The remaining banks have been struggling to recapitalize on their own. Although the main cause of this crisis is not the lack of sound early warning systems, the adverse impacts of the crisis might have been lower if Thailand had such effective systems.

Not only financial and banking sectors, corporate sectors in Thailand were also severely negatively affected by the 1997 East Asian economic crisis. Considering companies traded on the stock market, there have been many non-financial listed firms that experienced financial difficulties as a result of the East Asian crisis. The number of non-financial firms that were ordered to delist by the Stock Exchange of Thailand during the period 1997 and 2001 is 28, while the number of non-financial listed firms that entered "rehabilitation sector" is as high as 102. On the bright side, however, the economic crisis enables us to examine corporate distress and develop prediction models of such distress for listed companies in an emerging market economy, which we believe only little evidence has been provided.

Other than the opportunity to explore the prediction of corporate financial distress, Thai firms are also of interest due to their concentrated ownership structure. Such characteristic is common among most of economies around the world, but different from the US where extensive research on corporate financial distress prediction has been conducted. To empirically investigate the effects of corporate governance regarding ownership and board structures on firms, the literature has typically focused on linking ownership and board characteristics and performance.[1] In this study, however, we aim to investigate the effects of corporate governance, particularly ownership and board structures, on the likelihood of corporate distress.

Moreover, unlike most of existing research on distress prediction models that use mainly financial variables, our models also incorporate governance variables regarding ownership and board structures. Not until recently have studies documented significant effects of governance variables on the probability of bankruptcy/failure (Bongini, Claessens, and Ferri, 2001; Heiss and Köke, 2001; Bechetti and Sierra, 2003; Claessens, Djankov, and Klapper, 2003; Dewaelheyns and Van Hulle, 2004) or distress (Bongini, Ferri, and Kang, 2000; Bongini, Claessens, and Ferri, 2001; Lee and Yeh, 2004).

In addition, to study the effects of ownership and board structures on firms, a number of studies choose to focus on the East Asian crisis.[2] Corporate governance has been considered as one of the important factors that led to the East Asian financial crisis in 1997. Rajan and Zingales (1998) and Prowse (1998) document that concentrated ownership structure and ineffective corporate governance are key factors causing the crisis. Moreover, Johnson, Boone, Breach and Friedman (2000) suggest that corporate governance factors help explain the crisis better than macroeconomic factors. They also argue that poor economic conditions exacerbated agency problems, which in turn instigated the stock market crashes and currency depreciation, especially in economies with ineffective corporate governance systems. However, in this study, we focus on a single country, Thailand that provides a natural setting to study this issue. An advantage

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[1] See, for example, Khanna and Palepu (2000), Thomsen and Pedersen (2000), Wiwattanakantang (2001), Claessens, Djankov, Fan, and Lang (2002), Mitton (2002), Volpin (2002), Anderson and Reeb (2003), Attig, Fischer, and Gadhoum (2003), Cronqvist and Nilsson (2003), Joh (2003), Lemmon and Lins (2003), Lins (2003), and Baek, Kang, and Park (2004).

[2] See, for example, Johnson, Boone, Breach, and Friedman (2000), Mitton (2002), Friedman, Johnson, and Mitton (2003), Mitton (2003), and Baek, Kang, and Park (2004).

of investigating one country is that we can control for the institutional effects (such as legal and regulatory effects) because all firms are operating in the same environment.

Our interests are to (1) describe the ownership and board characteristics of non-financial listed firms that experienced financial difficulties, (2) investigate the effects of such characteristics on the likelihood of corporate distress, and (3) develop distress prediction models that consist of governance and financial variables. We conjecture that expropriation of minority shareholders by a firm's controlling shareholder causes corporate distress. Hence, governance variables should help explain the likelihood that a firm experiences distress and be incorporated in prediction models.

We consider several aspects of governance characteristics regarding ownership and board structures. In companies with concentrated ownership, conflicts of interests arise between controlling shareholders and minority shareholders, rather than between management and shareholders since controlling shareholders are more likely to control and monitor management (Shlefier and Vishny, 1997). The power to control a corporation *entrenches* the controlling shareholders' status and provides them with an opportunity to *expropriate* corporate resources for their private benefits at other stakeholders' expenses (Shleifer and Vishny, 1997; La Porta, Lopez-de-Silanes, Shleifer, and Vishny, 1998, 1999; Bebchuk, 1999; DeAngelo and DeAngelo, 2000; Johnson, La Porta, Lopez-de-Silanes, and Shleifer, 2000). Hence, the presence of controlling shareholders should be detrimental to the firms and may increase the likelihood of corporate distress.

The expropriation problem caused by controlling shareholders tends to be more severe when controlling shareholders own more voting rights relative to their cash-flow rights and when controlling shareholders also serve as managers or executive directors (Shleifer and Vishny, 1997; La Porta, Lopez-de-Silanes, Shleifer, and Vishny, 1998, 1999; Bebchuk, Kraakman, and Triantis, 2000; Claessens, Djankov, Fan, and Lang, 2002).[3,4] We conjecture that the expropriation by controlling shareholders not only deteriorate corporate value and firm performance but also increase the likelihood of

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[3] This is because greater voting rights provide the controlling shareholders with more power for wealth expropriation, while less cash-flow rights reduce the controlling shareholders' share of losses from the wealth expropriation.

[4] This is because the controlling shareholders-cum-managers will get entrenched.

corporate financial distress. More precisely, we hypothesize that the greater the difference between voting and cash-flow rights held by controlling shareholders and the higher the fraction of board seats occupied by controlling shareholders, the higher the probability of financial distress. We also expect to find a positive relation between the participation of controlling shareholders in top management and the probability of financial distress.

Nevertheless, controlling shareholders are valuable if they perform important governance functions. Since controlling shareholders own a substantial fraction of a firm's residual claims, they have strong incentives to effectively *monitor* managerial decision-making to ensure that it is consistent with value-maximizing strategies (Shleifer and Vishny, 1986; Admati, Pfleiderer, and Zechner, 1994; Burkart, Gromb, and Panunzi, 1997). Moreover, when controlling shareholders possess a large proportion of the firm's cash-flow rights, they will internalize more of the costs of expropriation actions that involve some loss of firm value. Consequently, they are less likely to extract private benefits (Bennedsen and Wolfenzon, 2000). Significant cash-flow rights held by controlling shareholders can also serve as a credible commitment that controlling shareholders will not expropriate minority shareholders (Gomes, 2000). Hence, a larger ownership stake may better *align* their interests and minority shareholders' interests (Claessens and Fan, 2002). As a result of the *monitoring/alignment* effects of controlling shareholders, the presence of controlling shareholders may reduce the probability of corporate distress.[5]

In this study, we use the data from Thailand. Our sample includes non-financial companies listed on the Stock Exchange of Thailand that were financially distressed during the period 1998-2000 of which data are available, and control firms that are matched by size and industry. We define distressed firms as firms that were ordered by the Stock Exchange of Thailand to delist or submit a rehabilitation plan. The techniques we employ are a popular traditional statistical approach, namely a logit regression, as well as a recently developed approach, namely a neural network. Both different techniques are constructed to check the robustness of our prediction models.

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[5] Bongini, Claessens, and Ferri (2001) hypothesize that financial institutions in which influential families are the largest shareholders will be less likely to be closed due to the family's political connection.

The results from our distress prediction models suggest that governance variables play an important role in predicting the odds of corporate distress. More precisely, we find that non-financial listed firms in which controlling shareholders exist are less likely to be in distress. Moreover, active board involvement by controlling shareholders reduces the distress likelihood. These findings support the *monitoring/alignment hypothesis* of controlling shareholders.[6] We also find evidence of the benefits of top business group affiliation in decreasing the probability of corporate distress.

On the other hand, as expected, traditional financial variables perform well in forecasting the probability of corporate distress. Specifically, our results indicate that firms with excessive use of debt, poor operating performance, and small market capitalization tend to experience corporate distress. These results are consistent with what have been found in previous studies.

Overall, our distress prediction models that incorporate governance variables show high accuracy rates. For the logit prediction models, more than 85% of the sample firms are correctly classified with the Type I error of about 9%. Similarly, the neural network prediction models appear to have good results. That is, on average, the accuracy of the four neural network prediction models ranges from around 84% to 787% while the average Type I error rages from around 10% to 16%. These results thus suggest that our prediction models can serve as efficient early warning systems.

We add to the literature on corporate governance by examining a possible relation between corporate governance, concerning ownership and board structures, and corporate distress. Moreover, as far as we concern, no studies on the neural network prediction models that incorporate characteristics of ownership and board structures have been documented. Therefore, the neural network models we develop will be a contribution to the literature on corporate distress prediction.

The rest of the study is structured as follows. Chapter 2 provides review of the relevant literature including the agency problems that arise in firms with concentrated ownership structure, the impact of corporate governance attributes, i.e., ownership and board structures, on firm value and the likelihood of financial distress. We also discuss

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[6] However, it is also possible that controlling shareholders may intend to prolong the expropriation honeymoon. Hence, they attempt to prevent financial distress from happening during an economic crisis.

the effects of typically documented financial variables that help predict the likelihood of distress. A brief overview of corporate distress/failure prediction models widely applied in the existing literature is also provided in this chapter. Chapter 3 discusses the data, sample design, and methodology used in this study. Chapter 4 describes corporate governance and financial characteristics of the distressed firms in our sample and compares them with those of non-distressed counterparts. This chapter also investigates the effects of ownership and board structures on the likelihood of financial distress. In addition, the chapter examines the empirical results from our developed distress prediction models. Finally, Chapter 5 concludes the study with a summary of the main findings and directions for future research.

Chapter 2

Literature Review

In this chapter, we review the literature relevant to the present study. The review can be divided into three sections. Firstly, we review the agency problems that arise in firms with concentrated ownership structure and their effects on firm value. Then we talk about the effects of ownership and board structures on the probability of corporate distress and/or failure. We also discuss how some financial ratios have been used in predicting the likelihood of distress and/or failure. Such ratios will be used as control variables in our models. Finally, we discuss prediction models that are extensively documented and developed, focusing on those using logit regression and neural network approaches.

2.1 Ownership concentration and agency problems

Since the mid 1990s, researchers have begun to explore corporate ownership structure, board structure and other governance characteristics in economies outside the "big four" -- the UK and the US on the one hand, and Germany and Japan on the other hand. A survey of corporate ownership worldwide reveals a high degree of ownership concentration in these economies (La Porta, Lopez-de-Silanes, Shleifer, and Vishny, 1999). Ownership of firms in these economies is usually concentrated in the hands of a single controlling shareholder. Firms with controlling shareholders are common in Europe (Thomsen and Pedersen, 2000; Faccio and Lang, 2002), developing countries (La Porta, Lopez-de-Silanes, Shleifer, and Vishny, 1998), emerging market economies (Lins, 2003), and East Asia (Claessens, Djankov, and Lang, 2000; Mitton, 2002; Lemmon and Lins, 2003).

Many countries where controlling shareholders are dominant lack the external governance mechanisms provided by active markets for corporate control. For firms in relationship-oriented economies, close ties with corporate shareholders provide not only internal capital but also monitoring over management. Where ownership is concentrated in the hands of controlling shareholders, such shareholders are expected to serve governance roles. Controlling shareholders are often individuals or founding families,

and less often state and widely-held corporations. It is common for controlling shareholders to actively participate in management and occupy board seats. These shareholders are thus the key players in corporate governance in many countries.

Agency problems in firms with concentrated ownership structure

There have been a number of recent studies on corporate governance which have focused on the impact of agency conflicts that arise in firms with concentrated ownership structure. These studies focus on the expropriation of minority shareholders by controlling shareholders and on the impact of concentrated ownership on firm value. The extent and magnitude of the impact of agency conflicts in firms with concentrated ownership structure has been difficult to gauge. Part of the difficulty lies in differentiating the effects of agency conflicts from other, unrelated, benefits and costs associated with concentrated ownership. Other difficulties arise in obtaining accurate accounting and market measures of firm value on which to make assessments.

Costs and benefits of ownership concentration

Although the presence of controlling shareholders is widely observed in many economies, it is not until recently have researchers studied the costs and benefits of having controlling shareholders. Among them are Thomsen and Pedersen (2000) and Faccio and Lang (2002) on Europe; Edwards and Weichenrieder (1999) and Gorton and Schmid (2000) on Germany; Volpin (2002) on Italy. Cronqvist and Nilsson (2003) on Sweden; Lins (2003) on emerging market economies; Claessens, Djankov, Fan, and Lang (2002), Mitton (2002), and Lemmon and Lins (2003) on East Asia; Morck, Nakamura, and Shivdasani (2000) on Japan; Joh (2003) and Baek, Kang, and Park (2004) on Korea; and Wiwattanakantang (2001) on Thailand.

Concentrated ownership, most commonly seen in the form of controlling shareholders, may be either detrimental or beneficial to the firm and its minority shareholders. Due to their substantial claims upon the firm's future cash flows, controlling shareholders have an incentive to bear the costs involved in monitoring management (Shleifer and Vishny; 1986; Admati, Pfleiderer, and Zechner, 1994; Burkart, Gromb, and Panunzi, 1997). For this reason, the *monitoring hypothesis* states that the

presence of controlling shareholders is beneficial to the firm and to minority shareholders. The presence of controlling shareholders, though, can be costly to the firm and minority shareholders. The stock liquidity of firms with concentrated ownership is relatively low since the amount of free float of shares is small (Bolton and Von Thadden, 1998). In addition, although monitoring by controlling shareholders can be beneficial, excessive monitoring can constrain managerial initiatives that can raise firm value like the seeking out of new investment projects (Burkart, Gromb, and Panunzi, 1997).

If controlling shareholders own a substantial fraction of the rights to the firm's cash flows, they will assume a similarly substantial fraction of any deadweight losses associated with their attempts to expropriate minority shareholders (Bennedsen and Wolfenzon, 2000). Owning high cash-flow rights can also provide a commitment that controlling shareholders will not extract private benefits (Gomes, 2000). The commitment is credible since minority shareholders evaluate a firm's share price based on the expectations of ex-post expropriation by controlling shareholders. If the controlling shareholders divert cash flows for private benefits, the minority shareholders will discount the share price. Accordingly, value of the shares held by controlling shareholders will be reduced as well. For these reasons, a high ownership stake held by controlling shareholders can align interests between controlling and minority shareholders (Claessens and Fan, 2002). This is so-called the *interest alignment hypothesis*.

Consistent with the *incentives alignment hypothesis*, Denis and Denis (1994) find that majority ownership endures as an organizational form, and uncover no evidence that majority-owned US firms underperform industry benchmarks. However, high degrees of ownership concentration can also diminish the efficiency of some significant governance instruments that protect shareholder rights. These instruments include the board of directors, shareholders' participation at shareholders' meetings, as well as transparency and disclosure. Concentrated ownership can also be a major impediment that deters initiatives for an improvement in corporate governance mechanisms, particularly in economies where the legal environment is not investor friendly (Cronqvist and Nilsson, 2003).

The *monitoring/alignment hypothesis* predicts that the presence of controlling shareholders can raise firm value. Substantial ownership stakes provide controlling shareholders with both the right to claim the firm's future cash flows and the right to cast votes on major decisions. Controlling shareholders therefore have incentives to monitor, as well as power to control managers to ensure that firm value and shareholder wealth are maximized. In this way, the benefits of control brought by controlling shareholders are shared among all shareholders. Nevertheless, the presence of controlling shareholders may be detrimental to a firm, through the erosion of other corporate governance mechanisms, and the inhibition of management initiatives.

Conflicts between controlling and minority shareholders

The most important and widely documented agency cost of concentrated ownership occurs when controlling shareholders expropriate minority shareholders. Controlling shareholders (or their representatives) commonly serve as managers and board members and can use their positions to divert the firm's assets and profit for their own interests (Shleifer and Vishny, 1997; Johnson, La Porta, Lopez-de-Silanes, and Shleifer, 2000). The *expropriation/entrenchment hypothesis* predicts that concentrated ownership has an unfavorable impact on firm value and minority shareholder wealth.

There are a variety of ways in which controlling shareholders can expropriate minority shareholders. Controlling shareholders' malfeasance can include conveying corporate assets to themselves (or to another company that they own) at non-market prices; transferring the firm's shares to their brokerage account at below-market prices; engaging in insider trading; appointing themselves or their representatives as management and paying themselves or their representatives excessive salaries and compensation; using the firm's assets as collateral for personal loans; diverting business opportunities to other firms where they can derive better private benefits; and investing in sub-optimal projects (Jensen and Meckling, 1976; Shleifer and Vishny, 1997; Bebchuk, 1999; Bebchuk, Kraakman, and Triantis, 2000; Johnson, La Porta, Lopez-de-Silanes, and Shleifer, 2000).

Due to agency conflicts, the presence of controlling shareholders can lower firm value and minority shareholder wealth. The *expropriation/entrenchment hypothesis* hence

predicts that controlling shareholders will exercise their power to extract private benefits from the firms that they control leaving minority shareholders to bear the costs.

Johnson, Boone, Breach, and Friedman (2000) document certain cases of expropriation by controlling shareholders during the 1997 East Asian crisis. The fact that controlling shareholders themselves or their associates typically serve top management positions paves an easy way to achieve expropriation transfers. Claessens, Djankov, Fan, and Lang (2002) and Lemmon and Lins (2003) argue that the risk of expropriation by controlling shareholders is a major principal-agent problem for large firms before and during the East Asian crisis. It is also documented that similar wealth expropriation exists in other economies such as Sweden (Bergstron and Rydquist, 1990), the U.S. (Barclay and Holderness, 1989), Italy (Zingales, 1994), and Taiwan (Yeh, Lee, and Woidtke, 2001).

Relation between ownership stake and degree of control

The adverse effects of the agency conflict between controlling and minority shareholders are exacerbated when significant shareholders can gain a higher proportion of a firm's voting rights than the cash-flow rights associated with the proportion of shares that they hold. The mechanisms that shareholders can use to increase their voting include holding shares with superior voting rights, controlling a firm via a pyramidal structure, and owning equity across companies in a group (Grossman and Hart, 1988; Harris and Raviv, 1988; Wolfenzon, 1999; Bebchuk, Kraakman, and Triantis, 2000).[7] There are a number of cross-country empirical studies showing that it is not uncommon for controlling shareholders to use these mechanisms, especially in economies where legal protection of minority shareholders is poor (La Porta, Lopez-de-Silanes, Shleifer, and Vishny, 1999; Claessens, Djankov, and Lang 2000; Faccio and Lang, 2002; Lins, 2003).

Theory and empirical evidence support the view that a divergence between control and ownership stakes of a dominant shareholder affects firm value. La Porta, Lopez-de-Silanes, Shleifer, and Vishny (2002) develop a theoretical model implying that the cash-flow rights held by controlling shareholders are positively associated with firm

[7] The use of pyramidal structures and cross-shareholdings in Thai public companies is discussed in Khanthavit, Polsiri, and Wiwattanakantang (2003).

value, while the voting rights held by controlling shareholders are negatively associated with firm value. Empirical evidence indicates that stocks with superior voting rights are priced at a premium (Lease, McConnell, and Mikkelson, 1983; DeAngelo and DeAngelo, 1985; Bergstrom and Rydqvist, 1990; Zingales, 1994 and 1995; Nenova, 2003), thereby suggesting that there are private benefits of control.[8] Similarly, the existence of controlling shareholders who hold dual-class shares to enhance their control has an adverse impact on firm value (Cronqvist and Nilsson, 2003).

Several studies on the connection between blockholdings and firm value in emerging economies and East Asia provide similar evidence. These studies show that a higher level of controlling shareholders' voting rights relative to their cash-flow rights reduces firm value (Claessens, Djankov, Fan, and Lang, 2002; Mitton, 2002; Joh, 2003; Lemmon and Lins, 2003; Lins, 2003; Baek, Kang, and Park, 2004). In addition, the use of pyramidal structures and other indirect shareholdings has a negative impact on the value of firms (Mitton, 2002; Lins, 2003).

If the private benefits of control are large, controlling shareholders will fear losing control to outsiders. Accordingly, they will struggle to retain control whether or not it is optimal for other stakeholders (Bebchuk, 1999). Cronqvist and Nilsson (2003) find that firms controlled by families which use dual-class shares to enhance their control are less likely to be taken over than firms controlled by corporations or institutional investors that do not use control-enhancing mechanisms.

In sum, controlling shareholders who have greater control than ownership are likely to enjoy benefits that are not shared with minority shareholders. These controlling shareholders may strive to stay in control for a longer period than is optimal from the perspective of other stakeholders. The evidence indicates that the use of control-enhancing devices by controlling shareholders has detrimental effects on firm value and on minority shareholders.

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[8] The premium is much smaller in US studies, relative to studies from other countries This is consistent with the argument that the private benefits of control are lower in countries with higher quality legal systems (Dyck and Zingales, 2004; Nenova, 2003).

2.2 Concentrated ownership structure and the likelihood of distress

2.2.1 Controlling shareholder and the likelihood of distress

In the previous section, we have discussed that in an economy where ownership is concentrated in hands of controlling shareholders, the major agency problems arise between controlling and minority shareholders. The literature that investigates the impacts of controlling shareholders on firm value, nevertheless, has been largely inconclusive.

In contrast to what is observed in firms with dispersed ownership, the impact of block shareholdings on firms with a high degree of ownership concentration suggests that controlling shareholders perform an important role in monitoring and controlling management. The evidence shows that the identity of controlling shareholders, the fraction of the cash-flow and voting rights held by a controlling shareholder, and the difference between the two fractions, have a significant impact on firm value.[9] In general, higher cash-flow rights in the hands of controlling shareholders increase firm value, while the reverse holds for the difference between the cash-flow and voting rights. As mentioned earlier, a separation of control from ownership adversely affects firm value.

The *monitoring/alignment hypothesis* suggests favorable effects of ownership concentration, in particular the presence of controlling shareholders, on firm value. On the other hand, the *expropriation/entrenchment hypothesis* suggests that ownership and control by controlling shareholders have negative effects on firm value, in particular when controlling shareholders have excess control. Following these arguments, having a controlling shareholder may either decrease or increase the probability that the firm will experience financial difficulties. Hence the net impact of the presence of controlling shareholders on the likelihood of corporate distress is an empirical issue.

If the *monitoring/alignment hypothesis* holds, controlling shareholders have incentives and the power to effectively perform their role in monitoring and influencing management to pursue value-enhancing actions. Thus, firms in which controlling shareholders exist should be less likely to encounter corporate financial distress than

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[9] Claessens, Djankov, Fan, and Lang (2002), for example, examine firms in nine East Asian countries and show that the impact of ownership and control depend on the type of controlling shareholder. The separation between ownership and control is negatively related to value in firms owned by families and the state, while no significant relation is found in firms controlled by widely held corporations and financial institutions.

firms in which no controlling shareholder exists. However, if the *expropriation/ entrenchment hypothesis* holds, particularly when the value of their control is greater than the gain from associated ownership, controlling shareholders have a motive to expropriate firm resources for their own benefit. Thus, the likelihood of corporate distress should be greater in firms with controlling shareholders and especially with a larger disparity between cash-flow and voting rights held by controlling shareholders.

Even though there exists much evidence on the relation between the presence of controlling shareholders and firm value or performance, little has been known about the relation between the presence of controlling shareholders and the likelihood of corporate distress. For example, Bongini, Claessens, and Ferri (2001) show that privately-owned financial institutions are more likely to be in distress during the East Asian crisis. In addition, they find that financial institutions in which a foreigner is the largest shareholder have a lower probability of distress.

2.2.2 Multiple large shareholders and the likelihood of distress

Apart from controlling shareholders, a considerable fraction of Thai firms have also several large shareholders who hold at least 10 percent of the firms' voting rights (Khanthavit, Polsiri, and Wiwattanakantang, 2003). This evidence is consistent with what has been observed in Europe (Faccio and Lang, 2002) and East Asia (Claessens, Djankov, and Lang, 2000). It is thus interesting to examine the influence of blockholders besides controlling shareholders on the likelihood that firms get into financial trouble.

One of the crucial internal monitoring mechanisms is active shareholders. However, such shareholders must have a significant ownership and control stake in the firm so that they are willing to spend their resources on gathering and digesting the firm's information to monitor insiders, who are usually controlling shareholders and managers. Large outside shareholders have both the incentives to monitor and the power to act against the firm's controlling shareholder, and hence suggest a lower incidence that the controlling shareholder will extract firm value for his or her personal objectives. Furthermore, although having multiple blockholders might cause a free-riding problem in monitoring management, firm value is generally enhanced since this free-riding reduces

excessive monitoring by a single substantially concentrated shareholder (Pagano and Roell, 1998; La Porta, Lopez-de-Silanes, Shleifer, and Vishny, 1999).

Sharing voting rights among many large shareholders also helps to reduce the excessive power of one controlling shareholder as it necessitates the formation of an alliance among several blockholders to gain sufficient control over a company. Likewise, the presence of other large shareholders forces a controlling shareholder to accumulate a bigger ownership stake to stay in control. By holding a greater equity stake, the controlling shareholder has lower incentive to expropriate other shareholders (Bennedsen and Wolfenzon, 2000). Consistent with the view that multiple blockholders are valuable, shared control is efficient since ex-post bargaining problems among several large shareholders can prohibit them from undertaking actions that are beneficial to themselves but are detrimental to minority shareholders (Gomes and Novaes, 2001).

Empirical evidence also exists on the advantages of having multiple large shareholders. Edwards and Weichenreider (1999) document a positive relationship between voting rights held by the second largest shareholder and the value of German firms. Similarly, Lehman and Weigand (2000) find that German firms perform better when the second largest shareholder has a large ownership stake. In addition, Maury and Pajuste (2002) show that the presence of a firm's third largest shareholder is also positively associated with firm value, provided that they possess a significant fraction of votes. They argue that the number of large shareholders who have relatively equal voting rights increases the contestability of controlling power, which, in turn, favorably affects firm value.

In line with the view that multiple large shareholders are valuable, Volpin (2002) reports a higher Tobin's Q in Italian firms that have a voting syndicate, i.e., a coalition of large shareholders who agree to vote together, compared with firms without a voting syndicate. Wiwattanakantang (2001) shows that Thai companies with multiple controlling shareholders have better operating performance than those with no controlling shareholder. Moreover, Faccio, Lang, and Young (2001) find that European firms in which several blockholders exist pay higher dividends, suggesting lower expropriation of minority shareholders.

However, the presence of multiple large shareholders may harm firm value. Large outside shareholders do not always effectively monitor a firm's controlling shareholder. In fact, these blockholders may collude with the controlling shareholder to divert corporate resources for their own interests. Burkart, Gromb, and Panunzi (1997) argue that having a very large shareholder is value increasing if he or she performs an effective function in monitoring and disciplining management. This shareholder might, nevertheless, collaborate with managers in expropriating outside shareholders. In firms with several large shareholders, the same problem could arise if these shareholders delegate their voting rights to one shareholder. That is, the delegated shareholder may collude with managers and then share private benefits between the whole controlling group and management. Along the same line, Zwiebel (1995) contends that even though each of many large shareholders does not hold sufficient votes that confer on them adequate controlling power over the firm, such shareholders might conspire and form a controlling block. Hence, they can enjoy the benefits of control that are shared only among their group.

Another strand of theory explaining the disadvantages of several large shareholders is argued by Gomes and Novaes (2001). They develop models showing that value-enhancing investments may not be accepted or carried out when there are disagreements among large shareholders of a firm.

There has been little empirical research investigating the costs associated with having multiple blockholders. Faccio, Lang, and Young (2001) show that in East Asian firms, when more than one large shareholder is present, the expropriation problem of small (minority) shareholders is aggravated. In particular, they find that these large shareholders join together in expropriating small shareholders by forcing management to pay low dividends. Maury and Pajuste (2002) report that the presence of the second largest shareholder has an adverse effect on firm value when the combination between this shareholder's votes and the largest shareholder's votes exceeds 50 percent. The result supports the view that large shareholders might collude in expropriating small shareholders and enjoy sharing private benefits of control among themselves.

The above empirical results indicate benefits and costs brought by multiple large shareholders. According to the *multiple-blockholder monitoring* hypothesis, these large

shareholders are induced to monitor each other. At the same time, they are expected to monitor managerial decisions. Furthermore, sharing of control in a group of large shareholders can restrain these blockholders from being entrenched, suggesting that the presence of multiple large shareholders is favorable to a firm. Thus firms that also have other large shareholders should be less likely to experience corporate financial distress when compared with firms that have no other large shareholder but the controlling shareholder. However, *collusion* and *disagreements* among blockholders can be detrimental to a firm. Hence, the impact of large shareholders on the likelihood of distress or bankruptcy is open for empirical testing.

Although multiple blockholders are common and appear to have a significant impact on firm value, their impact on the distress likelihood is hardly known. In this study, we examine the influence of multiple large shareholders on the probability of corporate distress by adding the dummy variable indicating if a firm has more than one large shareholder with at least 10% of the voting rights.

2.2.3 Business group affiliation and the likelihood of distress

Most of corporate distress/failure prediction models generally ignore corporate ownership structure. Basically, this is equivalent to making the assumption that all firms are independent economic entities. In fact, in emerging market economies and several European countries, a large number of firms are linked through business groups.[10] In many cases, influential families typically control not a single firm but a group of associated firms. This control is usually achieved through direct shareholdings, pyramidal holding structures, cross-shareholdings and, in countries where the law allows, shares with differential voting rights. Links between group firms create agency problems that are not as straightforward as those discussed in the 1970s and 1980s literature (Bebchuk, Kraakman, and Triantis, 2000).

The evidence from existing studies on the costs and benefits associated with business group affiliation has been mixed. One of the advantages brought by group affiliation is that business groups provide internal markets among member firms which

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[10] See, for example, Deloof (2001), Faccio, Lang, and Young (2001), Claessens, Djankov, Fan, and Lang (2002), Lins and Servaes (2002), Yafeh and Khanna (2005), Claessens, Fan, and Lang (2006).

enable the groups to actively shift resources and risk throughout their structure (Yafeh and Khanna, 2005). This advantage explains why business groups are more pronounced in emerging economies. Due to a high degree of information asymmetries, a lack of intermediary institutions, and imperfections in capital, product, as well as labor markets, firms in emerging economies find it costly to acquire essential resources and also to establish corporate reputation and credibility (Khanna and Palepu, 2000). Business groups can help mitigate these problems through their internal markets (Claessens, Fan, and Lang, 2006).

One such method by which business groups can mitigate these problems is through intra-group trading so as to reduce transaction costs (Williamson, 1985). Business groups can generate the use of "internal capital markets" among affiliated firms by transferring funds from affiliated firms with high cash flows but poor investment opportunities to affiliated firms with low cash flows but superior investment opportunities (Stein, 1997). Size, scope, and reputation of business groups could also alleviate external market imperfections by providing internal intermediary institutions for member firms (Khanna and Palepu, 2000).

Nevertheless, the complicated ownership and control structures of business groups may increase the severity of any agency problems (Claessens, Djankov, Fan, and Lang, 2002; Lins and Servaes, 2002; Claessens, Fan, and Lang, 2006). Since business groups typically consist of firms ultimately controlled by a family or an ultimate owner, linked together via pyramids or cross-shareholdings, the major conflicts arise between controlling and minority shareholders. Large scale and scope of business groups and high informational asymmetries facilitate the expropriation of outside minority shareholders by owner-managers. The problems tend to be more acute in emerging economies where governance mechanisms are less effective. A greater opportunity to exploit corporate resources for personal purposes allows controlling shareholders of business groups in emerging markets to accomplish empire building or maximize their own or the group's wealth, rather than the value of individual firms (Jensen, 1986; Stulz, 1990).

Inefficient transfers of resources across group members and unproductive investments in a business group are related to the agency issues described above (Scharfstein, 1998; Shin and Stulz, 1998; Rajan, Henri, and Zingales, 2000; Scharfstein

and Stein, 2000). For example, ownership by common controlling shareholders may lead to a misallocation of capital among group firms via investing in unprofitable group firms where they own more, using cash flows produced by profitable firms where they own less. Controlling shareholders of business groups could also make use of group firms' resources for their own interests, such as self-dealing and transfer pricing transactions between affiliated firms.

Considering the impact of business group affiliation on the distress likelihood, if controlling shareholders of business groups effectively and vigorously get involved in managerial decision-making that enhance firm value, group firms should be less prone to distress, relative to non-group firms. Moreover, if the risk sharing among group firms and the utilization of internal markets within a diversified business group assist the group firms to avoid financial distress, group affiliation can have a negative impact on the distress likelihood of firms that belong to a business group. Alternatively, group affiliation could allow investment policies that inefficiently hold up affiliated firms in distress, through resources from relatively steady firms.[11] This may also result in a lower probability of corporate distress in group affiliated firms. Several studies document that business groups or conglomerates are likely to systematically support their poorly performing member firms or subsidiaries (Lamont, 1997; Claessens, Djankov, Fan, and Lang, 2002).[12] In contrast, if group connected firms are subject to higher degree of misallocation, the likelihood of corporate distress should be greater in group connected firms than stand-alone firms (Bongini, Ferri, and Kang, 2000; Bongini, Claessens, and Ferri, 2001). Like the impact of controlling shareholders on the distress likelihood, the impact of group affiliation on the distress likelihood is an empirical issue.

When a firm has access to an internal capital market due to its membership of a business group, well-documented distress/failure prediction ratios may likely be biased. For example, Hoshi, Kashyap, and Scharfstein (1991) and Deloof (2001) show that group firms usually have lower liquidity constraints and hence maintain lower liquidity levels than their stand-alone counterparts. Thus, in firms that belong to a business group, the

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[11] This might reduce value of other affiliated firms in a group, even though it is favorable to value of the distressed firms.

[12] The incidence of a member firm or subsidiary going bankrupt may severely jeopardize the relation between the parent and its creditors and on the group's reputation in general. This could lead to a group-wide increase in the cost of capital (Bebchuk, Kraakman, and Triantis, 2000).

power of liquidity ratios to predict corporate distress and/or failure can be limited. Likewise, the information content of leverage ratios in predicting corporate distress and/or failure could be affected by internal capital markets since group affiliation may increase debt bearing capacity (Hoshi, Kashyap, and Scharfstein, 1990). In addition, the leverage level of member firms within a group is likely the result of a global cost minimizing intra-group optimization process (Faccio, Lang, and Young, 2001; Bianco and Nicodano, 2002). Even performance ratios, which typically are the strongest group of distress/failure predictors, may not have the same predictive power as in the case of stand-alone firms. Moreover, Dewaelheyns and Van Hulle (2004) show that after correcting group effects, the predictive performance of existing models such as Altman (1983) is improved.

Empirical studies on the relation between group affiliation and firm value exist although the results are inconclusive. In contrast, research on the impact of group affiliation on the likelihood of corporate distress or bankruptcy is limited. Based on a set of Italian SMEs, Bechetti and Sierra (2003) report that group-affiliated firms have a lower probability of failure than non-affiliated firms. Similarly, Claessens, Djankov, and Klapper (2003) show a negative relationship between business group dummy and the probability of bankruptcy filings by distressed firms during the East Asian crisis. Similarly, Dewaelheyns and Van Hulle (2004) show the results that are consistent with the notion that business groups support poorly performing member firms unless the financial situation of the group prevents them from doing so. Nevertheless, Heiss and Köke (2001) examine the impact of control structure on corporate failure in Germany and find no relation between ownership and failure. However, they argue that this result may be due to lack of power due to the very low number of failing firms in their sample.

Studying the distress and closure of Korean financial institutions, Bongini, Ferri, and Kang (2000) find that connected financial institutions are more prone to distress due to their likely higher degree of misallocation. Similarly, Bongini, Claessens, and Ferri (2001) show that connection with influential groups increases the probability of financial institutions' closure during the East Asian crisis. Nevertheless, they interpret the result differently. That is, they argue that the result suggests that the financial institution closure process was relatively free from political pressures.

Although a large number of Thai listed firms belong to business groups (Polsiri and Wiwattanakantang, 2006), there has been no study on the impact of Thai business groups on the distress likelihood. This motivates an examination of whether the association with a top business group in Thailand has any impact on the likelihood of corporate distress. Thai business groups are typically defined as the number of firms that are owned by the same individual or family. In this study, a sample firm is classified as being affiliated with a business group when its largest shareholder is one of the families that own the top 30 business groups ranked by Suehiro (2000).[13]

2.3 Board structure and the likelihood of distress

Active participation in the board of directors by controlling shareholders is an outstanding characteristic of majority-owned firms as well as firms with concentrated ownership.[14] For Thai corporations, Khanthavit, Polsiri, and Wiwattanakantang (2003) show that in around 70% of non-financial listed firms, controlling shareholders and their associates serve as executive directors and in around 63% of the firms, they serve as non-executive directors. Moreover, the fraction of Thai non-financial listed firms with controlling shareholders and their associates serving as the majority of executive directors is approximately 37%.

Other than large shareholders, a board of directors is generally perceived as a crucial internal governance mechanism. Fama and Jensen (1983) contend that the separation of "decision management" and "decision control" in a decision-making process can mitigate agency problems between managers and shareholders. That is, while managers and inside directors perform a "decision management" function, independent outside directors should be accountable for a "decision control" function.

Independent outside directors are encouraged to exercise their decision control because they possess the relevant human capital to monitor management and they have to preserve their reputation as professional corporate referees in the external managerial

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[13] This ranking was based on sales. It includes only firms that appeared on the list of the top 1000 companies in 1994 that was published by Advance Research Group (1995). Therefore, it may not include all the groups' affiliates.

[14] See, for example, Denis and Denis (1994), Claessens, Djankov, and Lang (2000), and Faccio and Lang (2002).

labor market. These directors are hence expected to play an important role in monitoring and disciplining management on behalf of shareholders. A key factor that determines the effectiveness of board monitoring power is the degree of board independence. In general, a board of directors becomes more independent as the fraction of outside directors in the board increases.

There is a growing body of literature in the area of board independence and its impact on firm value. However, the empirical evidence remains inconclusive. Rosenstein and Wyatt (1990) document positive excess returns around the days that firms announce an appointment of outside directors. They then interpret that this appointment is related to an increase in shareholders' wealth. Borokhovich, Parrino, and Trapani (1996) find that the proportion of independent outside directors on a board is positively associated with the likelihood that a CEO will be replaced, and that such replacement is beneficial to shareholders. The monitoring function of independent outside directors is also supported by evidence from takeover markets. Byrd and Hickman (1992) show that the markets distinguish bidder firms with outsider-dominated boards to make better acquisitions. Likewise, Cotter, Shivdasani, and Zenner (1997) report that target firms with a majority of outside directors on the board obtain higher gains in tender offers than those with a minority of outside directors.

Empirical evidence that does not support the monitoring and disciplining role of independent outside directors is also provided. Baysinger and Butler (1985), Hermalin and Weisbach (1991), Merhan (1995), Klein (1998), Faccio and Lasfer (1999), and Bhagat and Black (2002) document no significant relationship between the fraction of outside directors on the board and firm performance. They argue that if a board is optimally weighted between insiders and outsiders, such relationship might not be observed at the equilibrium. In addition, it could be difficult to determine the efficiency of governance functions performed by outside directors on "day-to-day" operations.

Hermalin and Weisbach (2003) survey the literature on the governance role of US firms' board of directors and conclude that board structure has insignificant effects on firm performance. The value enhancement provided by independent outside directors appears to be related to better managerial decisions on a specific event such as

acquisitions. In other words, the effects of board independence are more evident on critical situations in which conflicts of interest between managers and shareholders are possibly greatest.

Regarding the relation between board structure and the likelihood of corporate distress, the *entrenchment hypothesis* predicts that when controlling shareholders also occupy board seats, they are more entrenched and less constrained by board monitoring. Consequently, firms in which controlling shareholders actively participate as directors are more likely to encounters corporate financial distress than firms in which controlling shareholders are not active in board participation. Lee and Yeh (2004) find the evidence that supports this view.

On the other hand, the *interest alignment hypothesis* predicts that if controlling shareholders own a significant portion of the cash-flow rights, their interests will be aligned with those of minority shareholders. Hence, when the controlling shareholders and their associates actively participate in the board, they should be able to influence major managerial decision making. Therefore, according to the *interest alignment hypothesis*, firms in which controlling shareholders actively occupy board seats will be less likely to be in distress.

Moreover, due to the fact that controlling shareholders commonly serve as top management (Khanthavit, Polsiri, and Wiwattanakantang, 2003), having a significant portion of directors associated with controlling shareholders on board reinforces the power of top management team. When the top management team has high power, the levels of affective conflict will be lower (Finkelstein, 1992; Buchholtz, Amason, and Rutherford, 2005). This effect will in turn reduce top management team deterioration that may hurt firm performance especially in bankruptcies (Hambrick and D'Aveni, 1992). Therefore, according to the *affective conflict* view, the greater the portion of directors associated with controlling shareholders, the lower the likelihood of distress.

The board structure is thus included as a governance variable in our prediction models. It is the combination of i) the fraction of directors who are the controlling shareholders or the controlling shareholders' affiliates, ii) the fraction of directors who not a firm's employees and not associated with controlling shareholders, and iii) the

fraction of independent directors (in case of Thailand, during our sample period, the Stock Exchange of Thailand requires that a listed firm appoint at least two independent directors).

2.4 Financial factors and the likelihood of distress

The literature on corporate distress/failure prediction has extensively documented that financial variables are significant factors that determine the likelihood of financial distress and bankruptcy. Shivaswamy, Hoban, and Matsumoto (1993) review 13 studies and summarize the frequency of financial variables applied in the studies. They conclude that the most commonly used financial ratios are those proxied for leverage, profitability, and liquidity. Likewise, Altman and Narayanan (1997) survey prediction models constructed worldwide and document that there is a similarity in selecting financial ratios as predictors. The commonly chosen financial predictors include leverage, past and present performance, liquidity, solvability, and efficiency – depending on the sampling approach – size and industry.

Therefore, to precisely investigate the effects of governance characteristics on corporate distress and to develop effective distress prediction models, financial characteristics are introduced as explanatory variables in our models. Following the literature, we use financial variables that measure leverage, profitability, liquidity, and size of the sample firms to construct the models.

Leverage and the likelihood of distress

Prior research of corporate distress/failure prediction commonly includes some measure of a firm's use of financial leverage. For highly leveraged firms, a slight decrease in firm value may lead to default on debt obligation. Obviously, the research suggests that a firm's level of leverage is expected to increase its likelihood of being distressed and/or going bankrupt (for example, Altman, 1968; Platt and Platt, 1990; Lee and Yeh, 2004). In this study, we measure leverage as the ratio of total debt to total assets.

Profitability and the likelihood of distress

Firms that perform poorly are expected to be more likely to encounter financial difficulties. The empirical evidence shows that firm performance does have a significant effect on the probability of corporate distress and/or failure (for example, Altman, 1968; Bongini, Ferri, and Kang, 2000; Claessens, Djankov, and Klapper, 2003; Dewaelheyns and Van Hulle, 2004; Lee and Yeh, 2004). Here, we measure a firm's profitability by the ratio of earning before interest and taxes (EBIT) to total assets. We use this measure to focus on the firm's operational profitability and control for the impact of capital structure and taxes.

Liquidity and the likelihood of distress

Firms with more liquid assets are generally less financially constrained. This suggests low demand for external sources of funds to finance losses in firms with high liquidity, at least in the short run. Accordingly, the probability that these firms will be financially distressed might be smaller. For Thai firms, Tirapat and Nittayagasetwat (1999) show that more liquid firms are less likely to experience distress during the East Asian crisis. Therefore, our distress prediction models will also include a variable representing financial liquidity, measured as the ratio of current assets to current liabilities.

Size and the likelihood of distress

Evidence from previous studies reveals a negative relation between firm size and the incidence of corporate distress. Because large firms are well established with large asset bases that can be used as collateral, they usually have a better access to external sources of funds. Moreover, larger firms are better able to avoid financial distress by using public equity markets or by exercising market power. In addition, size has frequently been included in early warning and bankruptcy prediction studies as a proxy for "too-big-too-fail" situations. Such situations are widely especially in the case of emerging market economies. In this study, we measure firm size by the natural logarithm of the firm's stock market capitalization.

2.5 Distress Prediction Models

2.5.1 Traditional statistical approaches

Traditionally, models attempting to predict the probability of corporate distress and/or failure have employed statistical techniques. Such models have been built on the basic insights of a small number of pioneering papers. The first pioneering study is Beaver (1966) who initiates a univariate approach to examine the predictive ability of one financial ratio at a time. A "cut-off" score calculated for each ratio is used as the criterion to separate failed firms from non-failed firms. This is followed by Altman (1968) who introduces Multivariate Discriminant Analysis (MDA) in predicting the likelihood of corporate failure. The discriminant function applies five weighted financial ratios to generate the *z*-score. The *z*-score represents the "cut-off" threshold that discriminates between failed and non-failed firms. Then Ohlson (1980) points out statistical problems regarding MDA and introduces binary logit regression in classifying bankrupt and non-bankrupt firms. The Ohlson's logit model combines firms' characteristics into a logit score that indicates the probability of corporate failure. A firm is classified as failed if its logit score is below a prior chosen cut-off level.

Statistical techniques used to developed prediction models also include (but not limited to) linear probability model (LPM), probit regression approach, cumulative sums (CUSUM) procedure, and partial adjustment process (Aziz and Dar, 2004). Most of these studies share a similar approach on the basis that a set of statistically best financial accounting data (or ratios) is chosen to differentiate between distressed and non-distressed firms or bankrupt and non-bankrupt firms, within a particular prediction horizon. Despite the development of more advanced statistical techniques, MDA and logistic regression have continued to be most widely used (Altman and Narayanan, 1997; Atiya, 2001). The early wave of the literature documented that, to name a few, MDA approaches were used in Altman (1968), Deakin (1972), Blum (1974), and Sinkey (1975), while logit regression approaches were used in Martin (1977), Ohlson (1980), and Gentry, Newbold, and Whitford (1985).[15]

Considering one of the two most popular approaches, an advantage of logit regression is that it imposes no assumptions on the distribution of the predictors or the

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[15] Altman (1981) provides a comprehensive survey.

prior probabilities of corporate distress and/or failure. Hence, it is unbound to the restrictive assumptions on which MDA relies. Another advantage of logit regression is about its result (i.e., the logit score) that indicates the likelihood of distress and/or failure. In addition, the coefficients in a logit regression model suggest the relative significance of the explanatory variables (Ohlson, 1980). Logit regression models also benefit from a degree of non-linearity due to their logistic function (Laitinen and Kankaanpaa, 1999). However, there are some limitations about logit regression models: (i) they are susceptible to the multicollinearity problem, (ii) they assume a logistic probability distribution, and (iii) they are sensitive to outliers and missing values (Balcaen and Ooghe, 2004).

2.5.2 Neural network approaches

Not until 1990 have neural network approaches been introduced in the field of corporate distress/failure prediction.[16] There are a number of reasons that explain the growth of neural network applications in this research. First, contrary to traditional statistical techniques, neural network approaches are not based on a-priori assumptions about the distribution of data (Zhang, Patuwo, and Hu, 1998; Vellido, Lisboa, and Vaughan, 1999; Atiya, 2001). Hence they are most appropriate for a problem of which data are available but the underlying theoretical model is unidentified (Zhang, Patuwo, and Hu, 1998). Second, neural networks can "learn" from experiences to extract the underlying attributes, and then generalize to an unidentified sample. As a result, neural networks are suited for predicting future events based on past data. Third, neural networks are advantageous of statistical techniques in handling multi-dimensional and non-linear data. Fourth, neural networks do not rely on the a-priori information about the relation between explanatory and dependent variables. Finally, neural networks are believed to be fault-tolerant when dealing with incomplete, missing or noisy input data (Caudill and Butler, 1990).

Wilson and Sharda (1994) compare between the performance of MDA and neural networks in predicting corporate bankruptcy and find that the neural networks perform

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[16] See Atiya (2001) for a review of neural networks applications in predicting corporate distress/failure, and comparisons between statistical and neural networks approaches in corporate distress/failure prediction models.

better than MDA in classifying and predicting corporate bankruptcy. Furthermore, Zhang, Hu, and Patuwo (1999) compare the bankruptcy predictive accuracy of neural networks with that of logit regression. They find that for small test sets, the overall classification rate of neural networks is significantly greater than that of the logit regression. However, the two methods are not significantly different in terms of their prediction for each category of bankrupt and non-bankrupt firms. For large test sets, Zhang, Hu, and Patuwo (1999) show that neural networks outperforms logistic regression in both overall classification rate and prediction for each category of bankrupt and non-bankrupt firms. Salchenberger, Cinar, and Lash (1992), Coats and Fant (1993), and Fernandez and Olmeda (1995) also obtain similar results when they compare neural networks with traditional statistical techniques.

On the contrary, Boritz and Kennedy (1995) find that the performance of neural network models is not better than that of MDA, logit regression, or probit regression in predicting business failure. Moreover, their results suggest that the performance of neural networks is susceptible to input variables and sampling errors. This rather contradicts the literature that neural networks are considered to be fault tolerant regarding noisy input data (Caudill and Butler, 1990).

Nevertheless, based on his review, Atiya (2001) concludes that in general, a neural network approach outperforms statistical techniques in predicting corporate distress/failure. Interestingly, Atiya's review shows that there is still a gap in the established body of knowledge in this area. That is none of previous studies have used governance variables as predictors in conjunction with neural network approaches to predict corporate distress or failure. To the best of our knowledge, no neural network application that incorporates governance characteristics to predict the likelihood of corporate distress and/or failure has been documented.

Chapter 3

Data and Methodology

In this chapter, we begin with the sample selection criteria. Then, we discuss the data sources and data collection. Finally, we review the approaches used to develop corporate distress prediction models, namely logit regression and neural networks. The logit regression is also used to investigate the effects of corporate governance, i.e., ownership and board structures, on the probability with which firms experience distress.

3.1 Sample selection

Our interests are to investigate the effects of governance characteristics on corporate distress, and to develop distress prediction models that consist of corporate governance and financial variables. We conjecture that expropriation of minority shareholders by a firm's controlling shareholder may cause corporate distress. Hence, governance variables should help explain the likelihood of corporate distress and be incorporated in prediction models.

Our sample includes non-financial companies listed on the Stock Exchange of Thailand that were in distress during the period 1998-2001 of which data are available, and control firms that are matched by size and industry on two-to-one basis. Banks and other financial institutions are not included due to the ownership restrictions imposed on banks and financial institutions by the Bank of Thailand.[17] The control firms are chosen in the following manner. We listed all the sample firms in each of the 19 industries under the Standard Industrial Classification (SIC) codes.[18] Then we ranked the firms in each industry according to their total assets at the end of the year prior to the year when our distressed firms experienced financial distress. Firms that belong to the same industry and are closest in terms of total assets but do not encounter financial distress during the

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[17] A shareholder is not allowed to own more than 5 percent and 10 percent of shares in commercial banks and finance (and securities) companies, respectively (Commercial Banking Act B.E. 2505 and Act on the Undertaking of Finance Business, Securities Business, and Credit Foncier Business B.E. 2522).

[18] Industries grouped by the SET are more disaggregated and are not in accordance with the SIC codes. In some cases, these industries have to be combined together to meet the international classification system. The final sample firms are classified into 19 industries.

sampling period are then selected. The final sample contains 80 distressed firms and 121 control firms.

In this study, we define distressed firms as firms that were ordered by the Stock Exchange of Thailand to delist or submit rehabilitation plans. Note that although the prediction models that we will develop are based on current environment and conditions, our sample covers non-financial listed firms between 1998 and 2001. The reason is that in such a period, many firms in the Thai stock market became financially distressed due to the economy-wide crisis. This will give us a sufficiently large sample size. If our models are sound, it will suggest that the models hold even dating back several years. In other words, our models serve as an effective early-warning signal across time.

3.2 Data collection

The main objective of this study is to develop corporate distress prediction models that incorporate both governance and financial variables. However, due to data availability, we will focus on firms listed on the Stock Exchange of Thailand. The data here are categorized to governance (i.e., ownership and board structures) data and financial data

3.2.1 Data on governance characteristics

To investigate the effects of governance characteristics regarding concentrated ownership on the corporate distress likelihood, we construct a comprehensive ownership and board databases of non-financial companies during the period 1996-2000. The source of ownership and board information is the I-SIMS database. This database provides information on the shareholders with at least 0.5% of a firm's outstanding shares and a list of a firm's board members. Additional information on ownership and board data, including a list of a firm's affiliated companies and shareholdings owned by these companies, as well as relationships among major shareholders and board members, is manually collected from company files (FM 56-1) available at the SET library and website. Given that all members of a related family are treated as a single shareholder, family relationships beyond their surnames are traced through various documents that provide a genealogical diagram of influential Thai families in our sample (Phipatseritham,

1981; Phipatseritham and Yoshihara, 1983; Suehiro, 1989; Pornkulwat, 1996; Sappaiboon, 2000a, 2000b, 2001; Johnstone, Neilsen, and Henderson, 2001; Neilsen and Henderson, 2003).

Furthermore, the BOL database provided by BusinessOnLine Company Limited is used to search for owners of private companies that appear as corporate shareholders of the sample firms. The BusinessOnLine Company Limited has a license from the Thai Ministry of Commerce to reproduce company information from the Ministry's database. This database contains information of all registered companies, including ownership data, which is reported annually to the Ministry. Accordingly, owners of all privately owned companies that appear to be (domestic corporate) shareholders of listed firms in the sample are identified. The conduct of this search allows our accurate estimation of the equity stake held by a firm's shareholders whereas its omission can lead to an underestimation of such value.

As a result, our study is based on a unique and more comprehensive data set of ownership than used elsewhere. Previous research on ownership structure of firms in East Asian countries (for example, Claessens, Djankov, and Lang, 2000; Claessens, Djankov, Fan, and Lang, 2002; Mitton, 2002; Lemmon and Lins, 2003; Lins, 2003) typically employs a data set that includes shareholders with at least *5%* of a firm's shares, whereas the database used in this study provides more detailed information on shareholders who hold at least *0.5%* of a firm's shares. The data set is also extended in two directions. First, the data set allows the identification of ultimate owners of all privately owned companies that, in turn, hold shares in the sample firms. Second, the data set provides in-depth information on the family relationships among a sample firm's shareholders as well as board members.

3.2.2 Data on financial characteristics

Data on financial characteristics include industrial classification, book value of total assets, debt and equity, sales, and market capitalization. Key financial ratios that have widely been used in distress prediction models are also calculated. These ratios represent operating performance, capital structure, and liquidity of the sample firms.

The data are obtained mainly from the I-SIMS database. This database contains financial information on Thai listed companies, including financial statements, notes to financial statements, auditors' reports, released on a quarterly basis, and stock prices. For companies where such data are not available from the I-SIMS database, annual disclosure forms (FM 56-1) submitted to the SET are used instead.

3.2.3 The definition of controlling shareholders

Following Wiwattanakantang (2001) and Khanthavit, Polsiri, and Wiwattana-kantang (2003), we define a "controlling shareholder" as a shareholder who *directly* or *indirectly* owns more than 25 percent of a company's votes. The convention in the literature is to use cutoff levels of 10 percent and 20 percent (see for example, La Porta, Lopez-de-Silanes, Shleifer, and Vishny, 1999; Claessens, Djankov, and Lang, 2000; Faccio and Lang, 2002).[19] However, a 25 percent cutoff is more appropriate for Thailand for two reasons. First, under the Public Limited Companies Act B.E. 2535, to have the power to take most corporate decisions, a shareholder needs to own at least 75 percent of a firm's outstanding shares. Hence, a shareholding of more than 25 percent of votes means that no other single shareholder would own enough voting rights to have the absolute power over the firm.

Second, a shareholder with 25 percent of outstanding shares has sufficient legal rights to perform the following actions under Thai corporate law. First, the shareholder has the right to ask a court to withdraw a resolution that fails to comply with, or that is in contravention of, the articles of the company's association or of the provisions of the Public Limited Companies Act B.E. 2535. Second, the shareholder has the right to demand an inspection of the company's business operations and financial conditions. Third, the shareholder has the right to call an extraordinary general meeting at any time. Fourth, the shareholder has the right to request a court to dissolve the company if he or

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[19] La Porta, Lopez-de-Silanes, Shleifer, and Vishny (1999) used data for the 20 largest firms in the 27 wealthiest countries in 1995. Claessens, Djankov, and Lang (2000) used data for 2,980 publicly traded companies in nine East Asian countries in 1996. Faccio and Lang (2002) used data for 5,232 publicly traded companies in 13 Western European countries for the period between 1996 and 1999. All these studies exclude shareholders with less than 5 percent of the firms' shares and employ a 20 percent cutoff to define controlling shareholders.

she expects that further business operations will bring in only losses and that the company has no chance of recovery (Sersansie and Nimmansomboon, 1996).

In addition, we view that the definition of shareholders according to the Public Limited Companies Act B.E. 2535 (A.D. 1992) is too narrow.[20] It is a common practice in Thailand as in many emerging economies that firms are owned by a group of people from the same family or families that are connected by marriages. Family members in Thailand often do business together and vote as a coalition. Therefore, we employ a broader definition of a shareholder defined as follows. A shareholder here includes: 1) his or her spouse, minor children, siblings, relatives who have the same family name, and in-law families, and 2) companies that are owned by him or her for more than 25%.

3.3 Explanatory variables: Governance versus financial variables

Unlike most of previous studies of which financial distress prediction models are based on financial variables, we develop prediction models using two types of variables: our main focus, governance variables, in relation to ownership and board structures, and commonly used financial variables.

Our governance variables can be classified to five ownership structure variables and three board structure variables. The ownership structure variables include *CSDUM*, which is the dummy variable equal to 1 if the firm has a controlling shareholder (i.e., a shareholder who has more than 25% of the firm's voting rights) and 0 otherwise, *BLOCK*, which is the dummy variable which takes the value of 1 if the firm has at least two shareholders with more than 10% of the firm's voting rights and 0 otherwise, *INDIR*, which is the dummy variable which takes the value of 1 if the firm is controlled via pyramidal structure or cross-shareholdings and 0 otherwise, *CFRLEV*, which is the ratio of cash-flow rights to voting rights held by the firm's largest shareholder, and *GRRANK*, which is the rank of business group belonging to the firm's controlling shareholder. The board structure variables include *CSBODF*, which is the fraction of board seats held by controlling shareholders and their associates, *NCSBODF*, which is the fraction of board

[20] See Sersansie and Nimmansomboon (1996) and the Stock Exchange of Thailand (1998, 2001) for the review of the Thai corporate law.

seats held by members other than controlling shareholders and their associates, and *INDBODF*, which is the fraction of board seats held by outside independent directors

On the other hand, as discussed in Chapter 2 the variables most extensively used in the existing literature are based on financial statements. In this study, the financial variables (ratios) include *DTA*, which is the ratio of total debt to total assets, as a proxy for "leverage", *OPTA*, which is the ratio of operating profits to total assets, as a proxy for "profitability", *CATCL*, which is the ratio of current assets to total assets, as a proxy for "liquidity", and *LOGCAP*, which is the logarithm of market capitalization, as a proxy for "size". The definition of all explanatory variables is presented in Table 3-1.

In sum, there are two groups of explanatory variables. The first group contains variables that represent major governance characteristics of ownership and board structures of firms in an economy where concentrated ownership is common. The second group of explanatory variables consists of financial variables that are well documented to have a significant impact on the likelihood of corporate distress. These explanatory variables are measured as of the base year, i.e., one year prior to the distress year. Consequently, we associate a firm's corporate distress incidence with its prior year governance and financial characteristics. The expected effects of these explanatory variables on the likelihood of corporate financial distress are summarized in Table 3-2.

3.4 Methodology

3.4.1 Logit regression

Following the existing literature, we apply binary logit regression to develop the dichotomous prediction models. Binary logit provides significant tests on the parameter estimates and allows us to generate the probability of corporate distress for each firm in order to investigate the classification accuracy. The probability of distress can be viewed as an approximation of the corporate distress risk for each firm.

A logit model is estimated using the maximum likelihood method. The logit prediction model used in this study is as follows.

$$\text{Prob}\,(Y_i = 1) = \frac{1}{1 + \exp(-Z_i)}$$

where

$$Z_i = \alpha + \sum \beta_j X_{j,i} + \varepsilon_i$$

Table 3-1 Definition of variables

Variable	Type	Definition
CSDUM	Governance (Ownership)	Dummy variable which takes the value of 1 if the firm has at least one shareholder with more than 25% of the firm's voting rights and 0 otherwise
BLOCK	Governance (Ownership)	Dummy variable which takes the value of 1 if the firm has at least two shareholders with more than 10% of the firm's voting rights and 0 otherwise
CFRLEV	Governance (Ownership)	Ratio of cash-flow to voting rights held by largest shareholder
INDIR	Governance (Ownership)	Dummy variable which takes the value of 1 if the firm is controlled via pyramidal structure or cross-shareholdings, 0 otherwise
GRRANK	Governance (Ownership)	Rank of business group belonging to the firm's controlling shareholder
CSBODF	Governance (Board)	Fraction of board seats held by controlling shareholder
NCSBODF	Governance (Board)	Fraction of board seats held by members other than controlling shareholder
INDBODF	Governance (Board)	Fraction of board seats held by independent directors
DTA	Financial	Ratio of total debt to total assets
OPTA	Financial	Ratio of operating profits to assets
CATCL	Financial	Ratio of current assets to current liabilities
LOGCAP	Financial	Logarithm of market capitalization

Table 3-2 Explanatory variables and their expected effects on the probability of corporate distress

Variables	Proxy for	Expected effect on distress probability
Governance variables		
CSDUM	Ownership structure	(+/-) Expropriation/Monitoring
BLOCK	Ownership structure	(-) More incentives to monitor
CFRLEV	Control structure	(-) Less incentives to expropriate
INDIR	Control structure	(+) More incentives to expropriate
GRRANK	Ownership structure	(-) Risk sharing or utilization of internal capital market
CSBODF	Board structure	(+/-) Entrenchment/Interest alignment
NCSBODF	Board structure	(+/-) Higher affective conflict/Monitoring
INDBODF	Board structure	(-) Board independence
Financial variables		
DTA	Leverage	(+) Default risk
OPTA	Performance	(-) Profitability
CATCL	Liquidity	(-) Less liquidity risk
LOGCAP	Size	(-) Ability to absorb losses

Y_i is the dependent categorical variable assigned the value of 1 if a firm *i* is in distress (as defined in Section 3.1), and zero otherwise; Z_i is a linear function in which α is the estimated intercept; $X_{j,i}$ is the explanatory variable *j* for the *i*th firm; β_j is the coefficient of $X_{j,i}$; and ε_i is the unknown parameter *j*. Prob ($Y_i = 1$) is the probability with which firm *i* will be in distress. If the computed probability exceeds 0.5, the firm is classified as being distressed.

We construct four logit models that are different in terms of corporate governance variables while the set of financial variables, on the other hand, are the same in all models. In Model 1, the governance variables consist of *CSDUM, BLOCK, INDIR, GRANK, CSBODF,* and *INDBODF*. In Model 2, we replace *INDIR* with *CFRLEV*. The reason of

doing so is to investigate the effect of the magnitude of the separation between ownership and control on the distress likelihood.

In Models 3 and 4, the difference of governance variables from those of Models 1 and 2 lies on the board structure variables. This is to test whether directors who are not associated with the controlling shareholders but at the same time they are not really "outside" independent directors have a significant impact on the probability of distress. That is in Model 3, the governance variables consist of *CSDUM, BLOCK, INDIR, GRANK,* and *NCSBODF*. Similar to Models 1 and 2, in Model 4, we replace *INDIR* in Model 3 with *CFRLEV*.

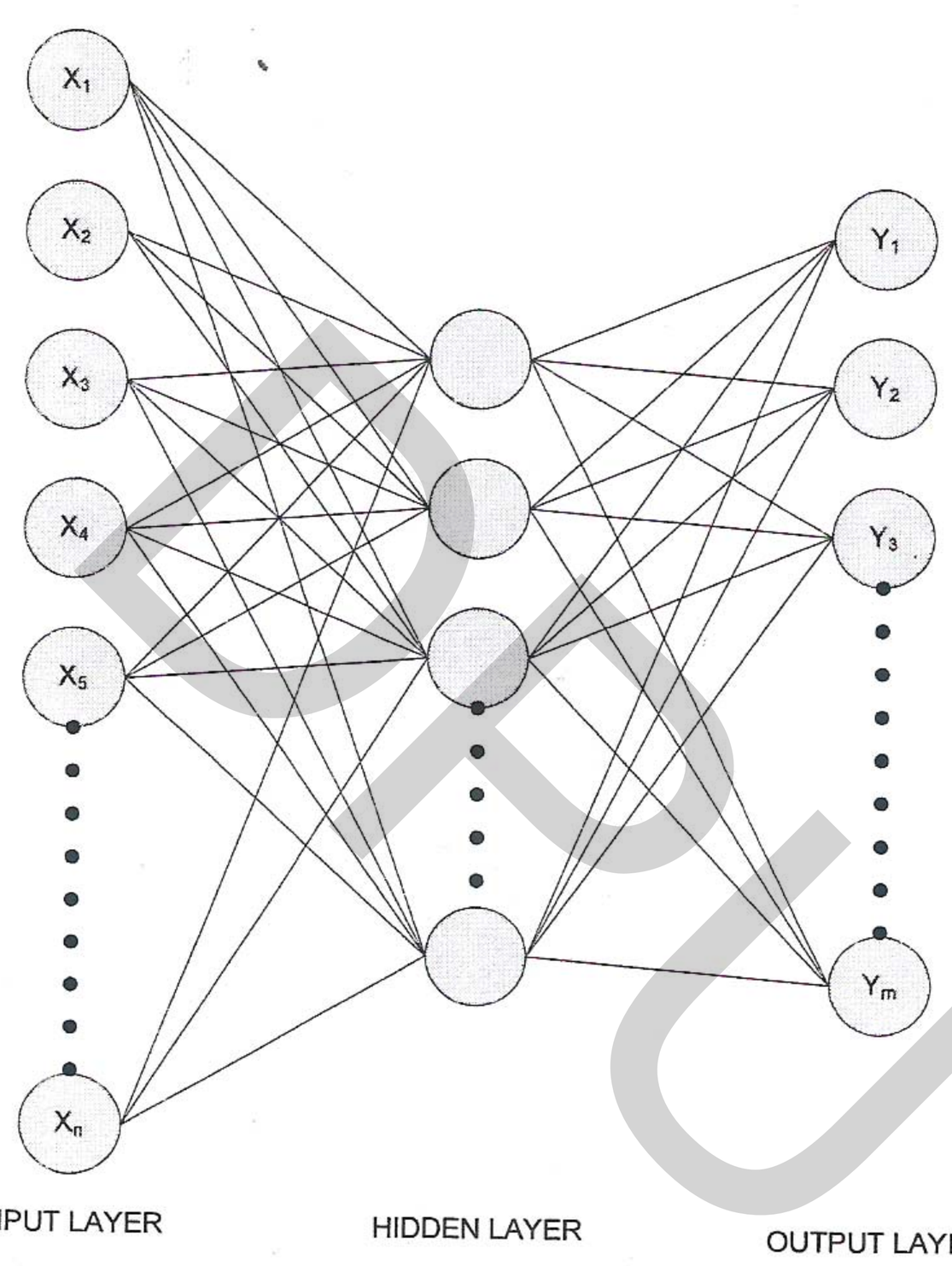
3.4.2 Neural networks

In principle, neural networks can process any computable function. In this study, we concentrate on a specific type of neural networks, the multilayer feedforward neural network. The architecture of the multilayer feedforward neural network specifies the number of layers, the number of neurodes in which each layer contains, and how the neurodes are interconnected. Especially anything that can be represented as a mapping between vector spaces can be approximated to arbitrary precision by the multilayer feedforward neural network applied in this study. The multilayer feedforward neural network consist of three layers: the input layer, the hidden layer with the arbitrary number of hidden neurodes, and the output layer. Each layer performs a specific function (Caudill and Butler, 1990). Particularly, the input layer receives an input signal and then distributes it to all the neurodes in the hidden layer. The input layer, however, does not perform any processing on the input signal. The neurodes in the hidden layer act as the attribute detectors encoding in their weights an illustration of the attributes that are existent in the input layer. The choice of output neurons depends on the nature of the research study. In our study, a single output neuron is dichotomous and categorical that can be expressed in binary terms (i.e., 0 and 1).

Figure 3-1 shows the architecture of feedforward neural networks, which consist of n input neurons $(x_1, x_2, \ldots, x_n)$ and m output neurons $(y_1, y_2, \ldots, y_m)$. In this figure, processing units are analogous to neurons in the brain. Each neuron has a function

associated with it, along with a set of local parameters that determines the output of the neural, given an input.

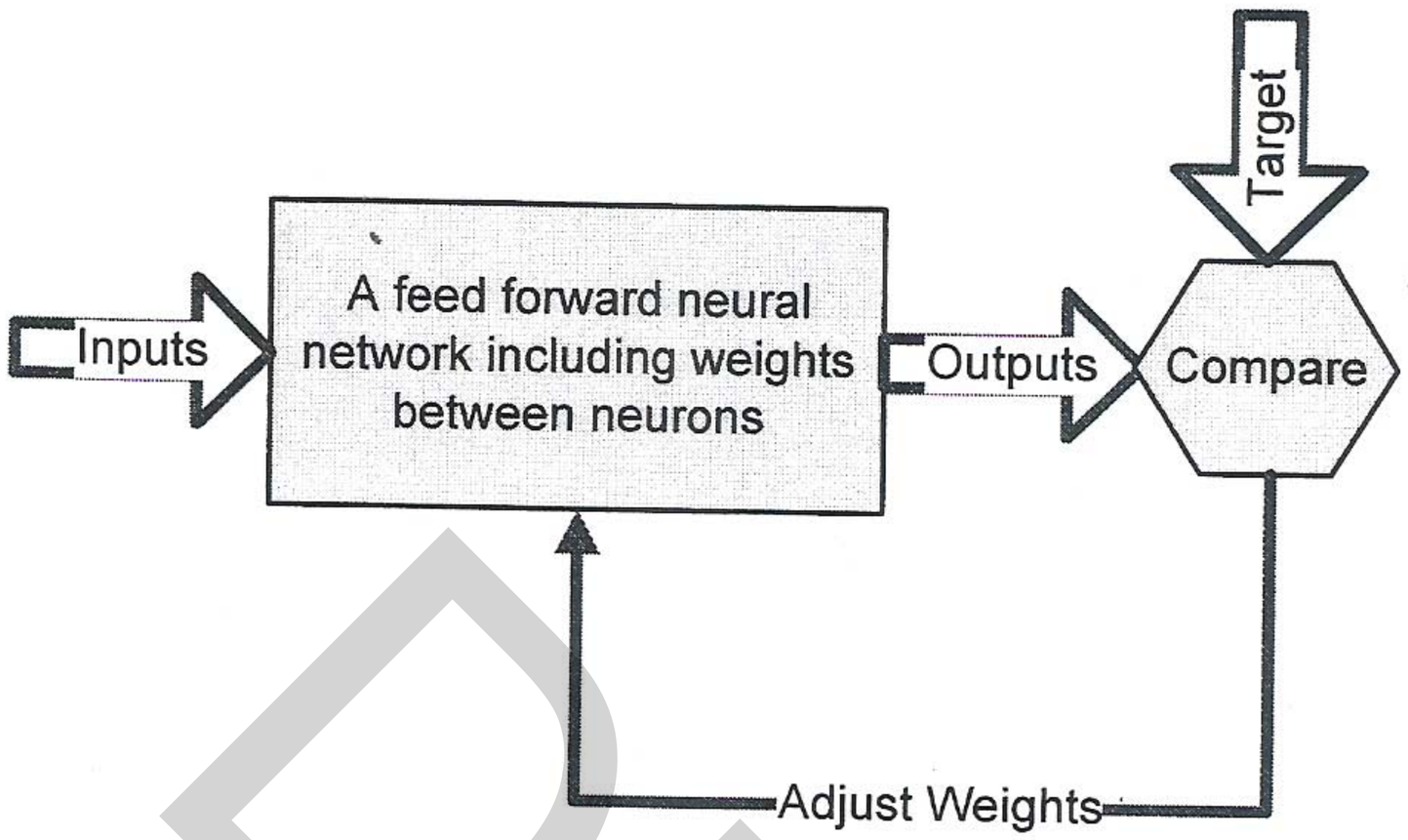
Figure 3-1 Architecture of a feedforward neural network



Commonly, neural networks are trained so that a particular input leads to a specific target. Such a situation is called "supervised learning" as shown in Figure 3-2. In supervised learning, the adjustment will be repeated until the network output matches the target in which each adjustment is based on a comparison of the output and the target.

In experiment, the supervised learning needs many such input/target pairs to train a network. The whole data set is partitioned into the training set and the test set. As a rule, the training set and the test set are disjoined.

Figure 3-2 Supervised learning diagram



Similar to the way we construct the logit models, we also develop four different neural network models. The number of input and output neurons depends on the solving problem. Thus, in each model, we define the input neurons standing for each explanatory variable as well as two output neurons standing for the decision whether a firm will be financially distressed or not. As a result, in Model 5, the input neurons include *CSDUM, BLOCK, CFRLEV, GRANK, CSBODF, INDBODF, DTA, OPTA, CATCL,* and *LOGCAP*. In Model 6, the input neurons include *CSDUM, BLOCK, INDIR, GRANK, CSBODF, INDBODF, DTA, OPTA, CATCL,* and *LOGCAP*. In Model 7, the input neurons include *CSDUM, BLOCK, CFRLEV, GRANK, NCSBODF, DTA, OPTA, CATCL,* and *LOGCAP*. Finally, in Model 8, the input neurons include *CSDUM, BLOCK, INDIR, GRANK, NCSBODF, DTA, OPTA, CATCL,* and *LOGCAP*.

The hidden layer uses the log-sigmoid activation function, while the output layer uses the pure linear activation function (Haykin, 1994). We apply the neural network with the conjugate gradient optimization algorithm that minimizes the least-squares error function as discussed in Haykin (1994). The following algorithm describes the experiments of neural network models. The algorithm that starts from data set generation and ends with neural network simulation contains mainly five steps as follow.

Step 1: Creating 10 data sets, each of which is divided to a training set and a test set.

1.1 The training set consists of 60 distressed companies and 97 non-distressed companies.

1.2 The test set consists of 16 distressed companies and 24 non-distressed companies.

Step 2: Normalizing the input data. All variables shown in Table 3.1 are computed as below

$$X_{new} = \frac{X_{old} - X_{\min}}{abs(X_{\max} - X_{\min})},$$

where X_{new} is represented as a new value of the variable X_{old}, and X_{min} and X_{max} are the minimum value and the maximum value of variable X_{old}, respectively.

Step 3: Creating a feedforward neural network. In this experiment, we use MATLAB Toolbox called the function "newff" to create the network. There are four parameters and one return network object.

3.1 An *Rx2* matrix of minimum and maximum values for each of the *R* elements of the input vector.

3.2 An array containing the sizes of each layer.

3.3 A cell array containing the names of the transfer functions to be used in each layer.

3.4 The name of the training function to be used.

In this experiment, the following command creates a two-layer network.[21] There is one input vector with two elements. The values for all element of the input vector range between 0 and 1 because normalized data are preceded in Step 2.

The number of neurons in the hidden layer is set in range *[3, 10]* as discussed in Sivanandam, Sumathi, and Deepa (2006). There are two neurons in the output layer since they stand for "distressed" and "non-distressed". The transfer function in the first layer is

[21]The function "newff" of MATLAB discards the input layer so that there are only two layers: hidden layer and output layer.

log-sigmoid, and the output layer transfer function is linear. The training function is *trainlm* backpropagation as mentioned in Sivanandam, Sumathi, and Deepa (2006). The following statements of four models include four parameters but the number of pairs of "0 1;" in Model_5 and Model_6 is 10 while it is nine in Model_7 and Model_8.

- Model_5 = newff ([0 1; 0 1; 0 1; 0 1; 0 1; 0 1; 0 1; 0 1; 0 1; 0 1],
  [5,2],
  {'logsig','purelin'},
  'trainlm');
- Model_6 = newff ([0 1; 0 1; 0 1; 0 1; 0 1; 0 1; 0 1; 0 1; 0 1; 0 1],
  [5,2],
  {'logsig','purelin'},
  'trainlm');
- Model_7 = newff ([0 1; 0 1; 0 1; 0 1; 0 1; 0 1; 0 1; 0 1; 0 1],
  [5,2],
  {'logsig','purelin'},
  'trainlm');
- Model_8 = newff ([0 1; 0 1; 0 1; 0 1; 0 1; 0 1; 0 1; 0 1; 0 1; 0 1],
  [5,2],
  {'logsig','purelin'},
  'trainlm');

The network objects "Model_5", "Model_6", "Model_7", and "Model_8" also initialize the weights and biases of the networks; therefore the networks are ready for training.

Step 4: Training the network objects. The function "train" is embedded in MATLAB toolbox for neural networks supervised learning. In this experiment, the networks are trained for up to 100 epochs to a error goal of 0.005. Let trainParam.epochs be the number of epochs and trainParam.goal the error goal. P^i and T^i is the i^{th} dataset from Step 1, which P^i stands for a set of 97+60 input vectors. For example, an input vector of Model 5 is [*CSDUM, BLOCK, CFRLEV, GRANK, CSBODF, INDBODF, DTA, OPTA, CATCL, LOGCAP*]^T and T^i is a corresponse of P^i.

```
Model_5.trainParam.epochs  = 100;
Model_5.trainParam.goal    = 0.005;
Model_5 = train(Model_5,P^i,T^i);

Model_6.trainParam.epochs  = 100;
Model_6.trainParam.goal    = 0.005;
Model_6 = train(Model_6, P^i,T^i);

Model_7.trainParam.epochs  = 100;
Model_7.trainParam.goal    = 0.005;
Model_7 = train(Model_7, P^i,T^i);

Model_8.trainParam.epochs  = 100;
Model_8.trainParam.goal    = 0.005;
Model_8 = train(Model_8, P^i,T^i);
```

Step 5: Test the network. The function "sim" is used for the simulation of a neural network. Let Q^i be a set of 24+16 input vectors corresponding to i^{th} dataset from Step 1.

```
Y = sim (Model_5, Q^i);
Y = sim (Model_6, Q^i);
Y = sim (Model_7, Q^i);
Y = sim (Model_8, Q^i);
```

where Y is an output vector, $[y_1, y_2]^T$, of which element is the probability whether a company will be in distress. If $y_1 \leq y_2$, the model predicts that the company will not be distress. Otherwise, the company will be in distress.

Chapter 4
Empirical Analysis

In this chapter, we discuss the results of our empirical investigation. We first present the major governance attributes that concern ownership and board structures, and financial attributes of our sample firms. We also separate the sample firms to distressed and non-distressed firms and look at their governance and financial characteristics. Then, we examine whether such governance and financial characteristics affect the likelihood of corporate distress using a logit approach. We also show the results of our logit and neural network prediction models. Note again that unlike most of previous prediction models, our models consist of both governance and financial variables.

4.1. Governance and financial characteristics of distressed versus non-distressed firms

Table 4-1 shows summary statistics of the governance (i.e., ownership and board structures) and financial variables for all sample firms. We also separate the firms to distressed firms and non-distressed control firms.

Relating to ownership structure variables, Table 4-1 presents that in almost 77% of Thai non-financial listed firms, the largest shareholder holds more than 25% of the voting rights. When we consider distressed and non-distressed firms separately, the presence of a controlling shareholder is in 71% and 80% of distressed and non-distressed firms, respectively. Other than controlling shareholders, 36.5% of our sample firms also have a large shareholder who owns more than 10% of the firms' voting rights. The percentage of distressed and non-distressed firms that have other blockholders besides controlling shareholders is 38.2% and 35.5%, respectively.

Considering cash-flow and voting rights held by a firm's largest shareholder, overall the largest shareholder holds, on average, 40.04% of the cash-flow rights and 42.42% of the voting rights. Distressed firms seem to have lower shares of voting and cash-flow rights held by the largest shareholder than non-distressed firms. Specifically, in distressed firms, 37.66% of the cash-flow rights and 39.91% of the voting rights are held by the largest shareholder. In non-distressed firms, the percentages are 41.53% and

Table 4-1 Governance and financial characteristics of all sample firms, distressed firms, and non-distressed control firms

This table presents mean values of the governance and financial variables of all sample firms, distressed firms, and non-distressed control firms one year prior to the distress. The sample consists of non-financial firms listed on the Stock Exchange of Thailand that were ordered by the Stock Exchange of Thailand to delist or submit rehabilitation plans during the period 1998-2001 and control firms matched by size and industry.

Variables	All firms	Distressed firms	Non-distressed control firms
Governance variables			
Fraction of firms in which the largest shareholder holds more than 25% of voting rights	0.766	0.711	0.802
Fraction of firms with multiple shareholders who hold more than 10% of voting rights	0.365	0.382	0.355
Cash-flow rights owned by the largest shareholder (%)	40.04	37.66	41.53
Voting rights owned by the largest shareholder (%)	42.42	39.91	43.99
Fraction of firms in pyramidal structure and/or with cross-shareholdings	0.198	0.197	0.198
Fraction of firms controlled by the top 30 business groups	0.188	0.145	0.215
Fraction of board seats held by controlling shareholder	0.229	0.225	0.231
Fraction of board seats held by outside independent directors	0.218	0.218	0.218
Financial variables			
Total debt/book value of assets (%)	76.28	123.57	46.58
Operating profit/total assets (%)	-12.33	-39.78	4.92
Current assets/current liabilities	1.288	0.752	1.627
Market capitalization (million baht)	1,094.35	329.27	1,568.58
Total assets (million baht)	5,990.71	7,114.90	5,284.61
No. of observations	197	76	121

43.99%, respectively. Regarding the use of control-enhancing mechanisms by the largest shareholder, about 20% of the sample firms are in pyramidal and/or cross-shareholding structures. The use of control-enhancing mechanisms is similar in both distressed and non-distressed subsamples. Finally, approximately 19% of our sample firms belong to one of the top 30 business groups. Non-distressed firms are more likely to be members of large business groups than their distressed counterparts. Specifically, 21.5% of non-distressed sample firms are affiliated with one of the top 30 business groups, compared with 14.5% of distressed sample firms.

As for board structure characteristics of the sample firms, Table 4-1 shows that 22.9% of board seats are occupied by controlling shareholders and their associates. In distressed firms, controlling shareholders and their associates seem to be involved in the board of directors less often than non-distressed firms. Considering the board involvement by outside independent directors, on average, 21.8% of board seats are held by independent directors. Not surprisingly, the fraction of board of directors served by outside independent directors is not different between two groups as the Securities and Exchange Commission (SEC) requires that a listed company have a certain minimum number of independent directors.

With regard to financial variables, Table 4-1 exhibits that non-financial listed firms have a high average debt level during the East Asian crisis period. On average, the debt ratio is 76.28%. As expected, distressed firms have a significantly greater debt ratio than non-distressed firms. More precisely, the average debt ratio is 123.57% for distressed firms, compared with 46.58% for non-distressed firms. In contrast, the sample firms have low profitability during the crisis. In fact, the operating profit to assets ratio is, on average, -12.33%. Distressed firms show even more negative profitability ratio of -39.78% while non-distressed firms show the average low positive ratio of 4.92%.

Considering liquidity of our sample firms, the average liquidity ratio is 1.29. While distressed firms have the poor liquidity ratio of less than 1 (0.75), non-distressed firms have the reasonably sound liquidity ratio of 1.63. In terms of market capitalization, on average, the sample firms have 1,094.35 million baht worth of market capitalization. Not surprisingly, distressed firms have significantly lower market capitalization than non-

distressed firms, i.e., 329.27 million baht compared with 1,568.58 million baht. However, when considering the value of total assets, distressed firms are larger than non-distressed firms. These interesting findings are due to the fact that distressed firms have excessively higher debt burden.

To investigate the effects of corporate governance on the distress likelihood and to develop corporate distress prediction models using governance and financial variables, we apply two methods: a logit regression, which is widely recognized in the existing literature, and a neural network, which has recently been applied in the filed of corporate distress/failure prediction. Nevertheless, we have no intention to make a comparison between these two methods. Instead, we do so to check the robustness of our developed prediction models. In the next section, we analyze the results of the models.

4.2 Empirical results analysis

4.2.1 Results of logit models

As noted before, the variables used in this study consist of governance and financial variables. The governance variables can be divided to ownership structure variables and board structure variables. The ownership structure variables include *CSDUM*, *BLOCK*, *CFRLEV*, *INDIR*, and *GRRANK*, while the board structure variables include *CSBODF*, *NCSBODF*, and *INDBODF*. As for the financial variables, following the existing literature, we incorporate *DTA*, *OPTA*, *CATCL*, and *LOGCAP* in our models.

The results of our logit models are presented in Table 4-2. Overall, the models produce good prediction accuracy. Specifically, 85.07% of the sample firms are correctly classified in Models 1 and 3 that use *INDIR* as an explanatory variable. In Models 2 and 4 where we replace *INDIR* with *CFRLEV*, the overall prediction accuracy has slightly increased to 87.06%. Compared with the models developed by Lee and Yeh (2004) who also study the effects of corporate governance on the distress likelihood of Taiwanese firms, our models appear to perform as well as theirs.

Considering the Type I error (the misclassification of distressed firms as non-distressed) and the Type II error (the misclassification of non-distressed firms as

Table 4-2 Logit estimations of the effects of governance and financial variables on the likelihood of corporate financial distress

The sample consists of non-financial firms listed on the Stock Exchange of Thailand that were ordered by the Stock Exchange of Thailand to delist or submit rehabilitation plans during the period 1998-2001 and control firms matched by size and industry. *CSDUM* is the dummy indicating if a firm has a controlling shareholder. *BLOCK* is the dummy indicating if the firm has at least two shareholders with more than 10% of the firm's voting rights. *INDIR* is the dummy indicating if the firm is controlled via pyramidal structure or cross-shareholdings. *CFRLEV* is the ratio of cash-flow rights to voting rights held by largest shareholder. *GRRANK* is the rank of business group belonging to the firm's controlling shareholder. *CSBODF* is the fraction of board seats held by controlling shareholder. *NCSBODF* is the fraction of board seats held by members other than controlling shareholder. *INDBODF* is the fraction of board seats held by independent directors. *DTA* is the ratio of total debt to total assets. *OPTA* is the ratio of operating profits to total assets. *CATCL* is the ratio of current assets to total assets. *LOGCAP* is the logarithm of market capitalization. Numbers in parentheses are the standard errors. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

	Model			
	(1)	(2)	(3)	(4)
Governance variables				
CSDUM	1.07* (0.61)	1.13* (0.62)	1.08* (0.61)	1.14* (0.62)
BLOCK	0.20 (0.47)	0.14 (0.47)	0.20 (0.47)	0.14 (0.47)
INDIR	0.60 (0.58)		0.60 (0.58)	
CFRLEV		-1.83 (1.51)		-1.82 (1.51)
GRANK	-0.07* (0.04)	-0.07* (0.04)	-0.07* (0.04)	-0.07* (0.04)
CSBODF	-2.55* (1.39)	-2.62* (1.93)		
NCSBODF			2.61** (1.18)	2.69** (1.19)
INDBODF	-2.80 (2.56)	-2.94 (2.59)		
Financial variables				
DTA	3.65*** (1.16)	3.68*** (1.16)	3.66*** (1.14)	3.70*** (1.15)
OPTA	-9.32*** (2.27)	-9.35*** (2.26)	-9.30*** (2.25)	-9.32*** (2.24)
CATCL	-0.34 (0.45)	-0.35 (0.46)	-0.34 (0.45)	-0.35 (0.45)
LOGCAP	-0.47*** (0.19)	-0.46*** (0.19)	-0.47*** (0.19)	-0.46*** (0.19)
No. of observations	194	194	194	194
χ^2	124.49	124.88	124.48	124.87
Prob > χ^2	0.00	0.00	0.00	0.00
Pseudo R^2	0.48	0.48	0.48	0.48
Overall prediction accuracy	85.07%	87.06%	85.07%	87.06%
Type I error[a]	9.45%	8.96%	9.45%	8.96%
Type II error[b]	5.47%	5.97%	5.47%	5.97%

[a] is the misclassification of distressed firms as non-distressed.
[b] is the misclassification of non-distressed firms as distressed.

distressed), we find that for Models 1 and 3, the Type I error is 9.45% while the Type II error is 5.47%.[22] For Models 2 and 4, the Type I error has declined to 8.96% while the Type II error has increased to 5.97%. Compared with the prediction models which include only financial variables, our models appear to perform relatively well. These results suggest that the models that incorporate governance as well as financial variables can be used as an effective early warning system.

The results of the logit models also suggest that not all governance variables are statistically significant in predicting corporate distress. Regarding ownership variables, Table 4-2 shows that only the controlling shareholder dummy and the business group rank have a marginally significant impact on the likelihood of distress. The variables concerning the presence of other blockholder(s) and the use of control-enhancing mechanisms (as measured by either the indirect control dummy (Models 1 and 3) or the ratio of cash-flow to voting rights (Models 2 and 4) are insignificant in determining the distress likelihood. More precisely, all models show that firms in which a controlling shareholder exists appear to be less likely to experience distress. This evidence tends to support the *monitoring/alignment hypothesis* of controlling shareholders.

The negative relation between the business group rank dummy and the probability of corporate distress suggests that firms that belong to a top business group are less likely to be in distress than non-group firms. This finding supports the argument that owners of business groups may actively get involved in managerial decision-making that enhance firm value. Alternatively, the risk sharing and the utilization of internal markets within a business group could help the member firms to avoid financial distress. It is also possible that a business group could use resources from relatively steady firms to prop affiliated firms in distress. This is consistent with Lamont (1997) and Claessens, Djankov, Fan, and Lang (2002) who show that business groups tend to support their poorly performing members. Claessens, Djankov, and Klapper (2003) also report a negative relation between business group affiliation and the likelihood that distressed firms will file for bankruptcy during the East Asian economic crisis. Similarly, Dewaelheyns and Van

[22] Type I error is more costly than Type II error.

Hulle (2004) find that Belgian group firms are less likely to go bankrupt than non-group firms.

Moreover, our logit prediction models show an insignificant relation between the multiple blockholders dummy and the incidence of corporate distress. In other words, the monitoring role played by large shareholders other than the controlling shareholder is not important. One explanation can be due to the fact that for Thai firms, controlling shareholders hold much higher voting and cash-flow rights than the second largest shareholder. Consequently, other blockholders may not have sufficient power and/or incentives to perform an efficient monitoring role.

Finally, the logit models suggest that the use of control-enhancing mechanisms by controlling shareholders has no significant impact on the distress likelihood. This result is rather not surprised since the use of control-enhancing mechanisms in Thai listed firms is relatively low when compared with their counterparts in other Asian countries (Claessens, Djankov, and Lang, 2000; Khanthavi, Polsiri, and Wiwattanakantang, 2003).

As for board structure variables, Models 1 and 2 of Table 4-2 show that the greater fraction of board seats occupied by directors who are associated with controlling shareholders decreases the distress likelihood. In line with the result of ownership structure variables, this result suggests that the *interest alignment* effects of having a controlling shareholder. The result is also consistent with the *affective conflict* view. This finding, however, is in contrast to Lee and Yeh (2004). Specifically, they find that the percentage of directors controlled by the largest shareholder is positively related with the probability of corporate distress.

Considering board involvement by non-controlling shareholders, Models 3 and 4 exhibit that the involvement of directors who are not controlling shareholders' associates is positively related with the probability of distress. The result supports what we find using the percentage of directors associated with controlling shareholders in Models 1 and 2. Moreover, Models 1 and 2 also show that outside independent directors play no important role in determining whether a firm will be in distress.

On the other hand, the financial variables appear to have a significant impact on the probability of corporate distress as shown by the following results. As expected, firms

with a higher debt ratio are more likely to experience corporate distress whereas firms with a higher operating return on assets ratio are less likely to be in distress. Regarding firm size, larger firms have a lower probability of distress than smaller firms. This result is expected as well. Finally, we find that the liquidly ratio is not related with the likelihood of corporate distress.

4.2.2 Results of neural network models

Following the logit models, we also construct neural network models to predict the probability of corporate distress. Our neural network distress prediction models are built by using feed-forward architecture and trained with back-propagation method. To teach the neural networks, the training set consists of 60 distressed and 97 non-distressed firms (which is equivalent to 157 data points). The dimensions of data points are the same set of governance and financial variables used to develop our logit models which the dimensions of four models are different, i.e. (1) Model 5 runs on $[0,1]^{10}$ space, (2) Model 6 runs on $[0,1]^{10}$ space, (3) Model 7 runs on $[0,1]^{9}$ space, and (4) Model 8 runs on $[0,1]^{9}$ space. The ratio of the number of distressed data points to the number of non-distressed data points is approximately 0.6 for both training and testing sets. In the back-propagation training, the procedure of selecting a training set is repeated until the optimal values of learning parameters and then the training set are determined. Here the number of iterations is set to 100 by experiments.

Tables 4-3, 4-4, 4-5, and 4-6 show the results of the neural network Models 5, 6, 7, and 8, respectively. Each model runs on data sets 1-10. The row of a table illustrates the accuracy of neural network prediction models testing of a data set. Each of the data sets consists of different pairs of training and testing sets. There are no overlapped companies in the training and the testing sets. Note again that we run the models with the following neural network parameters: maximum epochs are equivalent to 100 and training error is 0.005. The performance of a neural network model is considered in two phases: (1) testing and (2) training. The MATLAB command is expressed as below:

(1) Testing: $Y = \text{sim}(\text{net}, Q^i)$

(2) Training: $Y = \text{sim}(\text{net}, P^i)$

Table 4-3 Results for the neural network Model 5 which runs on data sets 1-10

The sample consists of non-financial firms listed on the Stock Exchange of Thailand that were ordered by the Stock Exchange of Thailand to delist or submit rehabilitation plans during the period 1998-2001 and control firms matched by size and industry. In the neural network Model 5, the governance variables consist of *CSDUM, BLOCK, INDIR, GRANK, CSBODF,* and *INDBODF* while the financial variables consist of *DTA*, *OPTA*, *CATCL*, and *LOGCAP*.

Data sets	Testing			Training
	Accuracy (%)	Type I error[a] (%)	Type II error[b] (%)	Accuracy (%)
1	90.00	6.25	12.50	96.18
2	85.00	18.75	12.50	90.45
3	92.99	0.00	12.50	92.99
4	90.00	6.25	12.50	96.82
5	80.00	25.00	16.67	94.90
6	82.50	18.75	16.67	98.09
7	85.00	6.25	20.83	95.54
8	85.00	6.25	20.83	98.09
9	80.00	18.75	20.83	97.45
10	72.50	18.75	33.33	96.18
Mean	84.30	12.50	17.92	95.67
S.D.	5.98	8.33	6.53	2.40

[a] is the misclassification of distressed firms as non-distressed.
[b] is the misclassification of non-distressed firms as distressed.

Table 4-3 shows the results of Model 5. The average accuracy of the training data sets is 95.67% while the average accuracy of the testing data sets is 84.30%. The average standard deviation of the testing sets is 5.98%. The Type I error and Type II error of the testing set is, on average, 12.50% and 17.92%, respectively.

Table 4-4 Results for the neural network Model 6 which runs on data sets 1-10

The sample consists of non-financial firms listed on the Stock Exchange of Thailand that were ordered by the Stock Exchange of Thailand to delist or submit rehabilitation plans during the period 1998-2001 and control firms matched by size and industry. In the neural network Model 6, the governance variables consist of *CSDUM, BLOCK, CFRLEV, GRANK, CSBODF,* and *INDBODF* while the financial variables consist of *DTA*, *OPTA*, *CATCL*, and *LOGCAP*.

Data sets	Testing			Training
	Accuracy (%)	Type I error[a] (%)	Type II error[b] (%)	Accuracy (%)
1	90.00	12.50	8.33	94.90
2	85.00	6.25	20.83	96.18
3	87.50	0.00	20.83	95.54
4	87.50	6.25	16.67	91.08
5	90.00	6.25	12.50	96.82
6	82.50	18.75	16.67	96.18
7	87.50	6.25	16.67	92.36
8	87.50	6.25	16.67	96.18
9	80.00	25.00	16.67	96.82
10	80.00	12.50	25.00	97.45
Mean	85.75	10.00	17.08	95.35
S.D.	3.74	7.34	4.59	2.06

[a] is the misclassification of distressed firms as non-distressed.
[b] is the misclassification of non-distressed firms as distressed.

The results of Model 6 are shown in Table 4-4. For this model, the average accuracy of the training sets is 95.35% while that of the testing sets is 85.75% with the standard deviation of 3.74%. Considering the Type I error and the Type II error of the testing sets, it is, on average, 10.00% and 17.08%, respectively. The performance of Models 5 and 6 is not evidently different.

Table 4-5 Results for the neural network Model 7 which runs on data sets 1-10

The sample consists of non-financial firms listed on the Stock Exchange of Thailand that were ordered by the Stock Exchange of Thailand to delist or submit rehabilitation plans during the period 1998-2001 and control firms matched by size and industry. In the neural network Model 7, the governance variables consist of *CSDUM, BLOCK, INDIR, GRANK,* and *NCSBODF* while the financial variables consist of *DTA*, *OPTA*, *CATCL*, and *LOGCAP*.

Data sets	Testing			Training
	Accuracy (%)	Type I error[a] (%)	Type II error[b] (%)	Accuracy (%)
1	92.50	6.25	8.33	94.27
2	90.00	6.25	12.50	87.26
3	90.00	6.25	12.50	92.36
4	87.50	12.50	12.50	94.90
5	85.00	12.50	16.67	96.82
6	82.50	25.00	12.50	96.18
7	87.50	0.00	20.83	98.09
8	85.00	12.50	16.67	94.27
9	87.50	6.25	16.67	94.27
10	82.50	18.75	16.67	92.99
Mean	87.00	10.63	14.58	94.14
S.D.	3.29	7.25	3.54	2.97

[a] is the misclassification of distressed firms as non-distressed.
[b] is the misclassification of non-distressed firms as distressed.

Table 4-5 presents the results of Model 7. For the training sets, the average accuracy is 94.14%. For the testing sets, on average, the accuracy is 87.00% and the standard deviation is 3.29% with the Type I and Type II errors of 10.63% and 14.58%, respectively.

Table 4-6 Results for the neural network Model 8 which runs on data sets 1-10

The sample consists of non-financial firms listed on the Stock Exchange of Thailand that were ordered by the Stock Exchange of Thailand to delist or submit rehabilitation plans during the period 1998-2001 and control firms matched by size and industry. In the neural network Model 8, the governance variables consist of *CSDUM, BLOCK, CFRLEV, GRANK,* and *NCSBODF* while the financial variables consist of *DTA*, *OPTA*, *CATCL*, and *LOGCAP*.

Data sets	Testing			Training
	Accuracy (%)	Type I error[a] (%)	Type II error[b] (%)	Accuracy (%)
1	90.00	0.00	16.67	94.90
2	85.00	12.50	16.67	98.09
3	85.00	18.75	12.50	93.63
4	82.50	12.50	20.83	96.18
5	77.50	37.50	12.50	96.82
6	77.50	25.00	20.83	98.09
7	95.00	6.25	4.17	92.99
8	90.00	0.00	16.67	96.18
9	80.00	31.25	12.50	98.73
10	77.50	18.75	25.00	96.18
Mean	84.00	16.25	15.83	96.18
S.D.	6.15	12.57	5.83	1.90

[a] is the misclassification of distressed firms as non-distressed.
[b] is the misclassification of non-distressed firms as distressed.

Table 4-6 shows that Model 8 gives the highest average accuracy of the training sets of 96.14%. However, the average accuracy of the testing sets of Model 8 is the lowest at 84% and the standard deviation is the greatest at 6.15%. Moreover, the Type I and Type II errors are 12.57% and 5.83%, respectively.

Overall, the results suggest that Model 7 seems to outperform other models in terms of the average accuracy, standard deviation, and Type I error of the testing data sets. In contrast, the performance of Model 8 seems to be the poorest when considering

the testing data sets. Nevertheless, this model shows the best performance for the training data sets.

Chapter 5

Conclusions and Suggestions for Future Research

So far, this study has tested how governance variables relating to ownership and board structures affect the likelihood of financial distress and developed logit and neural network prediction models that incorporate both governance and financial variables. The study has also explored governance and financial characteristics of non-financial listed firms that experience distress during the period 1998-2001 as well as their non-distressed counterparts. In this final chapter, we review the findings of governance characteristics of distressed firms and the results of the empirical tests. In addition, we provide some suggestions for future research in the areas of corporate governance as well as business distress/failure prediction.

5.1 Conclusions

In this study, we investigate the effects of corporate governance regarding ownership and board structures on the likelihood of corporate distress and develop distress prediction models using logit and neural networks. Our focus is firms in an emerging economy in which legal and regulatory frameworks are weak and concentrated ownership is common. In this environment, many scholars have argued that controlling shareholders are likely to expropriate corporate assets. As further contribution to the literature on the effects of corporate governance on firm performance in the time of economic crisis, we investigate how corporate governance affects the likelihood that a firm experiences corporate distress during an economic crisis. We use the data from Thailand to study this issue. Thailand provides a natural research setting because it shares a number of governance characteristics among most economies around the world, and it was the first hit by the East Asian economic crisis in July 1997.

We develop logit and neural network models to predict corporate financial distress of Thai listed non-financial firms. The results show that in an economy where ownership concentration is common and the legal environment is not really investor-friendly, corporate governance -- in addition to well-documented financial variables -- appears to play an important role in determining the likelihood of distress.

The results are consistent with the view that concentrated ownership structure of East Asian firms has contributed to the East Asia economic crisis (e.g., Johnson, Boone, Breach, and Friedman, 2000; Mitton, 2002; Lemmon and Lins, 2003). Specifically, we find that the presence of controlling shareholders and the board involvement by controlling shareholders reduce the probability of corporate financial distress. This evidence supports the *monitoring/alignment hypothesis*. However, it is also possible that controlling shareholders may prevent corporate distress from happening during an economic crisis in order to prolong the expropriation honeymoon (Friedman, Johnson, and Mitton, 2003).

Our findings also support the benefits of business group affiliation. More precisely, we find that being affiliated with a top business group decreases the likelihood of corporate distress. This result can be interpreted in several ways. First, controlling shareholders of top business groups may effectively and actively get involved in managerial decision-making that enhances firm value. Second, the lower distress likelihood may be due to risk sharing among group firms and the utilization of internal markets within a group. Third, group affiliation could allow investment policies that inefficiently support affiliated firms in distress, through resources from other firms in the group (Lamont, 1997; Claessens, Djankov, Fan, and Lang, 2002).

The extensively used financial variables appear to have significant effects in determining the likelihood of corporate distress and hence point out financial weaknesses of Thai firms before the East Asian crisis. The models suggest that excessive use of debt, poor operating performance, and small market capitalization lead to the higher distress likelihood of non-financial listed firms. This evidence is consistent with the view that Thai firms were financially vulnerable since a few years before the 1997 crisis (Alba, Claessens, and Djankov, 1998; Claessens, Djankov, and Lang, 1998).

Our logit prediction models show good predictive power. Such evidence indicates that the models serve as sound early warning signals and could thus be useful tools adding to supervisory resources. Specifically, more than 85% of non-financial listed firms are correctly classified in our models. When we consider the Type I error, on average the models have the Type I error of about 9%. Likewise, the neural network prediction models appear to have good results. Specifically, the average accuracy of the

neural network prediction models ranges from approximately 84% to 87% with the average Type I error raging from about 10% to 16%.

Overall, our findings suggest that corporate governance attributes, in particular ownership and board structures, play an important role in constructing sound corporate distress prediction models. This in turn helps improve the efficiency of an early-warning system developed from such models. In other words, only financial data that have been extensively used may not be sufficient for the purpose of predicting corporate distress. Incorporating corporate governance variables should be considered when developing prediction models in future research, especially in an economy where ownership concentration is common. Moreover, the empirical results of this study may shed some light on the effects of corporate governance on the likelihood of corporate distress for other countries. Finally, our study also helps explain that there were significant weaknesses contributing to individual corporate distress prior to the East Asian crisis.

5.2 Suggestions for future research

There are a large number of studies focusing on the relationship between corporate governance and performance. These studies are generally concerned with the agency problems arising between controlling and minority shareholders, and the effects of corporate governance characteristics on firm value. However, research on corporate governance and corporate distress and/or failure has been limited. Hence, it will be interesting in further conducting studies on governance characteristics and corporate distress and/or failure. At least the following four issues should be considered.

First, previous research has suggested that political connection is one of the governance attributes that have significant impact on firm performance, firm value, or stock returns (for example, Fisman, 2001; Bunkanwanicha and Wiwattanakantang, 2006; Faccio, 2006; Claessens, Feijen, and Laeven, 2007), financing (for example, Claessens, Feijen, and Laeven, 2007), and even corporate bailouts (Faccio, Masulis, and McConnell, 2006). Hence, examining the effects of political connection on corporate distress and/or failure can be a matter for future research. Also, including political connection in prediction models may increase the predictive power of the models.

Second, future research in business group affiliation and corporate distress and/or failure is promising. For example, a more detailed investigation of the impact of business groups and their ultimate owners on intra-group behaviors towards distressed subsidiaries can be an extension of this study.

Third, while we examine the role of corporate governance and financial characteristics in triggering corporate distress during the economic crisis, we do not examine the role of such characteristics on the resolution of corporate distress. In response to corporate distress, firms may, for instance, choose to restructure their assets, capital structure, and debt, or even file for bankruptcy. The importance of governance and financial factors on the resolution choices of corporate distress can be explored in future research.

Fourth, it will be interesting also to study managerial decision making during the distress period or managerial decision making of distressed firms. During the distress period, the agency problems, between controlling and minority shareholders, managers and shareholders, and creditors and shareholders, are likely to increase. Hence, the impact of corporate governance on major managerial decision making during a distress period may be different from its impact during normal circumstances.

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