

CONCENTRATED OWNERSHIP AND PREDICTION OF FINANCIAL INSTITUTION FAILURES

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Abstract

In an emerging economy where ownership concentration is common and legal protection of outside investors is weak, financial and economic factors that are widely documented might not have been sufficient in constructing sound models to predict financial institution failures. Using the data of financial institutions listed in the Thai stock exchange during the 1997 East Asian financial crisis, this study showed that to develop sound prediction models that are robust across time to failure models, ownership variables should be incorporated in the models. Specifically, in the logit models that include both financial and ownership variables, 85.45%, 85.41%, and 91.49% of financial institutions were correctly classified in the models using the data of one, two, and three years prior to failure, respectively. It was also found that the presence of family as the largest shareholder increases the probability that a financial institution was closed. This evidence supports the *expropriation effects* of controlling families. Finally, the results suggested evidence of a “too-big-to-fail” policy in the closure procedures of Thai financial institutions during the East Asian financial crisis.

Keywords: ownership structure, failure prediction model, early warning systems, East Asian crisis

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The author would like to specially acknowledge the Thailand Research Funds (TRF Grant Code: MRG5080446) for generous financial support.

1. Introduction

Early-warning systems developed from failure prediction models have been proven to lower the probability that a company gets into a financial trouble or goes bankrupt, which should help prevent the systemic collapse of a country's economy. A good example that a lack of effective early warning systems may lead to an economy-wide crisis was the collapse of the Thai financial and banking sector in 1997-1998. During the 1997 East Asian economic crisis, 58 out of 91 finance companies were suspended in the second half of 1997, and a further 12 finance companies were suspended in 1998. Finally, 56 finance companies were closed. Regarding the banking sector, out of the 15 domestic banks operating in 1994, six banks were suspended in 1998, followed by another one in 1999. In the end, one bank was closed down, three banks were merged into government-owned banks, two banks were taken over by the government and three banks became foreign owned during the crisis. The rest struggled to recapitalize on their own. On the bright side, however, the economic crisis enabled the examination of failure prediction models for financial institutions in an emerging

market economy, for which little evidence has been provided.

Most previous research on the causes and origins of the East Asian crisis (and other economic crises) have mainly studied the macroeconomic factors that may help predict financial and/or currency crises (e.g., Kaminsky et al., 1997; Eichengreen and Rose, 1998; Furman and Stiglitz, 1998; Radelet and Sachs, 1998; Kaminsky and Reinhart, 1999; Demircuc-Kunt and Detragiache, 2000). Although the early warning systems using macroeconomic variables were effective in timely detection of systemic crises, they did not recognize the contribution of firm-level weaknesses to the incidence of the crisis. In other words, macroeconomic analyses are “unlikely to be able to discriminate between the view that distressed financial institutions were hit by exogenous shocks and the view that many weaknesses before the crisis may have led to the systemic financial distress” (Bongini et al., 2001: 7). Hence, early warning systems using firm-level or microeconomic data should be worth developing.

This study also relates to the literature on predicting distress and failure/ bankruptcy of financial institutions (during an economy-wide crisis). Models attempting to predict the distress

and failure of individual financial institutions (e.g., early warning systems) have been developed since the 1970s. Primarily applied to banking and financial sectors in developed countries, these models emphasize early identification of financial institutions that are potentially financially troubled and may fail.

Not only do they provide the opportunity to develop prediction models of financial institution failure during the East Asian crisis, Thai financial institutions are also of interest because of their concentrated ownership structure. Such a characteristic is common among most economies around the world, but different from the U.S. where extensive research on failure prediction has been conducted.

In firms with concentrated ownership structure, the most typical type of largest shareholder is a family. The conflicts of interests between the firms' controlling shareholders and minority shareholders have been crucial issues in the discussion of family firms at least since the analysis of La Porta et al. (1999), Claessens et al. (2000), and Faccio and Lang (2002) who showed that family ownership is universal around the world. Moreover, La Porta et al. (1997, 1998, 2000), Johnson et al. (2000), and Burkart et al. (2003) showed that legal protection of minority shareholders varies across countries, and this variation determines the level of the ownership concentration, the existence of family firms worldwide, the patterns of separation between ownership and management, and the degree of expropriation by corporate insiders. In countries with moderate legal protection of outside investors, a controlling shareholder can be beneficial to the firm as an active monitor (Anderson and Reeb, 2003; Burkart et al. 2003; Morck and Yeung, 2003).

However, in emerging economies where legal and regulatory systems are weak, a controlling shareholder is likely to expropriate the firm's resources. Under some circumstances, for example, when firms are doing well, controlling shareholders may tunnel resources out of the firms for their own benefits (Johnson et al., 2000; Johnson et al., 2000; Bertrand et al., 2002; Morck and Yeung, 2003).

To empirically investigate the effects of ownership concentration on firms, the literature typically has concentrated on linking ownership and performance (e.g., Khanna and Palepu, 2000; Wiwattanakantang, 2001; Claessens et al., 2002; Mitton, 2002; Anderson and Reeb, 2003; Joh, 2003; Lemmon and Lins, 2003; Lins, 2003; Baek et al., 2004). In addition, a number of studies chose to focus on the East Asian crisis (Johnson et al., 2000; Mitton, 2002; Friedman et al., 2003; Lemmon and Lins, 2003; Baek et al., 2004). This study focused on a single country, Thailand, that provides an appropriate setting to study this issue. An advantage of investigating one country is that the institutional

effects (such as legal and regulatory effects) can be controlled for because all firms are operating in the same environment.

Rather than examine the relationship between ownership concentration and firm performance, the methodology of this study is to investigate the effects of ownership concentration on the likelihood of business failure. Moreover, unlike most existing research on failure/bankruptcy prediction models that use only financial variables, the models developed in this study also incorporated concentrated ownership variables.²³ The technique employed was a popular statistical approach, namely a logit regression.

The results from the prediction models suggested that traditional financial variables appeared not to perform relatively well in predicting financial institution failure. Only the variables related to asset quality and profitability showed significant results. That is, loan growth had a positive effect on the likelihood that a financial institution fails; a higher return on assets decreased the probability of failure; the ratio of interest income to total income, however, had a mixed impact on the likelihood of financial institution failure.

On the other hand, the ownership concentration proved to play an important role in determining the likelihood of financial institution failures. Specifically, it was found that financial institutions in which a family is the largest shareholder were more likely to fail, suggesting the *expropriation effects* of a controlling family. On the other hand, a higher fraction of voting rights held by the largest shareholder reduced the probability of business failure, suggesting greater incentives of a controlling shareholder to monitor managerial decisions and actions. Evidence of "too-big-to-fail" policies in the closure process of Thai financial institutions was also found.

Overall, the failure prediction models that incorporate ownership variables showed high accuracy rates, which were robust across time to failure. These results thus indicated that the models could serve as efficient early warning systems.

The rest of this study is structured as follows. Section 2 discusses data, variables and methodology used in this study. It also describes the impact of ownership concentration on the likelihood of financial institution failures. Section 3 examines the empirical results from the developed failure prediction models. Finally, Section 4 concludes the article.

²³ Not until the 2000s have studies documented significant effects of concentrated ownership on the probability of failure/bankruptcy (e.g., Bongini et al., 2001; Dewaelheyns and Van Hulle, 2004; Zeitun, 2009) or financial distress (e.g., Claessens et al., 2003; Lee and Yeh, 2004; Li et al., 2008; Donker et al., 2009; Polsiri and Sookhanaphibarn, 2009).

2. Data and Methodology

2.1. Sample

In this study, the sample included all banks and finance companies listed on the Stock Exchange of Thailand during the East Asian economic crisis period 1994-1998. In total, there were 55 financial institutions in the sample, 28 of which were closed or merged into other institutions. Among those financial institutions that failed, four were banks and the rest were finance companies. Because of the measures taken by the Bank of Thailand in order to restore the stability of financial and banking systems in response to the crisis, financially distressed finance companies were ordered to close or merge in 1997, while the order for banks came in 1998. Here, "failed financial institutions" is defined as financial institutions that were ordered to close or merge into other institutions. The list of failed banks and finance companies is provided on the Websites of the Bank of Thailand and the Stock Exchange of Thailand.²⁴

The SETSMART database (produced by the Stock Exchange of Thailand) was the main source of financial and ownership data used in this study. Regarding financial data, this database provided information on financial statements, including notes to financial statements. As for ownership data, the database provided the list of a financial institution's shareholders with shareholdings of at least 0.5%. Additional information on the family relationships among major shareholders was collected from the document FM 56-1.²⁵ Moreover, shareholders' family relationships via marriages were identified using various sources both in English and in Thai, namely Phipatseritham (1981), Phipatseritham and Yoshihara (1983), Suehiro (1989), Sappaiboon (2000, 2000a, 2001), and Johnstone et al. (2001). In addition, to trace the ultimate ownership of private companies who appeared as corporate shareholders of sample firms, the BOL database produced by the Business OnLine Ltd. was employed.²⁶

2.2. Explanatory variables: Financial and ownership

Unlike most previous studies that based failure prediction models largely on financial variables, this study developed prediction models using two types of variables: traditional financial variables

and the main focus, ownership variables. The financial variables most extensively used in the existing literature were based on the CAMEL-type of analysis.²⁷ Because of the availability of data, the traditional financial variables included *Equity to Assets*, *Loan Growth*, *Operating Expenses to Revenue*, *Return on Assets*, *Interest Income to Total Income*, and *Loan to Assets*. Ownership variables included the most common type of largest shareholders of firms around the world, *Family*, which is a dummy equal to 1 if a family is the largest shareholder of a financial institution, and zero otherwise, and *Control Rights*, which are the percentage of votes held by the largest shareholder of a financial institution. Finally, the explanatory variables also included *Size*, which is measured by the log of total assets. The effects of these factors on the probability with which a financial institution will fail are described in Section 2.3.

2.2.1 Legislation background on bank and finance company ownership in Thailand

Banks and finance companies operate under legal and regulatory environments which are substantially different from those in which non-financial firms operate. This section describes briefly the regulations that are related to the limitation on shareholdings of Thai financial institutions.

Commercial banks are governed by the Commercial Banking Act B.E. 2505 (C.E. 1962), while finance companies are governed by the Act on the Undertaking of Finance Business, Securities Business and Credit Foncier Business, B.E. 2522 (C.E. 1979). By law, a person is allowed to hold at most 5% of the total amount of a commercial bank's shares sold and 10% of the total amount of a finance company's shares sold. A person includes his or her spouse and minor child, as well as a company where the person and/or his or her spouse and minor child hold, separately or aggregately, more than 30% of the company's shares. However, the law does not apply to other members of the same family or related families. In addition, the law does not limit ownership by government agencies, state enterprises and juristic persons established under a specific law such as the Financial Institutions Development Fund (FIDF).

Until the 1997 financial crisis, the law imposed a foreign ownership ceiling at 25% of a financial institution's total shares and foreign board participation at less than one-fourth of a financial institution's total number of directors. Nevertheless, after the crisis, foreign investors were allowed to hold more than 25%. The Thai government relaxed existing restrictions on the foreign ownership in

²⁴ The websites of the Bank of Thailand and the Stock Exchange of Thailand are www.bot.or.th and www.set.or.th, respectively.

²⁵ All listed companies are required to submit FM 56-1 to the Stock Exchange annually. It is available at the library and the website of the Stock Exchange of Thailand.

²⁶ The BOL databank includes all registered companies in Thailand. The Business OnLine Ltd. is licensed by the Ministry of Commerce to reproduce this information.

²⁷ CAMEL stands for Capital, Asset, Management, Earnings, and Liquidity.

financial institutions by permitting foreign investors to hold 100% of banks' shares, subject to certain conditions. More precisely, foreign investors were allowed to acquire a majority ownership stake in a locally incorporated financial institution for a 10-year period. Subsequent to that period, although foreign investors were not forced to sell their shares, they could not acquire additional shares unless the ownership stake was below 49% of the financial institution's total shares.

2.2.2 The definition of largest shareholders

For purposes of this study, the definition of shareholders according to the law described above is too narrow for at least two reasons: First, 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 marriage. Family members in Thailand often do business together and vote as a coalition. Second, a person does not need to hold 30% of a firm's shares to be able to gain control. Holding at least 25%, a shareholder has a control power over a firm (Wiwattanakantang, 2001; Khanthavit et al., 2003). One interpretation of The Public Limited Companies Act B.E. 2535 (C.E. 1992) suggests that no other single shareholder would have enough voting rights of at least 75% to have absolute power over the firm.

Therefore, a broader definition of a shareholder is 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) a percentage of companies owned by him or her more than 25%.

2.3. The impact of explanatory variables on the probability of financial institution failure

As mentioned earlier, the choice of the financial variables used in the failure prediction models in this study was based on existing literature and the availability of data. Ownership variables, on the other hand, were used to examine the effects of ownership concentration on the probability of financial institution failure. In addition, this study examined the "too-big-to-fail" situations that are widely known, particularly in emerging market economies, by incorporating size of financial institutions in the models. Table 1 presents justification of each explanatory variable and its expected effect on the likelihood that a financial institution fails.

The financial variables commonly used in the literature on banking and financial systems are those related to the CAMEL rating system. Such variables have also applied in the empirical

literature on predicting distress and/or failure of financial institutions and have the expected impact on the probability of distress/failure.²⁸ This study developed prediction models based on the following financial variables. As a proxy of "capital adequacy," a higher *ratio of equity to asset* was expected to decrease the likelihood of financial institution failure because of the greater ability to absorb losses. Regarding "asset quality," higher *loan growth* was expected to have a positive effect on the probability of failure since it leads to greater credit risk exposure. The *ratio of operating expenses to total revenue* was used as a financial variable related to "management quality." It can be expected that the higher the ratio, the greater the likelihood of failure.

In terms of variables regarding "earning ability," a higher *return on assets* was expected to have a negative impact on the probability of failure, while the impact of the *ratio of interest income to total income* was uncertain. The *volatility hypothesis* predicts that, on the one hand, a higher ratio of net interest income to total income might increase the volatility of income if service income is more stable, increasing the probability with which a financial institution will fail. On the other hand, it might reduce the probability of failure if focusing on the core business entails a better allocation or if service income is actually more volatile in the face of an economic shock (Bongini et al., 2001). Finally, a financial institution with high liquidity risk should be more likely to fail. Hence, the *ratio of total loans to total assets* as a proxy for "liquidity position" was expected to have a positive effect on the probability of failure.

For the main focus of this study, two aspects of ownership concentration were considered: the presence of a family as the largest shareholder, and the degree of ownership and control concentration held by the largest shareholder. Having a family as the largest shareholder can either be costly or beneficial to the firm. On the one hand, according to the *expropriation hypothesis*, a controlling family is entrenched and hence tends to abuse the power in extracting corporate resources for its own interests that are not shared with other stakeholders (Shleifer and Vishny, 1997; Bebchuk, 1999; DeAngelo and DeAngelo, 2000; Johnson et al., 2000a). For example, a family might be tempted to influence, for its own purpose, the financial institution's loan policies. Such action can lead to a higher degree of prior misallocation of corporate resources and risky lending behavior. As a result, this effect may deteriorate firm performance and increase the probability of financial distress and eventually business failure or bankruptcy. Thus, the presence of a family as the largest shareholder

²⁸ See, for example, Meyer and Pifer (1970), Sinkey (1975), Altman (1977), Martin (1977), Pettaway and Sinkey (1980) and Bongini et al. (2000, 2001).

increases the likelihood that the financial institution will fail.

Table 1. Explanatory variables and their expected effects on the likelihood that a financial institution fails

Variables	Type of Variables	Expected effect on failure probability
Equity to Assets	CAMEL: Capital Adequacy	(-) Ability to absorb losses
Loan Growth	CAMEL: Asset Quality	(+) Credit risk
Operating Expense to Revenue	CAMEL: Management Quality	(+) Inefficiency
Return on Assets	CAMEL: Earnings Ability	(-) Profitability
Interest Income to Total Income	CAMEL: Earnings Ability	(+/-) Less volatility/More volatility of income
Loans to Assets	CAMEL: Liquidity Position	(+) Liquidity risk
Family (dummy equal to 1 if largest shareholder is a family, and 0 otherwise)	Ownership	(+/-) Expropriation/ Monitoring
Control Rights (percentage of votes held by largest shareholder)	Ownership	(-) Incentives to monitor
Size (measured by log of total assets)	-	(-) Too big to fail

On the other hand, the *monitoring* hypothesis suggests that a controlling family has incentives to monitor and influence the management to undertake only value-enhancing actions (Demsetz and Lehn, 1985; Shleifer and Vishny, 1986; Admati et al., 1994; Burkart et al., 1997). Because controlling families normally remain in the firms for a long period, hold undiversified portfolios as perceived by substantial ownership stake in the firms and appoint their members as managers or directors, they usually monitor managerial decision-making and influence management to pursue value-maximizing strategies (Demsetz and Lehn, 1985). In addition, if monitoring skills depend on specialized knowledge regarding firm technology, their long-term stay with the firm should make controlling families a good monitor. This is because a controlling family has moved with the firm along its learning curve (Anderson and Reeb, 2003). Therefore, in this case we should find a negative relationship between the presence of a controlling family and the likelihood of business failure.²⁹

Regarding the degree of ownership and control concentration, large shareholders with significant fractions of ownership and control stakes are better aligned in terms of interests with other shareholders (Claessens and Fan, 2002). Consequently, these large shareholders will be less likely to take

advantage of corporate resources for their private benefits (Bennedsen and Wolfenzon, 2000; Gomes, 2000). Moreover, large shareholders with higher ownership and control rights have greater incentives to monitor the management, ensuring that firm value maximization is pursued. As a result, the probability of business failure will decrease when the largest shareholder has substantial shares in the firm's votes. Li et al. (2008) provided empirical evidence that ownership concentration was negatively related with the probability of corporate failures in China.³⁰ However, Zeitun (2009) found the opposite using the data from Jordan.

Although it is not considered a CAMEL-type variable, size has frequently been included in early warning and failure/bankruptcy prediction studies as a proxy for "too-big-to-fail" situations. Such situations are widely known, especially in the case of emerging market economies. Following Bongini et al. (2001), this study conjectured that larger intermediaries are more inclined to be subject to political intervention and that regulators may consider large financial institutions to be "too-big-to-fail".

²⁹ In a similar study, Bongini et al. (2001) hypothesized that financial institutions in which an influential family is the largest shareholders will be less likely to be closed because of the family's political connection, unless the resolution procedures are transparent and free from political interference.

³⁰ Along the same lines, Polsiri and Sookhanaphibarn (2009) found that the presence of controlling shareholders reduced the probability of financial distress of Thai listed firms; while Donker et al. (2009) showed that the presence of large outside shareholders lowered the likelihood of financial distress of listed firms in the Netherlands.

2.4. Financial and ownership characteristics: Non-failed versus failed financial institutions

Summary statistics of the explanatory variables for all financial institutions in the sample are presented in Table 2. The table also shows the mean tests for differences in financial and ownership characteristics between non-failed and failed financial institutions. To investigate whether the models are robust over time to failure, we divided the data into three periods: one year (denoted by $t-1$), two years (denoted by $t-2$), and three years (denoted by $t-3$) prior to failure.

Regarding financial variables, our univariate tests indicated that in one year before failure, failed financial institutions have higher ratios of interest income to total income and loans to assets. The

former result supports the *volatility* hypothesis while the latter result suggests that failed financial institutions have higher liquidity risk. However, these variables are not significantly different between the two groups when we consider two and three years before failure. Specifically, in the two-year period, the only financial variable that is significantly different between two subsamples is the return on assets. As expected, failed financial institutions have a lower return than non-failed ones. This also holds for the three-year period data. Moreover, in three years prior to failure, failed financial institutions have a higher growth of loans, which is consistent with the notion of greater credit risk in failed financial institutions.

Table 2. Financial and ownership characteristics of sample financial institutions (FIs) and the mean tests for differences in such characteristics between non-failed and failed financial institutions

The sample consists of financial firms listed on the Stock Exchange of Thailand between 1994 and 1998. “ $t-1$ ” represents the data of one year prior to failure. “ $t-2$ ” represents the data of two years prior to failure. “ $t-3$ ” represents the data of three years prior to failure. “Failed FIs” are defined as financial institutions that are ordered to close or merge into other institutions. “Family” is a dummy equal to 1 if a family is the largest shareholder of a financial institution, and 0 otherwise. “Control Rights” are the percentage of votes held by the largest shareholder of a financial institution.

Variables	$t-1$			$t-2$			$t-3$		
	All FIs	Non-failed FIs	Failed FIs	All FIs	Non-failed FIs	Failed FIs	All FIs	Non-failed FIs	Failed FIs
Financial									
Equity to Assets	0.090	0.095	0.085	0.111	0.114	0.108	0.111	0.113	0.109
Loan Growth (%)	15.51	14.89	16.12	26.65	24.96	28.48	32.76	20.31	46.91***
Operating Expense to Revenue	0.162	0.160	0.164	0.164	0.160	0.169	0.172	0.163	0.180
Return on Assets (%)	-0.16	0.19	-0.51	0.86	1.47	0.17*	1.96	2.21	1.68**
Interest Income to Total Income	0.936	0.915	0.958***	0.886	0.880	0.892	0.819	0.827	0.810
Loans to Assets	0.823	0.809	0.837**	0.813	0.809	0.818	0.812	0.803	0.821
Ownership									
Family Control rights (%)	0.679	0.464	0.893***	0.706	0.519	0.912***	0.708	0.520	0.913***
Size									
Total assets (mil. baht)	128.86	164.10	93.61***	127.74	157.11	94.70***	121.03	151.92	87.45***
No. of observations	55	27	28	48	25	23	47	22	25

*** denotes statistically significant difference in means at the 1% level.

** denotes statistically significant difference in means at the 5% level.

* denotes statistically significant difference in means at the 10% level.

Considering ownership variables, Table 2 shows that in almost 70% of Thai financial institutions, a family is the largest shareholder. The presence of a family as the largest shareholder is higher in failed institutions. For example, in one year prior to failure, 89% of failed financial institutions had a family as their largest shareholder, while only 48% of non-failed financial institutions did. The statistical difference between these two groups is significant at 99% level. In other words, financial institutions whose largest shareholder is a family are significantly more likely to fail. This result is also robust across time to failure. Such evidence may support the *expropriation effects* of controlling families.

As for the control rights held by a financial institution's largest shareholder, although no shareholder was allowed to hold more than 5% of a bank's outstanding shares and 10% of a finance company's outstanding shares, largest shareholders of Thai financial institutions could somehow manage to go beyond the limitation.³¹ Overall, the largest shareholder of a financial institution held, on average, 22.87% of the control rights during the crisis period. Such percentage was even higher in the period before the crisis (approximately 30%). Failed financial institutions seemed to have lower fractions of votes held by the largest shareholder. However, while the identity of the largest shareholder appeared to be significantly different between failed and non-failed institutions, control rights held by the largest shareholder were not different between two subsamples. Only in two years before failure did failed financial institutions have marginal significantly lower control rights by the largest shareholder than non-failed ones. This result suggests that the lower the control rights, the less the incentives of a largest shareholder to monitor managerial actions, although the effect is marginal.

With regard to the size of failed and non-failed financial institutions, our univariate results showed that failed financial intermediaries were significantly smaller than non-failed intermediaries. This result implies that larger institutions are less likely to fail. Hence, the view of a "too-big-to-fail" policy is supported.

The univariate specifications discussed previously have one main limitation. That is, they fail to control for other variables that also have a significant impact on the likelihood that a financial institution fails. To control for the effects of other significant variables as well as to develop failure prediction models using financial and ownership variables, in the next section, a logit regression that is widely recognized in the existing literature is applied.

³¹ See Polsiri and Wiwattanakantang (2006) for the detailed discussion about ownership characteristics of Thai banks.

2.5. Methodology

Traditional failure prediction models have employed statistical methods such as in models pioneered by Beaver's (1966) univariate tests and Altman's (1968) multivariate discriminant analysis (MDA). Statistical methods used to developed prediction models also include linear probability model (LPM), logit regression approach, probit regression approach, cumulative sums (CUSUM) procedure and partial adjustment process (Aziz and Dar, 2006). Nevertheless, the most widely used methods are MDA and a logit regression (Altman and Narayanan, 1997; Atiya, 2001). Early literature documented that MDA approaches were used in, to name a few, Altman (1968), Deakin (1972), Blum (1974) and Sinkey (1975); while logit regression approaches were used in Martin (1977), Ohlson (1980) and Gentry et al. (1985). Most of these studies shared a similar technique on the basis that a set of the statistically best financial ratios was chosen to differentiate between failed and non-failed firms, within a particular prediction horizon. In this study, a logit regression was applied to develop bankruptcy prediction models for Thai financial firms.

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

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

where

$$Z_i = \alpha + \sum \beta_j X_{j,i} + \varepsilon_i \quad (2)$$

Y_i is the dependent categorical variable assigned the value of 1 if a financial institution i is ordered by the Bank of Thailand to close or merge into another institution, and zero otherwise; Z_i is a linear function in which α is the estimated intercept, β_j is the coefficient of X_j ; $X_{j,i}$ is the explanatory variable j for the i th financial institution; and ε_i is the unknown parameter j . $\text{Prob}(Y_i = 1)$ is the probability with which financial institution i will fail. If the computed probability exceeds 0.5, the financial institution is classified as failed.

3. Empirical Analysis

As noted before, the variables used in this study consisted of financial and ownership variables. The financial or CAMEL-type variables included *Equity to Assets*, *Loan Growth*, *Operating Expenses to Revenue*, *Return on Assets*, *Interest Income to Total Income*, and *Loan to Assets*, while the ownership variables included *Family*, and *Control Rights*. *Size* is also incorporated to examine the "too-big-to-fail" policy in the closure of Thai financial intermediaries during the economic crisis. The results of the logit models are presented in Table 3.

Overall, the models produced good prediction accuracy. Specifically, 85.45%, 85.41%, and 91.49% of financial institutions were correctly classified in the models that used the data of one year (the $t-1$ model), two years (the $t-2$ model) and three years (the $t-3$ model) prior to the failure, respectively. This result shows that the models are robust, regardless of time to failure.

Considering Type I error (the misclassification of failed financial institutions as non-failed) and Type II error (the misclassification of non-failed financial institutions as failed), it was found that Type I error is only 7.14% while Type II error is 22.22% for the $t-1$ model. Note that because Type I error is more costly than Type II error, this result suggests that the model can serve as a sound early warning signal.³² However, just as the result of overall predictive power, the $t-3$ model appeared to perform the best with Type I and Type II errors as low as 9% and 8%, respectively, which is rather surprising when compared with previous studies (e.g., Atiya, 2001; Dewaelheyns and Van Hulle, 2004).

Consistent with those of the univariate tests, the results of the logit models also suggested that traditional financial variables appeared not to perform relatively well in predicting financial institution failure. Only the proxies for “Asset Quality” and “Earnings” of the CAMEL-type variables showed significant results. Specifically, loan growth had a positive and significant impact on the probability with which a financial institution fails. Hence, it supports the notion that higher credit risk increases the failure likelihood of intermediaries. However, this result holds only for the “ $t-3$ ” model.

As expected, financial institutions with a higher return on assets were less likely to fail. This result holds for all periods before failures. The ratio of interest income to total income, nevertheless, had a mixed impact on the likelihood that a financial institution fails. More precisely, in the $t-1$ model, the likelihood of failure increased with a share of interest income in total income, while in the $t-3$ model, the likelihood of failure was lower when a share of interest income in total income was larger.³³ The significant impact of the ratio of interest income to total income confirms the *volatility* hypothesis.

On the other hand, ownership variables appeared to have a significant impact on the probability of business failure as shown by the following results. Considering the identity of a

largest shareholder, financial institutions in which a family was the largest shareholder were more likely to fail.³⁴ The result is robust for all three models and consistent with the result of univariate tests in Section 2.2, suggesting the *expropriation effects* of controlling families. Regarding control rights held by the largest shareholder, a high degree of ownership concentration decreased the likelihood of failure. This finding indicates that when the largest shareholder of a financial institution holds substantial voting rights, he or she has *greater incentives* and more power to *monitor* the management to pursue value-enhancing actions. Accordingly, the likelihood of financial institution failure is reduced.

Examining a “too-big-to-fail” policy, it was found that larger financial institutions were less likely to fail. Nevertheless, this result might be due to the fact that larger financial institutions have performed better than smaller ones. Hence, it was investigated whether it was the case. The univariate test not reported here showed that using the $t-1$ data, larger financial institutions (i.e., financial institutions with *Size* greater than the median) actually have lower return on assets (significant at the 5% level). However, this result does not hold for the $t-2$ and $t-3$ data. Specifically, the test of the $t-2$ and $t-3$ data showed insignificant differences in the performance between large and small financial institutions. Taken altogether, these findings imply that a “too-big-to-fail” policy may exist in the closure decision of Thai financial institutions.

³² This study’s model also appears to perform relatively well compared with a similar study by Bongini et al. (2001). Specifically, their prediction model had overall predictive power of 84.58% with Type I and Type II errors of 47.37% and 8.52%, respectively.

³³ The result of the $t-3$ model is consistent with Bongini et al. (2001).

³⁴ In Bongini et al. (2000) and Bongini et al. (2001), “*Family*” means a connection with influential families. While they obtain similar results, their interpretation was different from that of this study. Bongini et al. (2000) interpreted the result that connected financial institutions were more likely to distress because of their likely higher degree of misallocation. Bongini et al. (2001) argued that connection with influential families increased the probability of closure suggesting that the financial institution closure process was relatively free from political pressures.

Table 3. Logit Regression Models: The coefficients of explanatory variables on the likelihood of financial institution failure

The sample consists of financial firms listed on the Stock Exchange of Thailand between 1994 and 1998. The “*t*-1” model uses the explanatory variables of one year prior to the failure. The “*t*-2” model uses the explanatory variables of two years prior to the failure. The “*t*-3” model uses the explanatory variables of three years prior to the failure. Numbers in parentheses are *t*-statistics. The independent variable is a dummy that takes value of 1 if a financial institution is ordered to close or merge into another institution, and 0 otherwise. “Family” is a dummy equal to 1 if a family is the largest shareholder of a financial institution, and zero otherwise. “Control Rights” are the percentage of votes held by the largest shareholder of a financial institution. “Size” is measured by the log of total assets.

	<i>Model</i>		
	<i>t</i> -1	<i>t</i> -2	<i>t</i> -3
CAMEL variables			
Equity to Assets	-6.94 (-0.35)	30.55 (1.25)	41.90 (1.18)
Loan Growth	0.67 (0.17)	0.35 (0.21)	18.94** (2.10)
Operating Expense to Revenue	8.81 (0.70)	-34.10 (-1.49)	-37.34 (-1.57)
Return on Assets	-50.99* (-1.67)	-304.93** (-2.25)	-469.51** (-2.18)
Interest Income to Total Income	31.92*** (3.39)	3.25 (0.19)	-34.77* (-1.85)
Loans to Assets	-9.34 (-0.67)	6.42 (0.55)	14.11 (0.54)
Ownership variables			
Family	5.46*** (3.42)	6.11*** (3.06)	4.39* (1.81)
Control Rights	-12.62** (-2.43)	-10.96* (-1.80)	-4.99 (-0.72)
Size	-6.50*** (-2.88)	-4.05** (-2.03)	-1.61 (-0.66)
No. of observations	55	48	47
χ^2	42.79	38.08	47.49
Prob > χ^2	0.00	0.00	0.00
Pseudo R ²	0.56	0.57	0.73
Overall prediction accuracy	85.45%	85.41%	91.49%
Type I error ^a	7.14%	17.39%	9.09%
Type II error ^b	22.22%	12.00%	8.00%

*** denotes statistical significance at the 1% level.

** denotes statistical significance at the 5% level.

* denotes statistical significance at the 10% level.

^a is the misclassification of failed financial institutions as non-failed.

^b is the misclassification of non-failed financial institutions as failed.

4. Conclusion

This study developed logit models to predict failure of financial institutions and investigated the effects of concentrated ownership structure that is prevalent worldwide. The focus was on firms in an emerging economy with weak legal and regulatory systems. In this environment, many scholars argue that controlling shareholders are likely to expropriate corporate assets. As further contribution to the literature on the effects of concentrated ownership structure on firm performance in the time of economic crisis, the study investigated how

ownership concentration affects the likelihood that a financial institution fails during the crisis period.

The results showed that in the emerging market economy where ownership concentration is common and the legal environment is not really investor-friendly, ownership variables appeared to play a more important role than financial variables traditionally used when developing efficient early warning systems. The results are also consistent with the view that concentrated ownership structure of East Asian firms has contributed to the East Asian economic crisis (e.g., Johnson et al., 2000; Mitton, 2002; Lemmon and Lins, 2003). Specifically, it was found that the presence of a

family as the largest shareholder increases the probability of financial institution failure. This evidence supports the *expropriation effects* of controlling families.

The logit prediction models showed good predictive power. Importantly, the power is robust for the periods of one to three years prior to failure. Such evidence indicates that the models serve as timely sound early warning signals and could thus be useful tools adding to supervisory resources. More precisely, 85.45%, 85.41%, and 91.49% of financial institutions were correctly classified in the models that use the explanatory variables of one, two and three years prior to the failure, respectively. Likewise, Type I error of such models was 7.14%, 17.39%, and 9.09%, respectively.

This study also helps explain that there were significant weaknesses contributing to individual financial institution failure prior to the East Asian crisis. Moreover, the evidence of “too-big-to-fail” policies was found in the closure procedures of Thai financial institutions. As argued by Bongini et al. (2001), this may have exacerbated the crisis in some ways. That is, to the degree that large financial institutions tend to have a connection with large business conglomerate, such policies may have diverted scarce funds away from other segments of the economy, such as small and medium firms, during the economy-wide crisis.

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