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นางสาว สุชาดา มนุญพงศ์พันธุ์

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# CORPORATE CASH HOLDINGS: EVIDENCE FROM THAILAND

Miss Suchada Manunphongpan

A Thesis Submitted in Partial Fulfillment of the Requirements
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Department of Banking and Finance
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| By | Miss Suchada Manunphongpan |
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Accepted by the Faculty of Commerce and Accountancy, Chulalongkorn University in Partial Fulfillment of the Requirements for the Master's Degree

.....Dean of the Faculty of Commerce and Accountancy
(Associate Professor Annop Tanlamai, Ph.D.)

THESIS COMMITTEE

.....Chairperson
(Anant Chiarawongse, Ph.D.)

..... Advisor
(Ruttachai Seelajaroen, Ph.D.)

.....Examiner
(Suparatana Tanthanongsakkun, Ph.D.)

.....External Examiner
(Yuadrith Dhiantravan, Ph.D.)

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จุดประสงค์ของวิทยานิพนธ์ฉบับนี้คือ การศึกษาการตัดสินใจการถือเงินสดของบริษัทในประเทศไทยในช่วงปี ค.ศ.1993 ถึง 2007 ซึ่งวิทยานิพนธ์ฉบับนี้ได้ทำการศึกษาถึงปัจจัยที่มีผลต่อการตัดสินใจถือเงินสดของบริษัทในประเทศไทย ผลที่ได้แสดงให้เห็นว่า โอกาสในการลงทุนของบริษัท, โครงสร้างระยะเวลาครบกำหนดการจ่ายคืนหนี้, การจ่ายเงินปันผล, สินทรัพย์สภาพคล่องทดแทน และ อัตราส่วนหนี้มีบทบาทอย่างมีนัยสำคัญในการกำหนดการถือเงินสดของบริษัทไทย

นอกจากนี้วิทยานิพนธ์ฉบับนี้ได้ทำการวัดอัตราการปรับเข้าสู่อัตราส่วนเงินสดเป้าหมายเพื่อเป็นหลักฐานบ่งชี้ถึงการมีอยู่ของอัตราส่วนเงินสดเป้าหมายในระยะยาวของบริษัทไทย ทั้งนี้ผลจากการศึกษาพบว่า บริษัทในประเทศไทยไม่มีการปรับอัตราส่วนเงินสดเข้าสู่อัตราส่วนเงินสดเป้าหมาย ในทางตรงกันข้าม อัตราส่วนเงินสดของบริษัทไทยมีแนวโน้มจะปรับออกห่างจากอัตราส่วนเงินสดเป้าหมาย ซึ่งผลการศึกษานี้ทำให้ทราบว่าพฤติกรรมการถือเงินสดของบริษัทไทยไม่สนับสนุนแนวคิดที่ว่า บริษัทต้องมีการพิจารณาให้ดีถึงต้นทุนในการปรับเข้าสู่อัตราส่วนเป้าหมายและผลประโยชน์ที่ได้จากการปรับออกห่างจากอัตราส่วนเป้าหมาย

สำหรับวัตถุประสงค์สุดท้ายของวิทยานิพนธ์ฉบับนี้คือ การทำการศึกษาถึงปัจจัยที่มีผลต่ออัตราการปรับเข้าสู่อัตราส่วนเงินสดเป้าหมายของบริษัทไทย ผลการศึกษาพบว่า ขนาดบริษัท, ความสามารถในการก่อหนี้, อัตราส่วนหนี้โดยเปรียบเทียบ, อัตราส่วนเงินสดโดยเปรียบเทียบ และสินทรัพย์ถาวรมีผลต่ออัตราการปรับเข้าสู่อัตราส่วนเงินสดเป้าหมายทั้งสิ้น ถึงแม้ว่า เราจะไม่พบการปรับเข้าสู่อัตราส่วนเงินสดเป้าหมาย แต่อัตราส่วนในการปรับออกห่างจากเป้าหมายของบริษัทที่มีลักษณะปัจจัยดังกล่าวที่ต่างกันจะมีอัตราการปรับออกห่างจากเป้าหมายไม่เท่ากัน

ภาควิชา การธนาคารและการเงิน ลายมือชื่อนิสิต.....Suchada Manunphangpan.....

สาขาวิชา การเงิน ลายมือชื่อ อ.ที่ปรึกษาวิทยานิพนธ์หลัก.....R. Seelajaroen.....

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KEYWORDS: CASH HOLDINGS/ DYNAMIC ADJUSTMENT/ TRADE-OFF THEORY/ PECKING ORDER THEORY

SUCHADA MANUNPHONGPAN: CORPORATE CASH HOLDINGS: EVIDENCE FROM THAILAND. ADVISOR: RUTTACHAI SEELAJAROEN, Ph.D., 65 pp.

The objective of this paper is to investigate the holdings of cash for a sample of Thai firms over the period 1993-2007. First, we investigate the determinants of corporate cash holdings. The results indicate that firm's growth opportunity, debt maturity structure, dividend's payment, liquid assets substitutes, and leverage ratio play a significant role in determining cash holdings.

Moreover, we try to provide the empirical evidence of the long-run target cash ratio of Thai firms by examine the speed of adjustment towards the target cash ratio. Our findings reveal that Thai firms do not adjust their cash holdings to the target cash ratio but their cash holdings trend to diverge from the target cash level. This result does not support the view that firms trade-off between costs of adjustment towards the target cash ratio and costs of being off the target.

The last objective in this study is to investigate the determinants of speed adjustment towards the target cash ratio. Although we find that cash holdings of firms trend to diverge from the target cash level, the speed of adjustment between firms that their characteristics in top and bottom quartile (firm size, debt capacity, and fixed assets) or firms that their leverage or cash under target and over target level are different.

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Student's Signature: Suchada Manunphongpan
Advisor's Signature: R. Seelajaroen

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**CONTENTS**

**Page**

**ABSTRACT (THAI)..……iv**
**ABSTRACT (ENGLISH)...……v**
**ACKNOWLEDGEMENTS ..... vi**
**CONTENTS..... vii**
**LIST OF TABLES ..... ix**
**LIST OF FIGURES .....x**
**CHAPTER I INTRODUCTION .....1**
1.1 Background and Problem Review .....1
1.2 Statement of Problem / Research Questions .....4
1.3 Objective of the study .....4
1.4 Scope of the study .....4
1.5 Contribution .....5
1.6 Organization of the study .....5
**CHAPTER II LITERATURE REVIEW .....6**
2.1 The Trade-off Theory .....7
2.2 The Pecking Order Theory .....11
2.3 Empirical studies on corporate cash holdings. .....13
2.3.1 Empirical studies on the determinants of corporate cash holdings. .....13
2.3.2 Empirical studies on speed of adjustment to the target cash ratio. .....15
2.3.3 Empirical studies on the determinants of speed adjustment towards the target level. .....16
**CHAPTER III DATA AND METHODOLOGY .....17**
3.1 Data description .....17
3.2 Research Hypotheses .....18
3.3 Methodology .....20
3.3.1 The determinants of corporate cash holdings .....20
3.3.2 Estimate the speed of adjustment towards the target cash ratio. .....22
3.3.3 Examine the determinants of speed adjustment towards the target cash ratio..... .....24
**CHAPTER IV RESULTS .....29**
4.1 Descriptive statistics .....29
4.2 Determinants of corporate cash holdings results .....29
4.3 Speed of adjustment towards the target cash ratio results .....33
4.4 Determinants of speed adjustment towards the target cash ratio results.....35
4.5 Robustness checks .....39
**CHAPTER V CONCLUSION AND RECOMMENDATION.....41**
5.1 Conclusion .....41

**Page**

5.2 Recommendation .....43

**REFERENCES.....44**

**APPENDIX.....48**

**BIOGRAPHY.....65**

# LIST OF TABLES

Table 1Summary of model predictions for determinants of corporate cash holdings.....49
Table 2 Descriptive Statistics .....49
Table 3 Correlation Matrix.....50
Table 4 Panel regression results .....51
Table 5 Dynamic panel data estimation results – Two-stage least squares estimations....53
Table 6 Wald test results .....54
Table 7 Result of determinants speed of adjustment towards the target cash ratio.....55
Table 8 Result of determinants speed of adjustment towards the target cash ratio.....57
Table 9 Panel regression results (Robustness) .....58
Table 10 Dynamic panel data estimation results – Two-stage least squares estimations (Robustness).....60
Table 11 Result of determinants speed of adjustment towards the target cash ratio (Robustness).....61
Table 12 Result of determinants speed of adjustment towards the target cash ratio (Robustness).....63

# LIST OF FIGURES

Figure 1. Mean cash ratio of Thai firms over the period of 1993-2007 .....64

# CHAPTER I

# INTRODUCTION

## 1.1 Background and Problem Review

The decision of firms in order to hold cash has recently been focus of attention in finance literature. Many international studies demonstrate that firms maintain important cash holdings for example, Opler et al. (1999) find that U.S. firms hold on average 17% of their total assets in cash and cash equivalents and Ferreira and Vilela (2004) observe an average cash ratio of 15% in EMU countries. According to existing studies on corporate cash holdings (e.g.,Opler et al.,1999; Ozkan and Ozkan,2004; Guney et al.,2003), they argue that the main benefit of holding cash is to reduce costs associated with dependence on external financing. In this view, cash holding decision may be affected by the existence of market imperfections such as information asymmetry, agency conflicts that make it difficult and expensive to obtain funds. However, there are also potential adverse effects of cash holdings. Central of this argument is the agency conflicts between shareholders and managers can be most severe when firms have large free cash flows (Jensen, 1986). Managers can pursue their own private objectives that need not coincide with those of shareholders. Therefore, cash holdings obviously play an important role in financial management of corporations.

Due to the arguments of the costs and benefits of holding cash, one of the main questions that the previous studies try to answer is whether there is optimal level of cash holding. There are two main theoretical models that can help to explain the cash holding decision: the trade-off model (Myers, 1977) and the pecking order model (Myers and Mailuf, 1984). The trade-off model suggests that the optimal level of cash

holding is at the point where by the marginal costs and marginal benefits of holding cash are equal. In contrast, the pecking order theory suggests that firms finance investments first with retain earnings, then with safe debt and risky debt, and finally with equity in order to minimize asymmetric information costs and other financing costs. Under this theory, cash is used as a buffer between retained earnings and investment needs. When operational cash flow are high, firms use them to finance new profitable projects, to repay debts, to pay dividends, and finally to accumulate cash. However, when retained earnings are insufficient to finance new investments, firms use the accumulated cash holdings and then issue new debt. Thus, there is no static level of optimal cash holding.

The results from empirical previous studies on corporate cash holdings (e.g. Opler et al., 1999; Kim et al., 1998; Ozkan and Ozkan, 2004) validate the trade-off theory. They find that the cash level increases with the growth opportunities of firms, business risk, capital expenditures and difficulty of access to the capital markets, and cash level decreases with firm size, leverage and dividend payments. However, most of previous studies focus their analysis on corporate cash holdings only in U.S. market and developed markets. The previous studies have two main research questions. First, what determine cash holdings. Second, is there long-term target cash holdings.

In Thailand, there are a few studies on corporate cash holdings. Wichada (1998) reports that Thai listed firms have mean cash ratio ranging between 6% to 12% and standard deviation around 12% over the period of 1993 to 1998. This implies that cash holdings among Thai firms are quite varied across firms. Therefore, in this paper we study cash holdings behavior of Thai firms and our question is that whether Thai firms have optimal levels of cash holdings. To answer this question, we test that what

are factors determining levels of cash holdings. For this test, we based on trade-off and pecking order theories that help to explain which firm characteristics influence cash holding decisions in order to investigate the determinants of Thai corporate cash holdings.

Another objective in this paper lies in the dynamic analysis of corporate cash holding decision. Because of previous Thai studies focus only on the static analysis of cash holdings in order to examine the determinants of Thai corporate cash holdings (Wichada ,1998; Chayanin ,2001), in this paper we adopt a more realistic recognizing that when cash holdings change due to firm characteristics change or random shocks occur. Market imperfections such as adjustment costs may prevent firms from adapting the current cash ratio immediately adjust to new desired cash level. Therefore, the objective for dynamic analysis of corporate cash holding is to investigate whether firms have long-run target cash ratio and if so how quickly that firms adjust toward the optimum. The important is that the interpretation from speed of adjustment towards the target cash ratio can evaluate the credibility of competing capital structure theories. In this view, a fast speed of adjustment is interpreted as support for the trade-off theory while a slow adjustment is in consistent with the pecking order theory.

However, most of empirical studies on the speed of adjustment towards the target cash ratio are based on the implicit assumption that firms follow a uniform adjustment rule and the speed of adjustment is linear and symmetric (e.g., Opler et al.,1999; Ozkan and Ozkan ,2004; Bruinshoofd and Kool, 2004). This means that all firms in the sample have the same speed of adjustment at average value. Flannery and Hankins (2007) postulate that the speed of adjustment depends on the costs of deviating from the target and the costs of adjusting toward the optimum. Therefore,

the speed of adjustment should not be equal across all firms. In this paper, we allow for asymmetric adjustment when examining the determinants of speed adjustment towards the target cash ratio. To our knowledge, existing research lack to study on the determinants of speed adjustment towards the target cash ratio, this paper try to fill this gap by investigate that what are factors determining the speed of adjustment towards the target cash ratio.

### 1.2 Statement of Problem / Research Questions

This paper studies cash holding behavior of Thai firms and the questions to be examined are:

1. What are factors determining levels of cash holdings?
2. Does firm try to adjust towards the target cash ratio and what is the speed of the adjustment?
3. What are factors determining the speed of adjustment towards the target cash ratio?

### 1.3 Objective of the study

This paper attempts to investigate the determinants of Thai corporate cash holdings and try to provide the empirical evidence of the long-run target cash ratio of Thai firms. In addition, this study also examines the determinants of speed adjustment towards the target cash ratio of Thai firms.

### 1.4 Scope of the study

This thesis sample contains the data from Thai firms during the period of 1993 to 2007. In this paper, firms which operate in the financial sector were excluded.

## 1.5 Contribution

Firstly, this research extends the previous study of corporate cash holdings of Thai firms by examines the speed of adjustment towards the target cash ratio. The main idea is to investigate whether Thai firms have long-run target cash ratio and if so how quickly that firms adjust toward the target level. The important thing is that the interpretation of adjustment behavior of firms to target cash level can confirm the credibility of trade-off theory. Furthermore, as the previous studies lack to study in the question that what are the factors determine the speed of adjustment towards the target cash ratio, this thesis seeks to provide empirical evidence on the determinants of speed of adjustment towards the target cash ratio by investigate whether the speed of adjustment toward the target cash ratio depends on the costs of deviating from the target and the costs of adjusting toward the target level.

## 1.6 Organization of the study

The remainder of this paper is organized as follows. Chapter 2 discusses the literature reviews, the theoretical background of the study. Chapter 3 describes the data and the empirical methods. Chapter 4 presents the results of the research and chapter 5 we end with our main conclusions.

# CHAPTER II

# LITERATURE REVIEW

The studies of corporate cash holdings try to explain whether firms have optimal cash holdings level by examine the determinants of cash holdings. The main ideas are based on the assumption that if capital market is perfect, holding large amounts of cash is irrelevant. In this situation, firms can easily raise external funds to keep operating and to invest in positive net present value projects at fair prices when cash flow turns out to be unexpectedly low. Since there is no liquidity premium in such a world, holdings of liquid assets have no opportunity cost. Thus, the decisions about investment in liquid assets would not affect shareholder wealth. (Myers and Majluf, 1984; Opler et al., 1999). However, in reality cash holdings decision may be affected by the existence of market imperfections such as asymmetric information, agency conflicts and financial distress. In this view, it is difficult and expensive for firms to obtain funds due to information asymmetry and agency conflicts between creditors and shareholders which lead to distortions in firms' investments that generate underinvestment problems (Myers, 1977). Moreover, accumulating cash may reduce the firms' financial distress. Therefore, regarding to the benefits of holding cash, these imply that there is an optimal cash level balance the marginal costs and marginal benefits of holding cash in order to maximize the value of firm. In this section, we discuss two theoretical models that can explain the determination of the cash holdings which are the trade-off and the pecking order theories. Then we discuss the previous empirical studies on corporate cash holdings.

## 2.1 The Trade-off Theory

The trade-off theory indicates that management to maximize shareholder wealth should set the firm's cash holding at a level such that the marginal benefit of cash holdings equal the marginal cost of those holdings.

There are several benefits of holding cash. First, cash holdings contribute to minimize the costs of raising external funds or liquidating existing assets. Myers and Majluf (1984) argue that in the presence of asymmetric information, firms tend to follow a hierarchy in their financing policies in the sense that they prefer internal over external finance. In this situation, holding cash can reduce the costs of being dependent on external financing. Second, cash holdings reduce the likelihood of financial distress especially for firms with more volatile cash flows as it acts as a safety reserve to face unexpected losses or borrowing constrains. Finally, cash holdings allow the pursuance of the optimal investment policy even when financial constraints are met.

However, there are also costs associated to cash holdings. The traditional cost of holding cash is the opportunity cost of the capital due to the low return on liquid assets. Furthermore, keeping a higher level of cash holdings in the firm can also generate agency costs of managerial discretion. In the presence of agency costs of managerial discretion, management may hold cash to pursue its own objectives at shareholder expense. Jensen (1986) suggests that managers have incentive to build up cash to increase the amounts of assets under their control and to gain discretionary power over the firm investment decision. The managers' incentive to hold cash are mainly to lower the probability of future financial distress and to allow investment in projects that suit his own interest but may not be in the interest of shareholders.

Based on the benefits and costs of cash holdings, we now describe the main firm characteristics that are relevant to determine cash holding decision according to trade-off theory as the following.

**Asymmetric Information, Financial distress**

Myers and Majluf (1984) suggest that the existence of asymmetric information between firms and investors make external financing costly. In this view, firms tend to prefer internal funds over informational external finance. Furthermore, they also argue that asymmetric information problem is more severe for firms whose values are determined by growth opportunity. Based on the view that firms whose value is largely determined by their growth opportunities have larger information asymmetry and external financing is more costly for firms with greater growth opportunities (Myers and Mailuf, 1984). In this view, the cost of incurring cash shortage is higher for firms with larger growth opportunities due to the expected losses that result from foregoing valuable investment opportunities. Therefore, firms with more growth opportunities have the incentive to hold more cash.

It is also important to note that firms with greater growth opportunities may also incur higher bankruptcy costs (Williamson, 1988; Harris and Raviv, 1990; Shleifer and Vishny, 1992). This is because their value depends on their growth opportunities rather than on tangible assets or specific cash flows. Therefore, firms with greater growth opportunities have incentive to hold more cash in order to avoid financial distress and bankruptcy. Thus, it is predicted that there is a positive relation between cash holdings and growth opportunities of firms, as has been shown in many studies (Kim et al.,1998; Opler et al.,1999; Ozkan and Ozkan, 2004; Guney et al., 2003 and Ferreira and Vilela, 2004).

To proxy for growth opportunities of firms, we use the market-to-book ratio defined as the ratio of book value of total assets minus the book value of equity plus the market value of equity to book value of assets.

It is also suggested that larger firms have less information asymmetry than smaller firms (Brennan and Hughes, 1991; Collins, 1981). Therefore, smaller firms face more borrowing constrains and higher costs of external financing than larger firms (Whited, 1992; Fazzari and Peterson, 1993). This leads larger firms can hold less cash than smaller firms. To the extent that size is an inverse proxy for both the degree of information asymmetry and external financing costs, we would expect a negative relation between firm size and cash holdings.

Moreover, size can also be related to costs of financial distress. It is also argued that larger firms are more likely to be diversified and less likely to experience financial distress than smaller firms (Titman and Wessel, 1988). Ozkan (1996) indicates that smaller firms are more likely to be liquidated when they are in financial distress. Thus, smaller firms are expected to hold more cash to avoid financial distress.

**Cash substitutions**

Cash flow provides a ready source of liquidity to meet operating expenditures and maturity liabilities (Kim et al.,1998) and the risk of having to pass up valuable investment opportunities and facing financial distress is lower for firms with higher cash flows. Therefore, cash flow can be seen as a cash substitute and we would expect a negative relation between cash flow and cash holdings (Kim et al.,1998; Guney et al.;2003 ).

Moreover, to the extent that firms can use other liquid assets besides cash in the event of cash shortage. These assets can be seen as substitutes for cash.

Consequently, firms with more liquid asset substitutes are expected to hold less cash. We expect that there is a negative relation between liquid assets and cash holdings, as has been shown in various empirical studies (Opler et al.,1999; Ozkan and Ozkan, 2004; Guney et al.;2003; Ferreira and Vilela ;2004; Drobetz and Gruninger ,2006).

**Dividend Payments**

Firms that currently pay dividends can raise funds easily and at low cost by reducing its dividend payments (Opler et al., 1999), in contrast to firms that does not pay dividends which have to use the capital markets to raise funds. Therefore, dividend paying firms don't need to hold high amounts of cash and the relation between dividend payments and cash holdings would be negative.

On the other hand, cash holdings can also increase with dividend payments. Firms that pay dividends may have to reduce or cut their dividends when having a cash shortage. In order to avoid these situations, firms will hold large amounts of cash. Thus, the relation between dividend payments and cash holdings would be positive. From above, the prediction for relationship between dividend payments and cash holdings is not clearly determined under the trade-off model.

**Leverage**

The leverage ratio will also affect firms' cash holdings as has been shown in many empirical studies (Kim et al., 1998; Opler et al., 1999; Ozkan and Ozkan, 2004). To the extent that leverage ratio acts as a proxy for the ability of the firms to issue new debt, it would be expected that firms with higher leverage have an easier access to capital markets and expect a negative relation between leverage and cash holdings. In this view, firms can use borrowing as a substitute for cash (John, 1993). Moreover, Baskin (1987) indicates that the cost of funds used to invest in liquidity increases as

debt financing increases, implying that reduction in cash holdings occur when firms increase their financial leverage.

However, it should be noted that higher debt levels can increases the probability of financial distress and bankruptcy. To reduce this probability, firms with higher leverage are expected to hold more cash. This would induce a positive relation between leverage and cash holdings. Thus, the predicted relationship between cash holdings and leverage is ambiguous.

**Debt maturity structure**

The debt structure between short and long term debt can also affect firm's cash holding decisions. Firms with more short-term debt in their capital structure are expected to hold more cash because they can meet constraints of renewal of their credit lines and are subject to the risk of experiencing financial distress. Furthermore, on the basis of debt maturity structure models, firms with a high degree of potential informational asymmetry are likely to issue short-term debt (e.g., Flannery, 1986 ;Kale and Noe, 1990). Firms with larger proportion of short-term debt will keep higher cash levels because their access to other external financing would be limited by high degree of asymmetric information. Therefore, we would expect a negative relation between debt maturity structure and cash holdings.

## 2.2 The Pecking Order Theory

The pecking order theory of Myers (1984) indicates that issuing new equities is very costly for firms because of asymmetric information. Thus, firms finance their investments first with retained earnings, then with safe debt and risky debt, and finally with equity. This theory suggests that firms do not have target cash levels. Cash is used as a buffer between retained earnings and investment needs. According to this theory, cash level would just be the result of the financing and investment decisions.

When operational cash flow are high, firms use them to finance new profitable projects, to repay debts, to pay dividends and finally to accumulate cash. However, when retained earnings are insufficient to finance new investments, firms use the accumulated cash holdings and then issue new debt.

We now describe the main firm characteristics that are relevant to determine cash holdings decision according to pecking order theory as the following.

**Asymmetric Information, Financial distress**

In the presence of information asymmetries between managers and investors, external funds are more costly. Based on the pecking order theory, firms must use accumulated cash to finance profitable projects. Therefore, it is expected a positive relation between the growth opportunity and cash holdings.

Furthermore, this theory suggested that larger firms have high level of operational cash flow. They increase their cash holdings and the relationship between cash holdings and size is expected to be positive.

**Cash substitutions**

The pecking order postulate that when operational cash flow are high, firms use them to finance new profitable projects, to repay debts, to pay dividends and finally to accumulate cash. Thus, we could expect a positive relation between cash flow and cash holdings as has been shown in previous studies (Opler et al.,1999; Ozkan and Ozkan, 2004; Ferreira and Vilela ,2004).

**Leverage**

In a pecking order world, debt typically grows when investment exceeds retained earnings and falls when investment is less than retained earnings while cash holdings follow an inverse pattern. Cash holdings fall when investment exceeds retained earnings and grow when investment is less than retained earnings. This

relationship between cash holdings, debt and investments suggests that there is a negative relation between leverage and cash holdings as has been shown in many studies (Opler et al.,1999; Ozkan and Ozkan, 2004; Ferreira and Vilela ,2004; Guney et al.;2003; Drobetz and Gruninger ,2006).

However, some of empirical predictions of the pecking order theory are similar to those of the trade-off theory. Thus, it is difficult to distinguish empirically between these two theories. We can summarize the empirical predictions of two models of cash holdings as table 1.

## 2.3 Empirical studies on corporate cash holdings.

### 2.3.1 Empirical studies on the determinants of corporate cash holdings.

The investigation of cash holding of firms has gained a great deal of attention in the empirical studies. The important stand of this studies have focused on the determinants of corporate holding of cash in order to answer the question that what are factors determining levels of cash holdings. To answer this question, there are two ways to calculate the cash ratio in existing literature. The first and most common method is to divide cash and cash equivalents by the net assets, where net assets are computed as total assets less cash and cash equivalents (Opler et al., 1999). Second, follow Kim et al.(1998) by divide cash and cash equivalents with total assets.

The main studies on corporate cash holdings are undertaken on the U.S. market. The important research is provided in Kim et al. (1998). They observe that firms facing higher costs of external financing and having more volatile earnings and firms with relatively lower returns on assets have significantly larger proportions of liquid assets to total assets. Opler et al. (1999) obtain similar results for the same market, finding that firms with strong growth opportunities and riskier cash flows, and

small firms hold larger amounts of cash. Faulkender (2004) investigates small U.S. firms and provides that the determinants of cash holdings are somewhat different. He finds that small firms trend to hold more cash as their leverage increases because of they have limited access to the capital markets. Therefore, the results that provided from U.S. market validate the trade-off theory. They find that cash level increases with the growth opportunities of firms, business risk, capital expenditures and difficulty of access to the capital markets, and cash decreases with firm size, leverage and dividend payments.

However, there are many studies on corporate cash holdings present evidence from outside the U.S. For example, Garcia-Teruel and Martinez-Solano (2004), Kytonen (2005) and Drobetz and Gruninger (2006) examine corporate cash holdings of Spanish, Finnish and Swiss firms, respectively, the results confirm previous findings for U.S. They report that firm size, growth opportunities, cash flows, leverage, dividend policy and the probability of financial distress impact cash holdings. More recently, there has been more emphasis on the role of corporate governance in explaining the corporate cash holding behavior using international data. Dittmar et al. (2002), Guney et al. (2003) and Ferreira and Vilela (2004) examine the relationship between cash holdings and the shareholders' and creditors' protection, the ownership structure and the financial markets' development. The important findings are that firms in countries with superior investor protection and capital markets are better developed hold less cash.

In Thailand, there are two main studies on corporate cash holdings of Thai firms. Wichada (1998) investigates the determinants of Thai corporate cash holdings in the period 1993 to 1998. Using the sample of 67 Thai firms and provide similar result of U.S. market. The results report that financial distress costs, growth rate of

index of industrial production, debt ratio, variability of cash flow are positively related to cash holdings and cash flow is negatively related to cash holdings while Chayanin (2001) reports that only firm size and market to book ratio are important in determining cash holdings. In this study, she provides evidence that cash is positively related to market to book ratio, and cash is negatively related to firm size.

### 2.3.2 Empirical studies on speed of adjustment to the target cash ratio.

Empirical studies of corporate cash holding decision has not focused only on the determinants of corporate holding of cash. Another objective in the empirical previous studies is attempt to investigate whether firms haves long-run target cash ratio and if so how quickly that they adjust toward the optimum. The different between the studies on static and dynamic cash holding decision based on their assumptions. The static cash holding model assumes that firms can instantaneously adjust towards the target cash level following changes in firm characteristics and random shocks. While the dynamic cash holding model view that there may be delays in the adjustment process because of positive costs of adjustment. This in turn causes the current cash structure not to be immediately adjusted to a new desired cash structure.

The important study on dynamic cash holding decision is provided in Opler et al. (1999) who examine whether cash holdings are mean-reverting by estimate different target-adjustment models relating the firm's actual cash holdings to its target cash holdings. The results provide evidence that firms have target cash level. Recently, most of studies on the dynamic cash holding decision apply partial adjustment model to estimate speed of adjustment towards target cash ratio. The conclusions of all studies confirm the existence of long-run target cash ratio but there are differences in the speed of adjustment across countries. Guney et al. (2003)

observe that Japanese and German firms have the low speed of adjustment towards target cash ratio. They mentioned that this result could be explained by their close ties to banks and depend on them for external financing. Moreover, they also find that firms in U.K. adjust their cash holdings quickly in an attempt to reach the target cash level. Ozkan and Ozkan (2004) confirm the faster speed of adjustment for U.K. firms. Couderc (2005) reveals the differences in the speed adjustment across countries. The results show the higher adjustment coefficients for U.S. and Canada than for Germany and France companies. However, Drobetz and Gruninger (2006) find that speed of adjustment of Swiss firms is on average lower than in other countries.

### 2.3.3 Empirical studies on the determinants of speed adjustment towards the target level.

From previous research on corporate cash holding decision, most of the empirical studies on dynamic cash holding model lack to investigate the determinants of speed adjustment towards the target cash ratio. However, the important study on the determinants of speed adjustment based on Flannery and Hankins (2007) study. They try to examine the determinants of speed adjustment towards the target debt ratio. The main idea is that the speed of adjustment depends on the costs of deviating from the target and the costs of adjusting toward the optimum. Therefore, the speed of adjustment should not be equal across all firms. From this study, the results show that capital structure adjustment process depends on the costs of deviating from the leverage target and the costs of adjusting toward the optimum. The rebalancing costs depend on external financing expenses, stock price movements, and financial constraints. While the benefits of achieving the target leverage vary with the potential costs of distress and the value of tax shields.

# CHAPTER III

# DATA AND METHODOLOGY

## 3.1 Data description

For our empirical analysis of corporate cash holdings, we use a sample of publicly traded Thai firms over the period 1993-2007. Our initial sample is the set of all firms for which data are available on the Datastream database. These data include survivors and non-survivors that appeared on Datastream at any time during the sample period. To build our final sample, we exclude financial firms since their cash policy differs from that of industrial firms. In addition, we noticed the presence of outliners. In this paper, we find that the outliners are firms in rehabitation sector. To avoid problems with these outliners, we detected them and removed them from our sample. Therefore, rehabitation companies are excluded. These criteria have provided us with a total 3,087 firm-year observations.

Consistent with the majority of previous studies (e.g. Kim et al.,1998; Opler et al.,1999; Ozkan and Ozkan,2004; Ferreira and Vilela ,2004), our variables are defined as follows.

The dependent variable in our study is the cash ratio. There are two ways to calculate the cash ratio. First, following Opler et al.(1999), we used the variable CASH calculated as the ratio of cash and cash equivalents to net assets, where net assets are computed as total assets less cash and cash equivalents. Second, follow Kim et al.(1998), we used the variable CASH2 which is defined as the ratio of cash and cash equivalents to total assets. To provide widely comparable results, we use both approaches to calculate the cash ratio.

We employ the market-to-book ratio (MB) as a proxy for the firm's growth opportunities. We estimate the market value of the firm's assets as the book value of assets minus the book value of equity plus the market value of equity. The market-to-book ratio is given by the market value of assets divided by the book value of assets.

We measure firm size (SIZ) as the natural logarithm of the book value of total assets and define cash flow (CF) as operating cash flow to total assets.

We use the net working capital to total assets ratio (LIQ) as a proxy for liquid asset substitutes as these assets can be seen as substitutes for cash holdings. Net working capital is defined as the difference between current assets (minus cash and cash equivalent) and current liabilities.

Leverage (LEV) is measured as the ratio of total debt (long-term and short-term debt) to the book value of total assets and to test the relationship between debt maturity structure and cash holdings, we use the ratio of long-term debt to total debt (DBT).

We use firm's dividend yield (DIVYIELD) to measure the effects of dividend's payment. It is defined as the ratio of dividend per share to the stock price.

### 3.2 Research Hypotheses

To achieve for our empirical objectives, the following hypotheses will examine:

Hypothesis 1: If Thai firms have optimal levels of cash holdings, the determinants (variables that we describe in section 3.1) will significantly related to cash holdings.

Under this hypothesis, the relationship of determinants and cash holdings can be explained by trade-off theory and the predicted sign are as following table.

| Variables | Trade-off Theory |
|---|---|
| Growth Opportunity | + |
| Firm size | - |
| Cash flow | - |
| Liquid assets substitutes | - |
| Dividend Payments | ? |
| Leverage | ? |
| Debt maturity structure | - |

Hypothesis 2: If Thai firm have long-run target cash ratio, the speed of adjustment towards the target cash level $(\lambda = 1 - \gamma_0)$ will lies between 0 and 1. The null hypothesis can be set as follow.

$H_0 : \gamma_0 \geq 1$

$H_1 : \gamma_0 < 1$

The assumption is to reject $H_0$ implies that the value of adjustment coefficient $(\lambda = 1 - \gamma_0)$ is positive. This result shows that firms will adjust their cash holdings to the target cash level.

Hypothesis 3: If the speed of adjustment towards the target cash ratio depends on the adjustment costs and adjustment benefits toward the target cash ratio, the speed of adjustment should not be equal across all firms due to the variation in the adjustment costs and adjustment benefits.

Under this hypothesis, the theory of capital structure adjustment speed suggests that large firms have faster speed of adjustment than smaller firms because they face low cost of financing. Firms with high debt capacity have faster speed of adjustment than firms with low debt capacity because they easy to access to capital markets. Overleveraged firms and firms with cash under target level are expected to have faster speed of adjustment because they are more likely to distress. Finally, firms

with more collateral (high fixed assets) have slower speed of adjustment than firms with low fixed assets because they face low costs of financial distress.

## 3.3 Methodology

### 3.3.1 The determinants of corporate cash holdings

The objective in this section is to investigate whether firms have optimal levels of cash holdings. To answer this question, we test that what are factors determining levels of cash holdings. Because of previous studies find that proxies for agency and asymmetric information problems are important determines cash holdings (e.g., John, 1993; Kim et al.,1998; Harford,1999; Opler et al.,1999), therefore the explanatory variables that we use for this test reflect these problems and based on trade-off and pecking order theories explanation in order to describe the relationship between these variables and cash holding decision.

To test that what are factors determining levels of cash holding, we will estimate the following equation.

$$CASH_{i,t} = \beta_0 + \beta_1 MB_{i,t} + \beta_2 SIZ_{i,t} + \beta_3 CF_{i,t} + \beta_4 LIQ_{i,t} + \beta_5 DIV_{i,t} + \beta_6 LEV_{i,t} + \beta_7 DBT_{i,t} + \alpha_i + \varepsilon_{i,t} \quad (1)$$

where, $CASH$ is the dependent variable

$CASH_{i,t}$ = Cash + Cash equivalents/ Total assets – (Cash + Cash equivalents).

$MB_{i,t}$ = (Book value of total assets – Book value of equity + Market value of equity) / Book value of assets.

$SIZ_{i,t}$ = Natural logarithm of total assets.

$CF_{i,t}$ = Operating cash flow/ Total assets.

$LIQ_{i,t}$ = Net working capital – (Cash + Cash equivalents) / Total assets.

$DIV_{i,t}$ = Dividend Yield

$LEV_{i,t}$ = Total debt (Long-term debt + Short-term debt) / Total assets.

$DBT_{i,t}$ = Long-term debt / Total debt.

From equation (1), *i* and *t* represent firms and time respectively. $\alpha_i$ represents time-constant firm-specific effects. It is assumed that firm-specific effects $\alpha_i$ (firm-heterogeneity term) are unobservable but have a significant impact on cash holdings. They change across firms but fixed for a given firm through time. In this paper, we use three different regression methodologies to examine the determinants of corporate cash holdings which are the Fama-Macbeth methodology, pool regression and fixed-effect regression.

Using the Fama-Macbeth method (Fama and Macbeth, 1973), a cross-sectional regression is estimated each year and the average of the time series of coefficients from annual cross-sectional regressions are our reference. With this approach, we use t-test to consider the significant of coefficients by calculated t-statistic as following $t = \frac{\bar{x}}{S.D./\sqrt{n}}$, where $\bar{x}$ is the mean of the coefficient, S.D is the standard deviation of the coefficient and n is the sample size. If the calculated t-statistic is below the threshold chosen for statistic significance (at the 0.10, the 0.05, or 0.01 level), then we can conclude that the coefficient is statistically significant.

Moreover, we use Fixed-effects method because there are relevant unobservable characteristics $(\alpha_i)$ in the underlying model, estimated coefficients in cross-sectional regression will be biased due to the correlation generated between the regressors and error term. This method is wildly uses in various empirical studies on corporate cash holdings (e.g.,Ozkan and Ozkan, 2004; Guney et al., 2003; Drobetz and Gruninger, 2006) because they recognize in the firm-specific effects $(\alpha_i)$. The

extent to which these unobserved effects remain relatively stable over time,
we could control for them by using a fixed-effects estimator to obtain consistent coefficient estimates (Wooldridge, 2002).

### 3.3.2 Estimate the speed of adjustment towards the target cash ratio.

In this section, the purpose is to examine whether firms have long-run target cash ratio and if so how quickly that firms adjust toward the target. The static cash holding model implicitly assumes that firms can instantaneously adjust towards the target cash level in response to changes in firm-specific characteristics or random shocks. In this paper, we adopt a more realistic recognizing that there may be delays in the adjustment process because of positive costs of adjustment causing the current cash ratio not to be immediately adjusted to the desire cash level. Following Ozkan and Ozkan (2004) and applying the partial adjustment toward target capital structures from Flannery and Rangan (2006), we estimate dynamic panel model. The process of firms in order to partially adjust to the target cash ratio can be represented by partial adjustment model:

$$CASH_{i,t} - CASH_{i,t-1} = \lambda\left(CASH^{*}_{i,t} - CASH_{i,t-1}\right) + \delta_{i,t} \qquad (2)$$

where, $CASH_{i,t}$ is the actual cash ratio and $(CASH^{*}_{i,t} - CASH_{i,t-1})$ can be interpreted as the target change whereas only a fraction $\lambda$ of it is achieved. The value of adjustment coefficient $\lambda$, capturing the ability of firms to adjust to their target cash levels. $\lambda$ lies between 0 and 1. If $\lambda$=1, firms will adjust their cash levels to optimal level immediately, i.e., $CASH_{i,t} = CASH^{*}_{i,t}$. On the other hand, if $\lambda$=0, this indicates that adjustment costs are so large that firms cannot change their existing cash structure, i.e., $CASH_{i,t} = CASH_{i,t-1}$. The important is that if $0 < \lambda \leq 1$, this means that cash holdings of firms are mean reverting.

However the target cash ratio $CASH^{*}_{i,t}$ cannot be observed directly, the proxy is used. The target cash ratio can be determined as follow:

$$CASH^{*}_{i,t} = \sum_{k} \beta_k x_{k,i,t} \tag{3}$$

where, $CASH^{*}_{i,t}$ is a function of explanatory variables, X, which describe in equation (1).

We use equation (3) as a proxy for target cash ratio in equation (2), then combining equation (2) and (3), the result is obtained as follow:

$$CASH_{i,t} - CASH_{i,t-1} = \lambda(\sum_{k} \beta_k x_{k,i,t} - CASH_{i,t-1}) + \delta_{i,t} \tag{4}$$

Then rearrange the above equation, we get

$$CASH_{i,t} = (1-\lambda)CASH_{i,t-1} + \lambda\sum_{k} \beta_k x_{k,i,t} + \delta_{i,t} \tag{5}$$

which can be simplified to :

$$CASH_{i,t} = \gamma_0 CASH_{i,t-1} + \sum_{k} \gamma_k x_{k,i,t} + \delta_{i,t} \tag{6}$$

where, $\gamma_0 = 1-\lambda$, $\gamma_k = \lambda\beta_k$. The most important is the estimated value of $\lambda = 1-\gamma_0$ measures the speed of adjustment towards the target cash ratio. Estimation equation is as follow:

$$\begin{aligned} CASH_{i,t} = {} & \gamma_0 CASH_{i,t-1} + \gamma_1 MB_{i,t} + \gamma_2 SIZ_{i,t} + \gamma_3 CF_{i,t} + \gamma_4 LIQ_{i,t} \\ & + \gamma_5 DIV_{i,t} + \gamma_6 LEV_{i,t} + \gamma_7 DBT_{i,t} + \alpha_i + \varepsilon_{i,t} \end{aligned} \tag{7}$$

However in dynamic panel model a problem arises from the lagged dependent variables $CASH_{i,t-1}$ as mentioned in many studies (Ozkan and Ozkan, 2004; Guney et al., 2003; Drobetz and Gruninger, 2006; Garcia-Teruel and Martinez-Solano,2004). In this view, OLS regression does not consistently estimate coefficients in equation (7) because there is an autocorrelation between the disturbances. The OLS estimators are no longer minimum variance. To solve this problem, we use the two-stage least

square (2SLS) regression and the unbiased estimation of equation (6) and (7) can provided by the two-stage least square regression if an instrument variable can be found that there is highly correlated with $CASH_{i,t-1}$ but not for the error term (Gujarati, 2003). In this paper, we use $CASH_{i,t-2}$ as an instrument variable.

Using the two-stage least square (2SLS), $CASH_{i,t-1}$ is regressed first on the instrument variable $CASH_{i,t-2}$ and the explanatory variables $x_{k,i,t}$.

$$CASH_{i,t-1} = \rho CASH_{i,t-2} + \sum_k \prod_k x_{ki,t-1} + \varepsilon_{i,t-1} \quad (8)$$

The fitted value of $CASH_{i,t-1}$ is obtained from equation (8).

$$\hat{CASH}_{i,t-1} = \hat{\rho} CASH_{i,t-2} + \sum_k \hat{\prod}_k x_{k,i,t-1} \quad (9)$$

where, $\hat{CASH}_{i,t-1}$ is the fitted value of $CASH_{i,t-1}$.

Therefore the equation (6) can be written as

$$CASH_{i,t} = \gamma_0 \hat{CASH}_{i,t-1} + \sum_k \gamma_k x_{k,i,t} + \delta_{i,t} \quad (10)$$

### 3.3.3 Examine the determinants of speed adjustment towards the target cash ratio.

In this section, we recognize that the speed of adjustment towards the target cash ratio depends on the costs of deviating from the target and the costs of adjusting toward that optimum. This means that firms with in the same sample may have difference speed of adjustment towards the target cash ratio due to the variation in adjustment costs and adjustment benefits. Therefore, in this study we will investigate that what are factors determining the speed of adjustment towards the target cash ratio.

Based on theory of capital structure adjustment speed of Flannery and Hankins (2007), we recognizing that the adjustment costs depend on firm's external financing

costs and the benefits of achieving the target vary with the costs of financial distress. The main idea is that firms that face lower external financing costs, can raise funds easily and have flexibility to adjust their cash holdings. Therefore, firms with lower external financing costs will have faster speed adjustment towards the target cash ratio than firms with higher external financing costs. Furthermore, the faster speed of adjustment towards the target cash ratio is predicted for firms with higher probability of financial distress.

To investigate the determinants of speed of adjustment towards the target cash ratio, we use firm size and debt capacity as the proxies for external financing costs and to capture the costs of financial distress, we examine relative leverage, relative cash and fixed assets. Debt capacity is measured as the ratio of total debt to fixed assets. The higher value of this ratio, the lower of firm's debt capacity. We measure fixed assets ratio (to capture the costs of financial distress) as the ratio of fixed asset to total assets.

Large firms imply faster speed of adjustment because they have low asymmetric information and face low cost of financing. Debt capacity measures firm's ability to access the external capital. High debt capacity, imply that firms easy to access capital markets and have faster speed of adjustment. Overleveraged firms and firms with cash under target level are expected to have faster speed of adjustment because they are more likely to distress. On the other hand, firms with more collateral (fixed assets) reflect low costs of financial distress. Therefore, firms with more fixed assets have slower speed of adjustment than firms with low fixed assets. In this paper, firms are categorized as high or low in terms of firm size, debt capacity and fixed assets based on whether they are in the top ($Q_4$) or bottom ($Q_1$) quartile. Leverage and cash ratio are classified into two groups which are over or under the target level.

To investigate the determinants of speed adjustment towards the target cash ratio, we hypothesis that differences in adjustment costs and adjustment benefits generate cross-sectional and variation in cash rebalancing. In this paper, we identify Z to represents the adjustment speed factors (firm size, debt capacity, relative leverage, relative cash and fixed assets) and the baseline model presented in equation (2) can be modified to allow the adjustment speed to vary with Z. The adjustment speed coefficient, λ, is replaced with a multi-factor coefficient which contain of a base adjustment speed estimate, $\lambda_0$, and the adjustment speed factor estimate, $\lambda_j$.

$$\lambda_{NEW} = \lambda_0 + \lambda_j Z_j \tag{11}$$

The modified partial adjustment model is:

$$CASH_{i,t} - CASH_{i,t-1} = \left(\lambda_0 + \lambda_j Z_j\right)\left(CASH^*_{i,t} - CASH_{i,t-1}\right) + \delta_{i,t} \tag{12}$$

The target cash ratio $CASH^*_{i,t}$ cannot be observed directly, the proxy is used. The target cash ratio can be determined as follow:

$$CASH^*_{i,t} = \sum_k \beta_k x_{k,i,t} \tag{13}$$

We use equation (13) as a proxy for target cash ratio in equation (12), then combining equation (12) and (13), the result is obtained as follow:

$$CASH_{i,t} - CASH_{i,t-1} = \left(\lambda_0 + \lambda_j Z_j\right)\left(\sum_k \beta_k x_{k,i,t} - CASH_{i,t-1}\right) + \delta_{i,t} \tag{14}$$

Then rearrange the above equation, we get

$$CASH_{i,t} = \left(1-\lambda_0\right)CASH_{i,t-1} + \left(-\lambda_j\right)Z_j CASH_{i,t-1} + \lambda_0 \sum_k \beta_k x_{k,i,t} + \lambda_j Z_j \sum_k \beta_k x_{k,i,t} + \delta_{i,t} \tag{15}$$

which can be simplified to:

$$CASH_{i,t} = \gamma_0 CASH_{i,t-1} + \gamma_j Z_j CASH_{i,t-1} + \sum_k \gamma_k x_{k,i,t} + \sum_k \gamma_j x_{k,i,t} + \delta_{i,t} \tag{16}$$

where, $\gamma_0 = 1 - \lambda_0$, $\gamma_j = -\lambda_j$, $\gamma_k = \lambda_0\beta_{k.}$, $\gamma_j = \lambda_j Z_j \beta_k$. The most important are the estimated values of $\lambda_0 = 1 - \gamma_0$ and $\lambda_j = -\gamma_j$.

However, we mentioned in section 3.3.2 that in dynamic panel model a problem arises from the lagged dependent variables $CASH_{i,t-1}$. Therefore, we use the two-stage least square (2SLS) regression to solve this problem by use the same method in equation (8) to (9) to get $CASH_{i,t-1}$ for equation (16) as the following.

Similar to the section 3.3.2, $CASH_{i,t-1}$ is regressed first on the instrument variable $CASH_{i,t-2}$ and the explanatory variables $x_{k,i,t}$.

$$CASH_{i,t-1} = \rho CASH_{i,t-2} + \sum_k \prod_k x_{ki,t-1} + \varepsilon_{i,t-1} \qquad (17)$$

The fitted value of $CASH_{i,t-1}$ is obtained from equation (17).

$$\hat{CASH}_{i,t-1} = \hat{\rho} CASH_{i,t-2} + \sum_k \hat{\prod}_k x_{k,i,t-1} \qquad (18)$$

where, $\hat{CASH}_{i,t-1}$ is the fitted value of $CASH_{i,t-1}$.

Therefore the equation (16) can be written as

$$CASH_{i,t} = \gamma_0 \hat{CASH}_{i,t-1} + \gamma_j Z_j \hat{CASH}_{i,t-1} + \sum_k \gamma_k x_{k,i,t} + \sum_k \gamma_j x_{k,i,t} + \delta_{i,t} \qquad (19)$$

Finally the speed of adjustment towards the target cash ratio can be examined by running the regression on equation (19).

The important estimated values are $\lambda_0$ and $\lambda_j$. $\lambda_0$ indicates the average speed of adjustment towards the target cash ratio of all firms while $\lambda_j$ reflects the speed of adjustment towards the target cash ratio that varied with the speed of adjustment factors Z (firm size, debt capacity, relative leverage, relative cash and fixed assets). To get $\lambda_j$, we set the dummy variables in the equation in order to separate the sample according to firm's characteristics (denoted as Z). For firm size, debt capacity, and fixed assets, we set $Z_1 = 1$ if these factors are in quartile1, and 0 otherwise and $Z_2 = 1$

if these factors are in quartile 4, and 0 otherwise. Moreover, for relative leverage and relative cash, we set $Z_1 = 1$ if these factors are over the target level, and 0 otherwise.

After we run equation (19), we can interpret the speed of adjustment towards the target cash ratio as the following:

- The speed of adjustment towards the target cash ratio for firms that their firm size or debt capacity or fixed assets are in quartile 1 is equal to $\lambda_0 + \lambda_{\text{Quartile 1}}$ and the speed of adjustment towards the target cash ratio for firms that their firm size or debt capacity or fixed assets are in quartile 4 is equal to $\lambda_0 + \lambda_{\text{Quartile 4}}$ (noted that $\lambda_0 = 1 - \gamma_0$ and $\lambda_{\text{Quartile 1}}$ or $\lambda_{\text{Quartile 4}} = -\gamma_j$).

- In case of relative leverage and relative cash, we can interpret that $\lambda_0$ is the speed of adjustment towards the target cash ratio for firms with leverage or cash under the target level while the speed of adjustment towards the target cash ratio for firms with leverage or cash over the target level is $\lambda_0 + \lambda_{\text{over target level}}$ ($\lambda_{\text{over target level}} = -\gamma_j$).

# CHAPTER IV

# RESULTS

## 4.1 Descriptive statistics

Table 2 presents descriptive statistics for the main variables used in our analysis. This table reports descriptive statistics for two sample periods. Panel A shows descriptive statistics over the period 1993-2007 (whole period). Panel B presents descriptive statistics during 1998-2007 (after crisis).

For whole period (1993-2007), the average cash holding of Thai firms is 11.17% of net assets (CASH) and 8.4% of total assets (CASH2). The mean of their leverage is 33.58% and most of their debt is short-term, with their long-term debt making up 37.09%. In addition, it seems that during the period of after crisis, these values are in line with the reported for the whole period.

For after crisis, Thai firms hold on average 11.35% of net assets (CASH) and 8.61% of total assets (CASH2) in cash. The mean of their leverage is 31.32% and long-term debt is about 38.29%.

Figure 1 shows the mean cash ratio of Thai firms over the sample period from 1993 to 2007. Panel A shows the mean cash ratio (CASH) and Panel B shows the mean cash ratio (CASH2).

Table 3 reports the correlation coefficients of the variables. There are no problems of correlation between the explanatory variables which could bias our results.

## 4.2 Determinants of corporate cash holdings results

We study the determinants of cash holdings using a regression of cash holdings on the explanatory variables described in section 3, where CASH is the

dependent variable. In this paper, we use three different regression methodologies. First, we use the Fama-Macbeth methodology: we run cross-sectional regression each year and use the time series of regression coefficients to make our inferences. Second, we run pool regression. Finally, we run a fixed-effect regression in order to control the unobserved firm heterogeneity problem. In this study, we examine the determinants of cash holdings in two sample periods. The regression results are presented in table 4. Panel A and B show the results in whole period and after crisis, respectively.

The first column in panel A of table 4 reports the estimation of determinants of corporate cash holdings using the method of Fama-Macbeth model. With this approach, a cross-sectional regression is estimated each year and we use the time series of regression coefficients to make our inferences. The results show that cash holdings increase significantly with market-to-book ratio, debt maturity structure and dividend's payment. The market-to-book ratio coefficient is positive and significant at the 1% level while debt maturity structure and dividend's payment coefficient are positive and significant at the 5% level. Moreover, cash holdings decrease significantly with liquid assets substitutes and leverage. Liquid assets substitutes and leverage are negatively related to cash holdings and significant at the 1% level. However, we find that the coefficients obtained for firm size and cash flow are positively related to cash holdings but not significant. The adjusted R-squared from this regression is 0.198 which similar to the results from previous study from Opler et al. (1999).

Our regression result shows a positive relation between growth opportunities (proxied by the market-to-book ratio) and cash holdings. This result consistent with trade-off and pecking order theories which support the view that firms with higher

levels of growth opportunities prefer to hold more cash to avoid situations in which they give up profitable investment opportunities because they are short of cash. This finding coincides with that found in previous studies (Kim et al.,1998; Opler et al.,1999; Ozkan and Ozkan, 2004; Ferreira and Vilela, 2004).

We also provide strong evidence that the coefficient of dividend's payment is positive and significant. This finding is similar to the result that found in Ozkan and Ozkan (2004), Drobetz and Gruninger (2006) and the result is consistent with the trade-off theory which view that dividend payers are particularly reluctant to omit dividends. Therefore, firms will hold large amounts of cash.

Moreover, we find that there is strong support for the negative relationship between leverage and cash holdings, as previously shown by Opler et al.,(1999), Ozkan and Ozkan(2004), Ferreira and Vilela (2004). This result can possibly explain by pecking order theory more than the trade-off theory because the trade-off model is not clear about the predicted sign for the relationship between cash holdings and leverage. According to the pecking order theory, cash holdings fall when investments exceed retained earnings and debt grows when investments exceed retained earnings. This suggests a negative relation between leverage and cash holdings. Furthermore, the result shows that the effect of liquidity asset substitutes on cash holdings is negative and significant. This result supports the trade-off theory which indicates that firms can use their non-cash liquid assets as substitute to cash holdings.

However, we find that the coefficients obtained for firm size and cash flow are positively related to cash holdings but insignificant, which contradicts the trade-off theory argument but consistent with the pecking order theory. The pecking order theory postulates that larger firms have high level of operational cash flow and firms will increase their cash holdings due to the presence of asymmetric information

problem. Moreover, the positive relation between cash flow and cash holdings coincides with the previous results (Opler et al., 1999; Ozkan and Ozkan, 2004; Ferreira and Vilela, 2004). This finding consistent with the view that when operational cash flow are high, firms use them to finance new profitable projects, to repay debts, to pay dividends and finally to accumulate cash.

In this paper, we present two additional regression estimates in table 4 which are pool regression and fixed-effect regression. These two regressions lead to the same results as the Fama-Macbeth regression, but the fixed-effect regression has higher adjusted-R squared at 0.488.

In summary, the results from all three methodologies for the whole period report that cash holdings increase significantly with market-to-book ratio and debt maturity structure and cash holdings decrease significantly with liquid assets substitutes and leverage. We also find that cash holdings increase significantly with dividend's payment in the Fama-Macbeth and Pool regression. However, the coefficients obtained for firm size and cash flow are not significant across all methodologies.

Furthermore, we can not conclude that our coefficient estimates consistent with only the trade-off theory or pecking order theory because our results are mixed. The coefficient of market-to-book ratio is support the trade-off theory as well as with the pecking order theory. The coefficients of liquidity assets substitutes and dividend's payment are consistent with the trade-off theory while the coefficients of firm size, cash flow, and leverage are consistent with the pecking order theory.

When we estimate our regression in the period of after crisis which reported in panel B, we find that the results from the regressions lead to the same conclusions as the whole period but the results have higher adjusted R-squared in all three

methodologies. During after crisis, we still find strong evidence that the coefficients of market-to-book ratio, debt maturity structure and dividend's payment are positive and significant and the coefficients of liquidity asset substitutes and leverage are negative and significant. However, we find some different result in the coefficient of firm size. The results after crisis show that firm size coefficient is negative but insignificant in Fama-Macbeth and pool regression. This finding support the trade-off theory which suggests that larger firms hold lower cash because they have better excess to external financing and less likely to experience to financial distress.

### 4.3 Speed of adjustment towards the target cash ratio results

In table 5, we report the results obtained for the estimation of speed of adjustment towards the target cash ratio. In this paper, we estimate speed of adjustment in two sample periods. Column (1) shows the result for the whole period (1993-2007) and Column (2) shows the results during after crisis. All the estimations have been carried out using the two-stage least squares estimator.

In column (1), the result shows that the coefficient of the lagged cash holdings CASH(t-1) is positive and significant at the 1% level with adjusted R-squared at 0.515. The speed of adjustment coefficient for Thai firms, $\lambda = 1-\gamma_0$, is -0.0667. From this result, we will additional test whether $\gamma_0$ (1.0667) is significantly different from 1 by Wald test. The objective for this test is to confirm that the speed of adjustment coefficient ($\lambda = 1-\gamma_0$) is significantly negative at the rate of -0.0667. The Wald test result is presented in table 6 and panel A of table 6 shows Wald test result for the whole period. The result indicates that $\gamma_0$ (1.0667) is significantly different from 1 at the 1% level. Therefore, we can conclude that the speed of adjustment coefficient ($\lambda = 1-\gamma_0$) is significantly negative at the rate of -0.0667. This means that Thai firms do not

adjust their cash holdings to the target cash ratio but their cash holdings trend to diverge from the target cash level. This finding provides the evidence that the dynamic nature of our model is rejected and do not support the view that firms trade-off between costs of adjustment towards the target cash ratio and costs of being off the target. In addition, our result is inconsistent with the previous empirical studies on speed of adjustment towards the target cash ratio which confirm the adjustment towards the target cash ratio of firms for example, Ozkan and Ozkan (2004) report the adjustment coefficient of 0.6 for U.K firms suggesting that U.K firms adjust their cash holdings relative quickly in an attempt to reach the target cash level. Moreover, Guney et al. (2003) confirm this result for a sample of firms from U.K. and also reveal that Japanese and German firms have lower speed of adjustment than U.K. firms at adjustment coefficient of 0.5.

When we estimate speed of adjustment towards the target cash ratio in the period of after crisis in column (2), we find that the conclusion for the result of after crisis is the same as the result for the whole period. The coefficient of the lagged cash holdings CASH(t-1) is positive and significant at the 1% level with adjusted R-squared at 0.518. The speed of adjustment coefficient, $\lambda = 1-\gamma_0$, is -0.1033 and the Wald test in panel B of table 6 also shows that $\gamma_0$ (1.1033) is significantly different from 1 at the 1% level. This confirm that the speed of adjustment coefficient ($\lambda = 1-\gamma_0$) is significantly negative at the rate of -0.1033. Therefore, the result of after crisis confirm the finding that Thai firms do not adjust their cash holdings to the target cash ratio but their cash holdings trend to diverge from the target cash level.

In summary, our results indicate that cash holdings of Thai firms trend to diverge from the target cash level and do not support the view that firms trade-off

between costs of adjustment towards the target cash ratio and costs of being off the target.

### 4.4 Determinants of speed adjustment towards the target cash ratio results

Table 7 and 8 present the results of the determinants of speed adjustment towards the target cash ratio. The main factors that we study the impact to speed of adjustment are firm size, debt capacity, relative leverage, relative cash, and fixed assets. Firms are categorized as high or low in terms of firm size, debt capacity, and fixed assets based on whether they are in the top ($Q_4$) or bottom ($Q_1$) quartile. Leverage and cash ratio are classified into two groups which are over or under the target level. In each factor, we investigate the determinants of speed to target cash level in two sample periods which are the result for the whole period (1993-2007) and the result during after crisis (1998-2007). All the estimations have been carried out using the two-stage least squares estimator.

Based on the theory of capital structure adjustment speed of Flannery and Hankins (2007), the main idea is that higher external financing costs are expected to slow the rate of adjustment. Because of external financing costs fluctuate with asymmetric information and firm's ability to access the capital markets. In this paper, we use firm size as the proxy for information asymmetry and debt capacity to evaluate access to the capital markets.

Column (1) in table 7 shows the impact of firm size to the speed of adjustment towards the target cash ratio. The result indicates that for the whole period the coefficient of the lagged cash holdings CASH(t-1) is positive and significant at the 1% level with adjusted R-squared at 0.527 and the average of speed adjustment coefficient for Thai firms is -0.0195 ($\lambda_0$ = 1-1.0195). However, the speed adjustment coefficients for small and large firms are negative. We find that the speed of

adjustment coefficient for small firms is -0.0779 ($\lambda_0 + \lambda_{Quartile\ 1}$) and speed of adjustment coefficient for large firms is -0.3383 ($\lambda_0 + \lambda_{Quartile\ 4}$). These results mean that both of small and large firms do not adjust their cash holdings to the target cash ratio but their cash holdings trend to diverge from the target cash level. Our findings do not support the hypothesis that larger firms have lower information asymmetry which would imply a lower cost of financing and have faster speed of adjustment towards the target cash ratio. Furthermore, when we consider the impact of firm size during after crisis, we find that the result during after crisis is similar to the result for the whole period. For during after crisis, we still find that the speed adjustment coefficients for both firms are negative at the rate of -0.2464 ($\lambda_0 + \lambda_{Quartile\ 1}$) and -0.2798 ($\lambda_0 + \lambda_{Quartile\ 4}$) which confirm that small and large firms do not adjust their cash to the target level.

Column (2) in table 7 shows the impact of debt capacity to the speed of adjustment towards the target cash ratio. The result shows that for the whole period the coefficient of the lagged cash holdings CASH(t-1) is positive and significant at the 1% level with adjusted R-squared at 0.560 and the average of speed adjustment coefficient for Thai firms is 0.1605 ($\lambda_0$ = 1-0.8395). However, we find that the speed adjustment coefficients for firms with low debt capacity and firms with high debt capacity are negative. The speed of adjustment coefficient for firms with high debt capacity is -0.01 ($\lambda_0 + \lambda_{Quartile\ 1}$) and speed of adjustment coefficient for firms with low debt capacity is -0.2320 ($\lambda_0 + \lambda_{Quartile\ 4}$). These results mean that both of firms with low debt capacity and firms with high debt capacity do not adjust their cash holdings to the target cash ratio but their cash holdings trend to diverge from the target cash level. Furthermore, we also find the same results as the whole period in during after crisis. The result during after crisis shows that the speed adjustment coefficients for

both firms are negative at the rate of -0.1641 ($\lambda_0 + \lambda_{Quartile\ 1}$) and -0.1902 ($\lambda_0 + \lambda_{Quartile\ 4}$) which confirm the result for the whole period. However, these findings are not consistent with the conclusion of Leary and Roberts (2005) which suggest that firms with low debt capacity have limited potential for distress and less need for rapid adjustment.

Column (3) in table 7, and column (1) and (2) in table 8 present the impacts of financial distress costs to adjustment process. The main idea is that faster adjustment is predicted for firms with a higher probability of distress. To capture costs of distress, we use relative leverage, relative cash and fixed assets as proxies.

Column (3) in table 7 shows the impact of fixed assets to the speed of adjustment towards the target cash ratio. The result indicates that for the whole period the coefficient of the lagged cash holdings CASH(t-1) is positive and significant at the 1% level with adjusted R-squared at 0.589. We find that firms with high fixed assets adjust their cash holdings to the target cash ratio while firms with low fixed assets do not adjust their cash holdings to the target cash ratio but the cash holdings trend to diverge from the target cash level. The speed of adjustment coefficient for firms with high fixed assets is 0.5173 ($\lambda_0 + \lambda_{Quartile\ 4}$) and speed of adjustment coefficient for firms with low fixed assets is -0.0831 ($\lambda_0 + \lambda_{Quartile\ 1}$). Furthermore, we find the same results as the whole period in during after crisis. The result after crisis shows that the speed adjustment coefficients for both firms are 0.4942 ($\lambda_0 + \lambda_{Quartile\ 4}$) and -0.02 ($\lambda_0 + \lambda_{Quartile\ 1}$). All these results do not support the conclusion that firms with higher fixed assets have slower speed of adjustment than firms with lower fixed assets.

Column (1) in table 8 shows the impact of relative leverage to the speed of adjustment towards the target cash ratio. The result shows that for the whole period the coefficient of the lagged cash holdings CASH(t-1) is positive and significant at the

1% level with adjusted R-squared at 0.524. We find that underleveraged firms adjust their cash holdings to the target cash ratio at the speed of 0.0463 ($\lambda_0$ = 1-0.9537) while overleveraged firms do not adjust their cash holdings to the target cash ratio but their cash holdings trend to diverge from the target cash level. The speed of adjustment coefficient for overleveraged firms is -0.1629 ($\lambda_0 + \lambda_{\text{over target level}}$). In addition, the conclusion of the result for during after crisis is the same as the result for the whole period. The speed of adjustment coefficient for underleveraged firms is 0.0193 ($\lambda_0$) and speed of adjustment coefficient for overleveraged firms is -0.2202 ($\lambda_0 + \lambda_{\text{over target level}}$). All these results do not support the conclusion that overleveraged firms have higher speed of adjustment than underleveraged firms because of the costs of financial distress for overleveraged firms are higher.

Column (2) in table 8 shows the impact of relative cash to the speed of adjustment towards the target cash ratio. The result reveals that for the whole period the coefficient of the lagged cash holdings CASH(t-1) is positive and significant at the 1% level with adjusted R-squared at 0.655. We find that firms with cash under target level have faster speed adjustment towards the target cash ratio than firms with cash over target level. The speed of adjustment coefficient for firms with cash under target level is 0.6992 ($\lambda_0$ = 1-0.3008) and speed of adjustment coefficient for firms with cash over target level is 0.1969 ($\lambda_0 + \lambda_{\text{over target level}}$). We also find that the conclusion of the results during after crisis is the same as the result for the whole period. The result during after crisis shows that the speed adjustment coefficients for both firms are positive at the rate of 0.6609 ($\lambda_0$) and 0.2242 ($\lambda_0 + \lambda_{\text{over target level}}$). The important is that these findings are consistent with the view that firms with cash under target level are expected to have faster speed of adjustment than firms with cash over target because they are more likely to distress.

In conclusion, the results demonstrate that all determinants (firm size, debt capacity, relative leverage, relative cash, and fixed assets) affect to the speed of adjustment towards the target cash ratio. Although most of the results indicate that firms do not adjust their cash holdings to the target cash ratio but the cash holdings trend to diverge from the target cash level, the speed of adjustment are different due to firm's characteristics. We find that the speed of adjustment towards the target cash ratio are different between firms that their characteristics in quartile 1 and quartile 4 (firm size, debt capacity, and fixed assets). Furthermore, the results also indicate the speed adjustment towards the target cash ratio of firms that their leverage or cash ratio under target level differ from firms that their leverage or cash ratio over target level. The important is that these findings support the main idea that speed of adjustment towards the target cash ratio depends on the costs of deviating from the target and the costs of adjusting toward the target. However, most of our results do not support the hypothesis which can be explained by the theory of capital structure adjustment speed (Flannery and Hankins, 2007). One of our results consistent with the adjustment speed theory indicates that firms with cash under target level have faster speed of adjustment towards the target cash ratio than firms with cash over target because they are more likely to distress.

### 4.5 Robustness checks

To test the robustness of our results, we use alternative proxies for cash ratio. We follow Kim et al. (1998) by defined cash ratio as cash and cash equivalents to total assets (CASH2) as the dependent variable. Table 9-12 contains the estimation results. The results obtained from table 9 are mainly consistent with the earlier results from table 4. We find that cash holdings increase significantly with market-to-book

ratio, debt maturity structure and dividend's payment. Cash holdings decrease significantly with liquid assets substitutes and leverage.

The results in table 10 reports that the speed of adjustment coefficients from two sample periods are negative and significant at the 1% level. These results confirm our previous findings that cash holdings of Thai firms trend to diverge from the target cash level and firms do not adjust their cash holdings to the target cash ratio.

Furthermore, our findings from table 11 and 12 show similar conclusions as the results from table 7 and 8. We find that firm size, debt capacity, relative leverage, relative cash, and fixed assets affect to the speed of adjustment towards the target cash ratio. Although the results reveal that cash holdings of firms trend to diverge from the target cash ratio and firms do not adjust their cash holdings to the target cash level, the speed of adjustment are different due to firm's characteristics.

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# CHAPTER V

# CONCLUSION AND RECOMMENDATION

## 5.1 Conclusion

We examine the holdings of cash of Thai non-financial firms during the period 1993 to 2007. First, we investigate the determinants of corporate cash holdings. The results show the significant influences from firm-specific variables on cash holdings. In this paper, we find that firm's growth opportunity, debt maturity structure, and dividend's payment are positively related to cash holdings. While liquid assets substitutes and leverage are negatively related to cash holdings. However, we can not observe the significant relationship of firm size and cash flow to cash holdings. Most of these findings support several hypotheses which derived from both the trade-off and pecking order theories. We find that the coefficient of market-to-book ratio is support the trade-off theory as well as with the pecking order theory. The coefficients of liquidity assets substitutes and dividend's payment are consistent with the trade-off theory while the coefficients of firm size, cash flow, and leverage are consistent with the pecking order theory.

Second, we analyze speed of adjustment towards the target cash ratio of Thai firms by two-stage least square estimator. The results show that the estimated adjustment coefficients from dynamic panel models are negative, indicating that Thai firms do not adjust their cash holdings to the target cash ratio and their cash holdings trend to diverge from the target level. This result provides the evidence that the dynamic nature of our model is rejected and do not support the view that firms trade-off between costs of adjustment towards the target cash ratio and costs of being off the target.

Finally, we focus on the determinants of speed adjustment towards the target cash ratio. In this paper, we examine the impact of firm's external financing costs and financial distress costs to the speed of adjustment. This study tries to investigate that whether firm size, debt capacity, relative leverage, relative cash, and fixed assets affect to the speed of adjustment towards the target cash ratio by categorized the sample in the top or bottom quartile, or group in over or under the target level. The results indicate that firm size, debt capacity, relative leverage, relative cash, and fixed assets) affect to speed of adjustment towards the target cash ratio. We find that firms that their characteristics in top or bottom quartile (firm size, debt capacity, and fixed assets) and firms that their leverage or cash under target or over target level have difference speed of adjustment. We find that firms do not adjust their cash holdings to the target cash ratio but the cash holdings trend to diverge from the target cash level with difference speed and most of our results are not support the hypothesis which can be explained by the theory of capital structure adjustment speed (Flannery and Hankins, 2007). However, one of our results consistent with the adjustment speed theory. Our result indicates that firms with cash under target level have faster speed of adjustment toward the target cash ratio than firms with cash over target because they are more likely to distress. Although we do not observe the adjustment towards the target cash ratio (the speed of adjustment coefficients are negative), the important finding is that the speeds of adjustment to diverge from the target cash level are difference between firms that their characteristics in top or bottom quartile/ firms that their leverage or cash under target or over target level. These findings support the view that speed of adjustment towards the target cash ratio depends on the costs of deviating from the target and the costs of adjusting toward the target.

## 5.2 Recommendation

Due to the conclusions of the determinants of corporate cash holdings and the speed of adjustment towards the target cash ratio seem to demonstrate that there is weak evidence of the trade-off theory to explain corporate cash holdings of Thai firms. As shown in this paper, we find that Thai firms do not adjust their cash holdings to the target cash ratio. Therefore, future research of corporate cash holdings will be benefit to try to investigate whether Thai corporate cash holdings decision can explained and supported by the pecking order theory instead of the trade-off theory.

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# APPENDIX

**Table 1Summary of model predictions for determinants of corporate cash holdings**

| Variables | Trade-off Theory | Pecking order theory |
|---|---|---|
| Growth Opportunity | + | + |
| Firm size | - | + |
| Cash flow | - | + |
| Liquid assets substitutes | - | |
| Dividend Payments | ? | |
| Leverage | ? | - |
| Debt maturity structure | - | |

**Table 2 Descriptive Statistics**

This table shows the sample characteristics for 426 firms over the period from 1993 to 2007. Panel A shows data description over the period 1993 to 2007 (whole period). Panel B shows data description during the period after crisis (1998-2007). CASH is the ratio of cash and cash equivalents to net assets. CASH2 is the ratio of cash and cash equivalents to total assets. MB is measured as the book value of total assets minus the book value of equity plus the market value of equity to book value of assets. SIZ is defined as the natural logarithm of total assets. CF is the ratio of operating cash flow to total assets. LIQ is the ratio of current assets minus current liabilities and total cash to total assets. LEV is the ratio of total debt to total assets. DBT is the ratio of long-term debt to total debt. DIVYIELD is the ratio of dividend to the stock price.

**Panel A :Period 1993 to 2007 (Whole period)**

| | CASH | CASH2 | MB | SIZ | CF | LIQ | LEV | DBT | DIVYIELD |
|---|---|---|---|---|---|---|---|---|---|
| Mean | 0.1117 | 0.0840 | 1.2063 | 15.0255 | 0.0977 | 0.0011 | 0.3358 | 0.3709 | 3.7068 |
| Median | 0.0479 | 0.0457 | 1.0236 | 14.8408 | 0.0760 | -0.0082 | 0.3314 | 0.3290 | 2.6200 |
| Maximum | 3.5534 | 0.7804 | 18.1558 | 20.6082 | 39.7511 | 0.8639 | 0.9969 | 1.0000 | 62.5000 |
| Minimum | 0.0000 | 0.0000 | 0.1912 | 10.6065 | -0.4862 | -1.2797 | 0.0000 | 0.0000 | 0.0000 |
| Std. Dev. | 0.1952 | 0.1012 | 0.8243 | 1.3635 | 0.8720 | 0.2295 | 0.2250 | 0.3271 | 4.7406 |
| N | 3087 | 3087 | 3087 | 3087 | 3087 | 3087 | 3087 | 3087 | 3087 |

**Panel B : Period 1998 to 2007 (After crisis)**

| | CASH | CASH2 | MB | SIZ | CF | LIQ | LEV | DBT | DIVYIELD |
|---|---|---|---|---|---|---|---|---|---|
| Mean | 0.1135 | 0.0861 | 1.1312 | 15.0316 | 0.1092 | 0.0162 | 0.3132 | 0.3829 | 3.4722 |
| Median | 0.0518 | 0.0492 | 0.9941 | 14.8386 | 0.0811 | 0.0013 | 0.3014 | 0.3523 | 2.2700 |
| Maximum | 3.5534 | 0.7804 | 16.3664 | 20.6082 | 39.7511 | 0.8639 | 0.9956 | 1.0000 | 57.7200 |
| Minimum | 0.0000 | 0.0000 | 0.1912 | 10.6065 | -0.4862 | -1.2797 | 0.0000 | 0.0000 | 0.0000 |
| Std. Dev. | 0.1922 | 0.1000 | 0.6857 | 1.3822 | 0.9859 | 0.2317 | 0.2228 | 0.3344 | 4.6961 |
| N | 2403 | 2403 | 2403 | 2403 | 2403 | 2403 | 2403 | 2403 | 2403 |

**Table 3 Correlation Matrix**

This table reports Pearson's correlation coefficients calculated with the values of the sample of 426 Thai non-financial firms over the period from 1993 to 2007. CASH is the ratio of cash and cash equivalents to net assets. CASH2 is the ratio of cash and cash equivalents to total assets. MB is measured as the book value of total assets minus the book value of equity plus the market value of equity to book value of assets. SIZ is defined as the natural logarithm of total assets. CF is the ratio of operating cash flow to total assets. LIQ is the ratio of current assets minus current liabilities and total cash to total assets. LEV is the ratio of total debt to total assets. DBT is the ratio of long-term debt to total debt. DIVYIELD is the ratio of dividend to the stock price.

| | CASH2 | CASH | MB | SIZ | CF | LIQ | LEV | DBT | DIVYIELD |
|---|---|---|---|---|---|---|---|---|---|
| CASH2 | 1.0000 | | | | | | | | |
| CASH | 0.9223 | 1.0000 | | | | | | | |
| MB | 0.1636 | 0.1578 | 1.0000 | | | | | | |
| SIZ | -0.0296 | -0.0417 | 0.1570 | 1.0000 | | | | | |
| CF | 0.0420 | 0.0301 | -0.0006 | -0.0169 | 1.0000 | | | | |
| LIQ | -0.0121 | -0.0409 | -0.0975 | -0.1796 | -0.0017 | 1.0000 | | | |
| LEV | -0.3745 | -0.2904 | -0.0259 | 0.2827 | -0.0460 | -0.4245 | 1.0000 | | |
| DBT | -0.0975 | -0.0981 | 0.0300 | 0.3825 | 0.0288 | 0.0398 | 0.3174 | 1.0000 | |
| DIVYIELD | 0.0896 | 0.0994 | -0.0240 | -0.0491 | 0.0151 | 0.2322 | -0.2829 | -0.1676 | 1.0000 |

**Table 4 Panel regression results**

The dependent variable in all regressions is CASH, which is calculated as cash and cash equivalents divided by net assets. Panel A shows results in period 1993 to 2007 (whole period). Panel B shows results in the period of after crisis (1998-2007). MB is measured as the book value of total assets minus the book value of equity plus the market value of equity to book value of assets. SIZ is defined as the natural logarithm of total assets. CF is the ratio of operating cash flow to total assets. LIQ is the ratio of current assets minus current liabilities and total cash to total assets. LEV is the ratio of total debt to total assets. DBT is the ratio of long-term debt to total debt. DIVYIELD is the ratio of dividend to the stock price. The Fama-Macbeth model gives the average of the time series of coefficients from annual cross-sectional regressions. ***, ** and * indicate significance at the 1 percent, 5 percent, and 10 percent level, respectively.

| **Dependent Variable : CASH** | | | |
|---|---|---|---|
| | | | |
| **Panel A : Period 1993 to 2007 (Whole period)** | | | |
| **Independent Variable** | **Fama-Macbeth model** | **Pool regression** | **Fixed-effects regression** |
| **Intercept** | 0.0526 | 0.1025 | 0.0178 |
| | (0.79) | (2.63) | (0.15) |
| **MB** | 0.0609*** | 0.0427*** | 0.0243*** |
| | (3.94) | (10.6) | (6.03) |
| **SIZ** | 0.0032 | 0.0023 | 0.0078 |
| | (0.81) | (0.86) | (1.02) |
| **CF** | 0.0608 | 0.0034 | 0.0005 |
| | (0.95) | (0.89) | (0.15) |
| **LIQ** | -0.1355*** | -0.1579*** | -0.2662*** |
| | (-5.94) | (-9.44) | (-10.62) |
| **LEV** | -0.2866*** | -0.2948*** | -0.2674*** |
| | (-9.75) | (-16.53) | (-11.1) |
| **DBT** | 0.0644** | 0.0329*** | 0.0967*** |
| | (2.56) | (2.82) | (6.84) |
| **DIVYIELD** | 0.0029** | 0.0025*** | 0.0003 |
| | (1.78) | (3.44) | (0.46) |
| **N** | 15 | 3087 | 3087 |
| **Adjusted R-squared** | 0.198 | 0.13 | 0.488 |

| Panel B : Period 1998 to 2007 (After crisis) | | | |
|---|---|---|---|
| **Independent Variable** | **Fama-Macbeth model** | **Pool regression** | **Fixed-effects regression** |
| **Intercept** | 0.1527 | 0.1667 | 0.0366 |
| | (3.33) | (3.91) | (0.28) |
| **MB** | 0.0738*** | 0.0365*** | 0.0082 |
| | (3.33) | (6.71) | (1.55) |
| **SIZ** | -0.0015 | -0.0005 | 0.0096 |
| | (-0.55) | (-0.16) | (1.11) |
| **CF** | 0.0103 | 0.0022 | -0.0007 |
| | (0.37) | (0.6) | (-0.23) |
| **LIQ** | -0.1382*** | -0.1629*** | -0.2006*** |
| | (-6.29) | (-8.9) | (-7.13) |
| **LEV** | -0.3290*** | -0.3145*** | -0.2705*** |
| | (-11.27) | (-15.73) | (-9.8) |
| **DBT** | 0.0266** | 0.0177 | 0.0379** |
| | (2.66) | (1.4) | (2.45) |
| **DIVYIELD** | 0.0011 | 0.002** | -0.001 |
| | (0.55) | (2.47) | (-1.35) |
| **N** | 10 | 2403 | 2403 |
| **Adjusted R-squared** | 0.206 | 0.134 | 0.573 |

**Table 5 Dynamic panel data estimation results – Two-stage least squares estimations**
This table presents the results from two-stage least squares estimations. Column (1) shows the results over the period from 1993 to 2007 (whole period). Column (2) shows the results in the period of after the crisis (1998-2007). CASH is calculated as cash and cash equivalents divided by net assets. MB is measured as the book value of total assets minus the book value of equity plus the market value of equity to book value of assets. SIZ is defined as the natural logarithm of total assets. CF is the ratio of operating cash flow to total assets. LIQ is the ratio of current assets minus current liabilities and total cash to total assets. LEV is the ratio of total debt to total assets. DBT is the ratio of long-term debt to total debt. DIVYIELD is the ratio of dividend to the stock price. ***, ** and * indicate significance at the 1 percent, 5 percent, and 10 percent level, respectively.

| **Dependent Variable : CASH** | | |
|---|---|---|
| | **(1)** | **(2)** |
| **Independent Variable** | **Whole period** | **After crisis** |
| **CASH(t-1)** | 1.0667*** | 1.1033*** |
| | (46.13) | (40.69) |
| **MB** | -0.0214*** | -0.0118** |
| | (-5.03) | (-2.32) |
| **SIZ** | 0.001 | 0.0002 |
| | (0.49) | (0.09) |
| **CF** | -0.0019 | -0.0019 |
| | (-0.72) | (-0.73) |
| **LIQ** | 0.0065 | 0.0138 |
| | (0.51) | (1) |
| **LEV** | 0.0139 | 0.0128 |
| | (0.94) | (0.76) |
| **DBT** | 0.0013 | -0.0094 |
| | (0.15) | (-1.03) |
| **DIVYIELD** | -0.0002 | -0.0006 |
| | (-0.4) | (-1.06) |
| **C** | -0.0009 | 0.0025 |
| | (-0.03) | (0.08) |
| **N** | 2793 | 2292 |
| **Adjusted R-squared** | 0.515 | 0.518 |

**Table 6 Wald test results**
This table reports Wald test result. Panel A shows results in period 1993 to 2007 (whole period). Panel B shows results in the period of after crisis (1998-2007).

| **Wald Test:** | | | |
|---|---|---|---|
| **Panel A : Period 1993 to 2007 ( Whole period)** | | | |
| **Test Statistic** | **Value** | **df** | **Probability** |
| **F-statistic** | 8.324397 | (1, 2784) | 0.0039 |
| **Chi-square** | 8.324397 | 1 | 0.0039 |
| **Null Hypothesis Summary:** | | | |
| **Normalized Restriction (= 0)** | | **Value** | **Std. Err.** |
| **-1 + C(1)** | | 0.066724 | 0.023126 |
| **Panel B : Period 1998 to 2007 ( After crisis)** | | | |
| **Test Statistic** | **Value** | **df** | **Probability** |
| **F-statistic** | 14.52292 | (1, 2283) | 0.0001 |
| **Chi-square** | 14.52292 | 1 | 0.0001 |
| **Null Hypothesis Summary:** | | | |
| **Normalized Restriction (= 0)** | | **Value** | **Std. Err.** |
| **-1 + C(1)** | | 0.103338 | 0.027117 |

**Table 7 Result of determinants speed of adjustment towards the target cash ratio**

This table examines firms in the top and bottom quartile for firm size, debt capacity, fixed assets. The speed of adjustment is estimated with a two-stage least squares methodology. This table shows the results over the period from 1993 to 2007 (whole period) and the results in the period of after the crisis (1998-2007). CASH is calculated as cash and cash equivalents divided by net assets. MB is measured as the book value of total assets minus the book value of equity plus the market value of equity to book value of assets. SIZ is defined as the natural logarithm of total assets. CF is the ratio of operating cash flow to total assets. LIQ is the ratio of current assets minus current liabilities and total cash to total assets. LEV is the ratio of total debt to total assets. DBT is the ratio of long-term debt to total debt. DIVYIELD is the ratio of dividend to the stock price. ***, ** and * indicate significance at the 1 percent, 5 percent, and 10 percent level, respectively.

| | **Firm size** | | **Debt capacity** | | **Fixed assets** | |
|---|---|---|---|---|---|---|
| **Variables** | **Whole period** | **After crisis** | **Whole period** | **After crisis** | **Whole period** | **After crisis** |
| **CASH(t-1)** | 1.0195*** | 0.9427*** | 0.8395*** | 0.8523*** | 0.9355*** | 1.1065*** |
| | (32.62) | (25.74) | (23.65) | (21.97) | (27.28) | (26.05) |
| **$Z_1$CASH(t-1) ( Quartile 1)** | 0.0585 | 0.3036*** | 0.1705*** | 0.3118*** | 0.1476*** | -0.0865 |
| | (1.05) | (4.8) | (3.16) | (5.03) | (3.06) | (-1.53) |
| **$Z_2$CASH(t-1) (Quartile 4)** | 0.1594*** | 0.3371*** | 0.3924*** | 0.3379*** | -0.4528*** | -0.6007*** |
| | (2.6) | (4.53) | (6.79) | (4.76) | (-4.34) | (-5.32) |
| **MB** | -0.0205*** | -0.0148** | -0.016*** | -0.0159** | -0.0147*** | -0.0104 |
| | (-3.33) | (-2.01) | (-2.74) | (-2.31) | (-2.61) | (-1.54) |
| **$Z_1$MB** | -0.057*** | -0.0183 | -0.0223** | -0.0057 | -0.0087 | -0.0034 |
| | (-4.83) | (-1.19) | (-2.42) | (-0.52) | (-0.83) | (-0.28) |
| **$Z_2$MB** | 0.0205** | 0.0014 | 0.015 | 0.008 | -0.0004 | -0.0024 |
| | (2.06) | (0.12) | (1.17) | (0.52) | (-0.04) | (-0.2) |
| **SIZ** | -0.0022 | 0.0026 | 0.0007 | 0.0012 | 0.0012 | -0.001 |
| | (-0.53) | (0.58) | (0.34) | (0.51) | (0.58) | (-0.47) |
| **$Z_1$SIZ** | 0.0044*** | -0.0015 | 0.0081*** | 0.0049*** | 0.0038*** | 0.0073*** |
| | (2.98) | (-0.83) | (5.99) | (3.22) | (2.73) | (4.69) |
| **$Z_2$SIZ** | -0.0056*** | -0.0081*** | -0.0013 | -0.0011 | -0.0013 | 0.0003 |
| | (-3.97) | (-5.15) | (-0.66) | (-0.5) | (-0.89) | (0.21) |
| **CF** | -0.0021 | -0.002 | -0.0016 | -0.0012 | -0.0026 | -0.0033 |
| | (-0.67) | (-0.64) | (-0.52) | (-0.39) | (-1.1) | (-1.37) |
| **$Z_1$CF** | -0.0008 | -0.002 | -0.0017 | -0.0042 | 0.2311*** | 0.2332*** |
| | (-0.15) | (-0.36) | (-0.32) | (-0.77) | (6.06) | (5.76) |
| **$Z_2$CF** | 0.08 | 0.1764*** | 0.088** | 0.095** | 0.0342 | 0.0348 |
| | (1.53) | (3.04) | (2.16) | (2.08) | (0.65) | (0.62) |
| **LIQ** | 0.006 | 0.0002 | -0.0313 | -0.0273 | -0.0882*** | -0.0469* |
| | (0.36) | (0.01) | (-1.58) | (-1.26) | (-3.74) | (-1.84) |
| **$Z_1$LIQ** | -0.0503 | -0.0199 | -0.1496*** | -0.1358*** | -0.0984*** | -0.1639*** |
| | (-1.47) | (-0.52) | (-3.92) | (-3.08) | (-2.82) | (-4.36) |
| **$Z_2$LIQ** | 0.0159 | 0.0585* | -0.0262 | -0.0065 | 0.0743* | 0.0549 |
| | (0.52) | (1.75) | (-0.79) | (-0.18) | (1.65) | (1.12) |
| **LEV** | -0.0106 | -0.051** | -0.112*** | -0.1144*** | -0.0565*** | -0.0129 |
| | (-0.52) | (-2.2) | (-3.86) | (-3.49) | (-2.6) | (-0.51) |
| **$Z_1$LEV** | -0.0122 | 0.0585 | -1.2358*** | -1.2791*** | 0.0139 | -0.0788* |
| | (-0.3) | (1.26) | (-8.13) | (-5.72) | (0.37) | (-1.88) |
| **$Z_2$LEV** | 0.1423*** | 0.2203*** | 0.0563 | 0.0825 | 0.0565 | 0.0335 |
| | (4.04) | (5.46) | (1.07) | (1.42) | (1.32) | (0.71) |
| **DBT** | 0.0033 | -0.0077 | 0.0392*** | 0.0334*** | 0.0483*** | 0.0256* |
| | (0.28) | (-0.62) | (3.56) | (2.8) | (3.89) | (1.93) |

| | | | | | | |
|---|---|---|---|---|---|---|
| **$Z_1$DBT** | -0.0228 | -0.0291 | -0.0607*** | -0.0717*** | 0.0296 | 0.0533** |
| | (-1.08) | (-1.24) | (-2.77) | (-2.89) | (1.34) | (2.24) |
| **$Z_2$DBT** | -0.0021 | 0.0047 | 0.0341 | 0.0198 | -0.0185 | -0.0052 |
| | (-0.1) | (0.21) | (1.54) | (0.83) | (-0.76) | (-0.2) |
| **DIVYIELD** | 0 | -0.0008 | 0.0005 | 0.0002 | -0.0001 | -0.0003 |
| | (0.01) | (-0.96) | (0.65) | (0.26) | (-0.16) | (-0.39) |
| **$Z_1$DIVYIELD** | -0.0009 | 0 | -0.0045*** | -0.0037** | -0.0016 | -0.0022* |
| | (-0.68) | (0.01) | (-3.27) | (-2.39) | (-1.37) | (-1.78) |
| **$Z_2$ DIVYIELD** | 0.0005 | 0.0006 | -0.0003 | -0.0008 | 0.0008 | 0.0015 |
| | (0.31) | (0.34) | (-0.28) | (-0.54) | (0.55) | (0.86) |
| **Intercept** | 0.0554 | 0.0048 | 0.0244 | 0.016 | 0.009 | 0.0124 |
| | (0.92) | (0.07) | (0.87) | (0.52) | (0.33) | (0.42) |
| **N** | 2793 | 2292 | 2792 | 2291 | 2584 | 2174 |
| **Adjusted R-squared** | 0.527 | 0.531 | 0.56 | 0.559 | 0.589 | 0.592 |

**Table 8 Result of determinants speed of adjustment towards the target cash ratio**

This table examines firms with leverage and cash ratio over or under the target level. The speed of adjustment is estimated with a two-stage least squares methodology. This table shows the results over the period from 1993 to 2007 (whole period) and the results in the period of after the crisis (1998-2007). CASH is calculated as cash and cash equivalents divided by net assets. MB is measured as the book value of total assets minus the book value of equity plus the market value of equity to book value of assets. SIZ is defined as the natural logarithm of total assets. CF is the ratio of operating cash flow to total assets. LIQ is the ratio of current assets minus current liabilities and total cash to total assets. LEV is the ratio of total debt to total assets. DBT is the ratio of long-term debt to total debt. DIVYIELD is the ratio of dividend to the stock price. ***, ** and * indicate significance at the 1 percent, 5 percent, and 10 percent level, respectively.

| | Relative leverage | | Relative cash | |
|---|---|---|---|---|
| **Variables** | **Whole period** | **After crisis** | **Whole period** | **After crisis** |
| **CASH(t-1)** | 0.9537*** | 0.9807*** | 0.3008*** | 0.3391*** |
| | (28.56) | (26.1) | (5.49) | (5.11) |
| **ZCASH(t-1) ( over target )** | 0.2093*** | 0.2396*** | 0.5024*** | 0.4368*** |
| | (4.53) | (4.44) | (8.35) | (6.06) |
| **MB** | -0.0248*** | -0.0078 | 0.0007 | 0.0001 |
| | (-4.4) | (-1.18) | (0.15) | (0.01) |
| **ZMB** | 0.014 | -0.008 | -0.0026 | 0.0285*** |
| | (1.62) | (-0.78) | (-0.35) | (3.15) |
| **SIZ** | 0.0041** | 0.0027 | -0.0035** | -0.0038** |
| | (2) | (1.2) | (-2.01) | (-2.03) |
| **ZSIZ** | -0.0075*** | -0.007*** | 0.0118*** | 0.0113*** |
| | (-6.44) | (-5.17) | (11.3) | (9.52) |
| **CF** | -0.0018 | -0.0019 | 0.0001 | 0.0001 |
| | (-0.69) | (-0.73) | (0.02) | (0.03) |
| **ZCF** | 0.0607* | 0.1222*** | -0.0046 | -0.004 |
| | (1.82) | (3.22) | (-0.98) | (-0.85) |
| **LIQ** | -0.0225 | -0.0154 | -0.0201 | -0.0185 |
| | (-1.26) | (-0.82) | (-1.36) | (-1.14) |
| **ZLIQ** | 0.0662*** | 0.078*** | -0.1378*** | -0.1163*** |
| | (2.63) | (2.84) | (-6.13) | (-4.79) |
| **LEV** | -0.0746*** | -0.0838*** | -0.0617*** | -0.0572** |
| | (-3.11) | (-3.14) | (-3.04) | (-2.38) |
| **ZLEV** | 0.1731*** | 0.2133*** | -0.1798*** | -0.2113*** |
| | (5.22) | (5.6) | (-6.51) | (-6.6) |
| **DBT** | -0.0146 | -0.0219* | 0.0231*** | 0.0217** |
| | (-1.28) | (-1.82) | (2.66) | (2.32) |
| **ZDBT** | 0.032** | 0.0269 | -0.0157 | -0.0298* |
| | (1.97) | (1.51) | (-1.1) | (-1.92) |
| **DIVYIELD** | -0.0009 | -0.0009 | 0.0004 | 0.0006 |
| | (-1.21) | (-1.1) | (0.84) | (1.03) |
| **ZDIVYIELD** | 0.0013 | 0.0006 | -0.0029*** | -0.0053*** |
| | (1.21) | (0.47) | (-2.69) | (-4.31) |
| **Intercept** | 0 | 0.0043 | 0.079*** | 0.0809*** |
| | (0) | (0.14) | (3.28) | (3.08) |
| **N** | 2791 | 2292 | 2793 | 2292 |
| **Adjusted R-squared** | 0.524 | 0.528 | 0.655 | 0.662 |

**Table 9 Panel regression results (Robustness)**

The dependent variable in all regressions is CASH2, which is calculated as cash and cash equivalents divided by total assets. Panel A shows results in period 1993 to 2007 (whole period). Panel B shows results in the period of after crisis (1998-2007). MB is measured as the book value of total assets minus the book value of equity plus the market value of equity to book value of assets. SIZ is defined as the natural logarithm of total assets. CF is the ratio of operating cash flow to total assets. LIQ is the ratio of current assets minus current liabilities and total cash to total assets. LEV is the ratio of total debt to total assets. DBT is the ratio of long-term debt to total debt. DIVYIELD is the ratio of dividend to the stock price. The Fama-Macbeth model gives the average of the time series of coefficients from annual cross-sectional regressions. ***, ** and * indicate significance at the 1 percent, 5 percent, and 10 percent level, respectively.

| **Dependent Variable : CASH2** | | | |
|---|---|---|---|
| **Panel A : Period 1993 to 2007 (Whole period)** | | | |
| **Independent Variable** | **Fama-Macbeth model** | **Pool regression** | **Fixed-effects regression** |
| **Intercept** | 0.0457 | 0.0588 | 0.1092 |
| | (1.25) | (2.98) | (1.96) |
| **MB** | 0.0311*** | 0.019*** | 0.0091*** |
| | (4.31) | (9.35) | (4.69) |
| **SIZ** | 0.0028 | 0.0038*** | -0.0004 |
| | (1.14) | (2.74) | (-0.12) |
| **CF** | 0.0341 | 0.002 | 0.0002 |
| | (1.33) | (1.06) | (0.11) |
| **LIQ** | -0.0742*** | -0.0854*** | -0.1453*** |
| | (-6.89) | (-10.1) | (-11.99) |
| **LEV** | -0.191*** | -0.1984*** | -0.1555*** |
| | (-13.21) | (-22.01) | (-13.34) |
| **DBT** | 0.0431*** | 0.0246*** | 0.0592*** |
| | (2.8) | (4.17) | (8.66) |
| **DIVYIELD** | 0.0016** | 0.0008** | 0.0002 |
| | (2.02) | (2.16) | (0.67) |
| **N** | 15 | 3087 | 3087 |
| **Adjusted R-squared** | 0.219 | 0.173 | 0.554 |

| **Panel B : Period 1998 to 2007 (After crisis)** | | | |
|---|---|---|---|
| **Independent Variable** | **Fama-Macbeth model** | **Pool regression** | **Fixed-effects regression** |
| **Intercept** | 0.0846 | 0.0922 | 0.1366 |
| | (3.49) | (4.32) | (2.2) |
| **MB** | 0.0362*** | 0.0183*** | 0.004 |
| | (3.46) | (6.72) | (1.57) |
| **SIZ** | 0.0017 | 0.0023 | -0.001 |
| | (1.18) | (1.54) | (-0.24) |
| **CF** | 0.031* | 0.0019 | 0.0000207 |
| | (1.55) | (1.03) | (0.01) |
| **LIQ** | -0.0734*** | -0.0868*** | -0.1037*** |
| | (-9.16) | (-9.46) | (-7.69) |
| **LEV** | -0.218*** | -0.2136*** | -0.1439*** |
| | (-15.31) | (-21.3) | (-10.87) |
| **DBT** | 0.0167*** | 0.0142** | 0.0212*** |
| | (3.45) | (2.23) | (2.85) |
| **DIVYIELD** | 0.0002 | 0.0003 | -0.0003 |
| | (0.29) | (0.71) | (-1) |
| **N** | 10 | 2403 | 2403 |
| **Adjusted R-squared** | 0.237 | 0.195 | 0.637 |

**Table 10 Dynamic panel data estimation results – Two-stage least squares estimations (Robustness)**

This table presents the results from two-stage least squares estimations. Column (1) shows the results over the period from 1993 to 2007 (whole period). Column (2) shows the results in the period of after the crisis (1998-2007). CASH2 is calculated as cash and cash equivalents divided by total assets. MB is measured as the book value of total assets minus the book value of equity plus the market value of equity to book value of assets. SIZ is defined as the natural logarithm of total assets. CF is the ratio of operating cash flow to total assets. LIQ is the ratio of current assets minus current liabilities and total cash to total assets. LEV is the ratio of total debt to total assets. DBT is the ratio of long-term debt to total debt. DIVYIELD is the ratio of dividend to the stock price. ***, ** and * indicate significance at the 1 percent, 5 percent , and 10 percent level, respectively.

| **Dependent Variable : CASH2** | | |
|---|---|---|
| **Independent Variable** | **(1) Whole period** | **(2) After crisis** |
| **CASH2(t-1)** | 1.0319*** | 1.0432*** |
| | (54.9) | (48.08) |
| **MB** | -0.0051** | -0.0028 |
| | (-2.49) | (-1.13) |
| **SIZ** | -0.0001 | 0.0001 |
| | (-0.09) | (0.1) |
| **CF** | -0.0005 | -0.0005 |
| | (-0.38) | (-0.37) |
| **LIQ** | 0.001 | 0.0023 |
| | (0.17) | (0.34) |
| **LEV** | 0.0029 | -0.0001 |
| | (0.39) | (-0.01) |
| **DBT** | 0.0006 | -0.0055 |
| | (0.15) | (-1.21) |
| **DIVYIELD** | -0.0001 | -0.0003 |
| | (-0.26) | (-0.89) |
| **C** | 0.004 | 0.0018 |
| | (0.28) | (0.12) |
| **N** | 2793 | 2292 |
| **Adjusted R-squared** | 0.61 | 0.61 |

**Table 11 Result of determinants speed of adjustment towards the target cash ratio (Robustness)**

This table examines firms in the top and bottom quartile for firm size, debt capacity, fixed assets. The speed of adjustment is estimated with a two-stage least squares methodology. This table shows the results over the period from 1993 to 2007 (whole period) and the results in the period of after the crisis (1998-2007). CASH2 is calculated as cash and cash equivalents divided by total assets. MB is measured as the book value of total assets minus the book value of equity plus the market value of equity to book value of assets. SIZ is defined as the natural logarithm of total assets. CF is the ratio of operating cash flow to total assets. LIQ is the ratio of current assets minus current liabilities and total cash to total assets. LEV is the ratio of total debt to total assets. DBT is the ratio of long-term debt to total debt. DIVYIELD is the ratio of dividend to the stock price. ***, ** and * indicate significance at the 1 percent, 5 percent, and 10 percent level, respectively.

| | Firm size | | Debt capacity | | Fixed assets | |
|---|---|---|---|---|---|---|
| **Variables** | **Whole period** | **After crisis** | **Whole period** | **After crisis** | **Whole period** | **After crisis** |
| **CASH2(t-1)** | 1.022*** | 0.9881*** | 0.8782*** | 0.8853*** | 0.9712*** | 1.0104*** |
| | (39.47) | (32.26) | (31.65) | (28.85) | (37.74) | (34.13) |
| **$Z_1$CASH2(t-1)** | 0.0004 | 0.0687 | 0.0958** | 0.1182** | 0.0768* | 0.0171 |
| **(Quartile 1)** | (0.01) | (1.31) | (2.17) | (2.37) | (1.83) | (0.36) |
| **$Z_2$CASH2(t-1)** | 0.0006 | 0.0973* | 0.1853*** | 0.1754*** | -0.4171*** | -0.429*** |
| **(Quartile 4)** | (0.01) | (1.77) | (3.88) | (2.96) | (-6.59) | (-6.28) |
| **MB** | -0.0049 | -0.0033 | -0.004 | -0.0039 | -0.0012 | -0.0012 |
| | (-1.61) | (-0.92) | (-1.42) | (-1.17) | (-0.45) | (-0.36) |
| **$Z_1$MB** | -0.0167*** | -0.0062 | -0.0093** | -0.0029 | -0.0067 | -0.004 |
| | (-2.99) | (-0.83) | (-2.17) | (-0.57) | (-1.34) | (-0.7) |
| **$Z_2$MB** | 0.0076 | -0.0003 | 0.0088 | 0.002 | -0.008* | -0.0066 |
| | (1.6) | (-0.05) | (1.39) | (0.26) | (-1.66) | (-1.18) |
| **SIZ** | -0.0026 | 0.0003 | 0.0002 | 0.0008 | 0.0001 | 0 |
| | (-1.23) | (0.12) | (0.15) | (0.7) | (0.12) | (-0.04) |
| **$Z_1$SIZ** | 0.0017** | 0.0006 | 0.0043*** | 0.0039*** | 0.0016** | 0.002** |
| | (2.11) | (0.68) | (6) | (4.7) | (2.07) | (2.38) |
| **$Z_2$SIZ** | -0.0019*** | -0.0031*** | -0.0009 | -0.0012 | 0 | -0.0002 |
| | (-2.63) | (-3.79) | (-0.88) | (-1.02) | (0.06) | (-0.21) |
| **CF** | -0.0007 | -0.0007 | -0.0006 | -0.0004 | -0.0014 | -0.0014 |
| | (-0.45) | (-0.47) | (-0.37) | (-0.25) | (-1.16) | (-1.21) |
| **$Z_1$CF** | 0 | 0 | -0.0007 | -0.0013 | 0.1661*** | 0.17*** |
| | (0.01) | (-0.02) | (-0.25) | (-0.49) | (8.67) | (8.37) |
| **$Z_2$CF** | 0.0656** | 0.1194*** | 0.0742*** | 0.0786*** | 0.0395 | 0.0366 |
| | (2.53) | (4.15) | (3.66) | (3.48) | (1.5) | (1.31) |
| **LIQ** | 0.0034 | 0.0039 | -0.0177* | -0.0166 | -0.0527*** | -0.0474*** |
| | (0.4) | (0.43) | (-1.81) | (-1.56) | (-4.43) | (-3.74) |
| **$Z_1$LIQ** | -0.0268 | -0.0358* | -0.0589*** | -0.0574*** | -0.0311* | -0.0414** |
| | (-1.56) | (-1.88) | (-3.11) | (-2.63) | (-1.74) | (-2.17) |
| **$Z_2$LIQ** | -0.0034 | 0.0128 | -0.0223 | -0.0059 | 0.038* | 0.0448* |
| | (-0.22) | (0.77) | (-1.35) | (-0.34) | (1.71) | (1.86) |
| **LEV** | -0.0052 | -0.0194 | -0.0657*** | -0.0683*** | -0.0309*** | -0.0308** |
| | (-0.5) | (-1.63) | (-4.48) | (-4.12) | (-2.79) | (-2.45) |
| **$Z_1$LEV** | -0.0182 | -0.0133 | -0.6697*** | -0.7666*** | 0.0194 | 0.0061 |
| | (-0.87) | (-0.56) | (-8.65) | (-6.78) | (0.99) | (0.27) |
| **$Z_2$LEV** | 0.0566*** | 0.0902*** | 0.0376 | 0.0667** | 0.0241 | 0.0383* |
| | (3.18) | (4.46) | (1.42) | (2.29) | (1.18) | (1.72) |
| **DBT** | 0.0009 | -0.0064 | 0.0233*** | 0.019*** | 0.0271*** | 0.0181*** |
| | (0.15) | (-1.03) | (4.25) | (3.22) | (4.33) | (2.73) |
| **$Z_1$DBT** | -0.0129 | -0.0133 | -0.0382*** | -0.0422*** | 0.0095 | 0.0186 |
| | (-1.22) | (-1.15) | (-3.51) | (-3.45) | (0.86) | (1.57) |
| **$Z_2$DBT** | 0.0035 | 0.0043 | 0.0201* | 0.0107 | -0.0071 | -0.0043 |
| | (0.33) | (0.39) | (1.82) | (0.91) | (-0.58) | (-0.33) |

| | | | | | | |
|---|---|---|---|---|---|---|
| **DIVYIELD** | -0.0001 | -0.0005 | 0.0003 | 0.0002 | 0 | -0.0001 |
| | (-0.14) | (-1.12) | (0.94) | (0.48) | (0.04) | (-0.38) |
| **$Z_1$DIVYIELD** | -0.0002 | 0.0001 | -0.0024*** | -0.0021*** | -0.001* | -0.0012* |
| | (-0.37) | (0.09) | (-3.55) | (-2.75) | (-1.74) | (-1.89) |
| **$Z_2$DIVYIELD** | 0.0002 | 0.0003 | -0.0002 | -0.0002 | 0.0004 | 0.001 |
| | (0.25) | (0.36) | (-0.26) | (-0.34) | (0.6) | (1.14) |
| **Intercept** | 0.043 | 0.0106 | 0.0127 | 0.0032 | 0.0046 | 0.007 |
| | (1.43) | (0.33) | (0.91) | (0.21) | (0.34) | (0.47) |
| **N** | 2793 | 2292 | 2792 | 2291 | 2584 | 2174 |
| **Adjusted R-squared** | 0.615 | 0.616 | 0.647 | 0.645 | 0.672 | 0.671 |

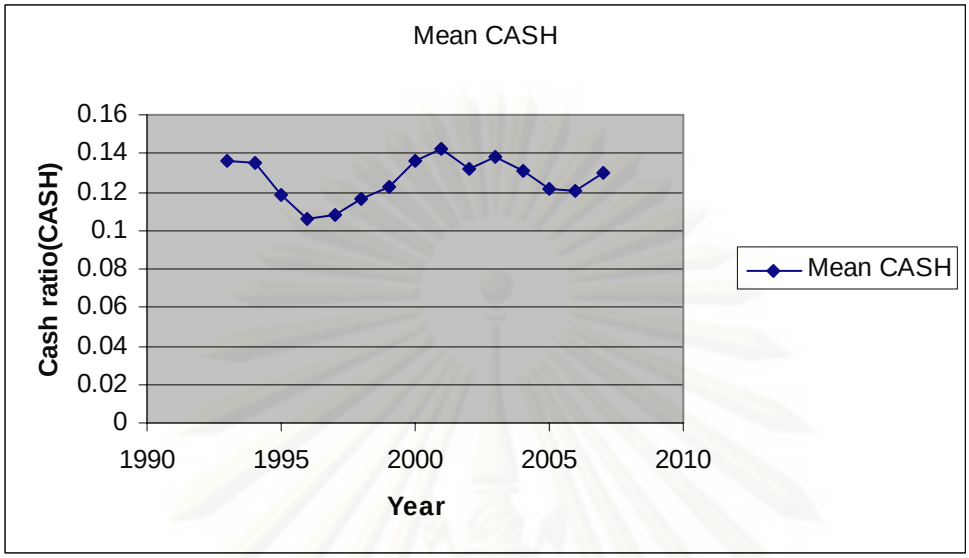
**Table 12 Result of determinants speed of adjustment towards the target cash ratio (Robustness)**

This table examines firms with leverage and cash ratio over or under the target level. The speed of adjustment is estimated with a two-stage least squares methodology. This table shows the results over the period from 1993 to 2007 (whole period) and the results in the period of after the crisis (1998-2007). CASH2 is calculated as cash and cash equivalents divided by total assets. MB is measured as the book value of total assets minus the book value of equity plus the market value of equity to book value of assets. SIZ is defined as the natural logarithm of total assets. CF is the ratio of operating cash flow to total assets. LIQ is the ratio of current assets minus current liabilities and total cash to total assets. LEV is the ratio of total debt to total assets. DBT is the ratio of long-term debt to total debt. DIVYIELD is the ratio of dividend to the stock price. ***, ** and * indicate significance at the 1 percent, 5 percent, and 10 percent level, respectively.

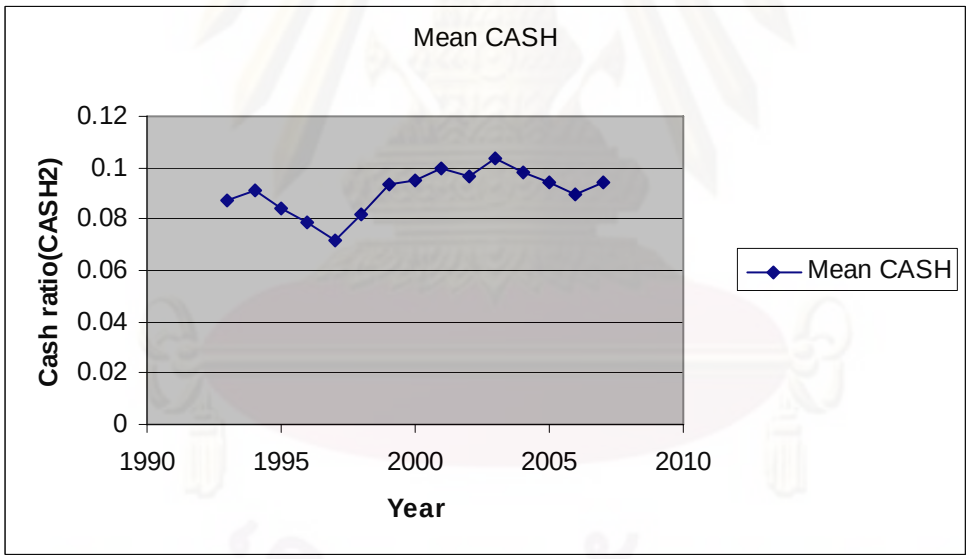
| | **Relative leverage** | | **Relative cash** | |
|---|---|---|---|---|
| **Variables** | **Whole period** | **After crisis** | **Whole period** | **After crisis** |
| **CASH2(t-1)** | 1.0092*** | 1.0001*** | 0.3367*** | 0.3361*** |
| | (38.32) | (35.14) | (10.26) | (9.58) |
| **ZCASH2(t-1)** | 0.0292 | 0.0824* | 0.3628*** | 0.3383*** |
| **(over target)** | (0.78) | (1.88) | (9.37) | (8.02) |
| **MB** | -0.008*** | -0.0013 | 0.002 | 0.0029 |
| | (-3.01) | (-0.42) | (0.95) | (1.21) |
| **ZMB** | 0.0063 | -0.0046 | 0.0053* | 0.0128*** |
| | (1.5) | (-0.92) | (1.66) | (3.41) |
| **SIZ** | 0.0013 | 0.0012 | -0.0017** | -0.0015* |
| | (1.28) | (1.13) | (-2.22) | (-1.82) |
| **ZSIZ** | -0.0031*** | -0.0033*** | 0.0066*** | 0.0069*** |
| | (-5.02) | (-4.6) | (13.66) | (12.92) |
| **CF** | -0.0008 | -0.0008 | 0.0005 | 0.0005 |
| | (-0.64) | (-0.62) | (0.39) | (0.4) |
| **ZCF** | 0.0671*** | 0.0982*** | -0.0016 | -0.0011 |
| | (4.04) | (5.25) | (-0.77) | (-0.52) |
| **LIQ** | -0.0051 | -0.0059 | -0.0141** | -0.0162** |
| | (-0.58) | (-0.65) | (-2.28) | (-2.48) |
| **ZLIQ** | 0.02 | 0.029** | -0.062*** | -0.0554*** |
| | (1.6) | (2.15) | (-6.26) | (-5.3) |
| **LEV** | -0.0331*** | -0.043*** | -0.0479*** | -0.0508*** |
| | (-2.7) | (-3.19) | (-5.47) | (-5.32) |
| **ZLEV** | 0.0756*** | 0.1024*** | -0.0961*** | -0.1064*** |
| | (4.49) | (5.32) | (-7.84) | (-7.82) |
| **DBT** | -0.0079 | -0.0125** | 0.0157*** | 0.0149*** |
| | (-1.4) | (-2.1) | (3.92) | (3.55) |
| **ZDBT** | 0.0174** | 0.0153* | -0.0112* | -0.0199*** |
| | (2.15) | (1.74) | (-1.8) | (-3) |
| **DIVYIELD** | -0.0004 | -0.0004 | 0.0001 | 0.0002 |
| | (-0.94) | (-1) | (0.6) | (0.88) |
| **ZDIVYIELD** | 0.0005 | 0.0003 | -0.0012*** | -0.0023*** |
| | (0.96) | (0.48) | (-2.62) | (-4.56) |
| **Intercept** | 0.0009 | 0.0002 | 0.0477*** | 0.0447*** |
| | (0.06) | (0.01) | (4.44) | (3.92) |
| **N** | 0.616196 | 0.619287 | 0.775189 | 0.786774 |
| **Adjusted R-squared** | 2791 | 2292 | 2788 | 2290 |

**Figure 1. Mean cash ratio of Thai firms over the period of 1993-2007**

**Panel A: Mean cash ratio (CASH)**




**Panel B: Mean cash ratio (CASH2)**



# BIOGRAPHY

Miss Suchada Manunphongpan was born in March 23, 1984 in Nakhonratchasima, Thailand. At the secondary school, she graduated from Suranari Wittaya School. At the undergraduate level, she graduated from the Faculty of Economics, Majoring in Monetary Economics and International Economics, Thammasat University in March 2006 with a Bachelor of Arts in Economics degree. She joined the Master of Science in Finance program, Chulalongkorn University in June 2006.