# Dividends, Investment and Cash Flow Uncertainty: Evidence from Thailand

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*Received: 9 May 2022*

*Revised: 29 August 2022*

*Accepted: 29 August 2022*

## Abstract

This study examines the relationship between dividends and investment with cash flow uncertainty and how firms manage cash flow uncertainty. The sample in the Stock Exchange of Thailand over the period from 2008-2020 is based on a yearly basis by using piecewise and cubic regressions. The results demonstrate that dividends and investment are nonlinear relation with the different levels of cash flow uncertainty due to agency cost and asymmetric information. Other factors, including external cash, operating cash flow, growth opportunities, size, profitability, and financial leverage are investigated. However, no effect from the global financial crisis and the COVID-19 pandemic on dividends and investment decisions with cash flow uncertainty. When facing cash flow uncertainty, firms slightly reduce investment while keeping dividends. External finance is the major method to manage uncertain cash flow.

**Keywords:** Dividends, Investment, Cash flow uncertainty, External financing, Asymmetric information, Agency cost, Crisis, Non-crisis

## Introduction

Dividends and investment are the primary decisions in corporate finance. Firms signal profitability to the market by payout policy and raising capital by investing in positive net present value projects. In a perfect capital market, the firm value depends on cash flow

generated by investment but is not related to dividends. Firms will invest first and pay residual cash flow as dividends.

In the real world with an imperfect capital market, firms cannot access unlimited capital for both decisions due to financial constraints, affecting investment (Minton and Schrand, 1999) and dividends (Chay and Suh, 2009). Fazzari et al. (1988) found that firms rely on internal capital in response to cash shortfall because firms have more difficulty accessing external finance.

Cash flow shortfall is sensitive to both decisions because of the agency cost and asymmetric information. In agency cost, managers have incentives to the interest of shareholders due to overinvestment. Firms may reduce investment by dividend payments and stock repurchases or keep investing by raising funds from external finance. By contrast, asymmetric information causes the difference between internal and external finance costs. As a result, investment levels rely on internal capital because external finance cost is more expensive. Managers need to determine whether to pay dividends or invest in future usage to match their needs and sufficient cash flow. However, both decisions have the objective of maximizing shareholder wealth.

During the global financial crisis, firms paid low dividends, maintained higher cash balances (Sun and Wang, 2015) (Bliss et al., 2015), and reduced investment (Duchin et al., 2010) (Bo et al., 2014). The COVID-19 pandemic put pressure on economic growth all over the world, leading to cash shortage and a reduction in investment (Jie et al., 2021) and dividends (Krieger et al., 2021).

According to dividends and investment change from the uncertainty of cash flow, this study aims to investigate the relationship between dividends and investment with different levels of cash flow uncertainty and how firms manage uncertain cash flow. This study aims to examine the relationship between dividends and investment with cash flow uncertainty and examines how firms manage the uncertain cash flow of the sample in the Stock Exchange of Thailand over the period 2008–2020 by obtaining the data from SETSMART and Datastream.

The contribution of this paper is its focus on periods that covers the global financial crisis and the COVID-19 pandemic to investigate the effect of two crises on dividends and investment to benefit managers in making decisions to maximize shareholder wealth. Investors

can also use these decisions and capital structure as factors for considering and selecting good firms for investments.

## Review of Literature

### Agency Cost Theory

The agency cost framework of Jensen and Meckling (1976) shows that agency problems cause conflicts between managers and shareholders because managers have investment needs when they have opportunities and resources for them.

Jensen (1986) stated that managers are expected to act in the interest of shareholders to avoid overinvesting by dividend payments. When dividends are paid, external finance can generate agency cost due to debt payment obligations.

### Asymmetric Information

The asymmetric information of Myers and Majluf (1984) refers to managers having information regarding firms and future cash flow more than outside investors. The markets rationally discount the share price, leading the firms to underinvest.

In the case of asymmetric information and investment levels, the difference between internal and external finance costs is caused by asymmetric information. Fazzari et al. (1988) suggested that when firms face financial constraints, investment relies on internal capital and leads to underinvestment.

## Empirical evidence related to dividends

### Life Cycle Theory

DeAngelo (2006) stated that the corporate cycle stage affects the firm ability to pay dividends. Initial firms generally need investment opportunities and are unlikely to pay dividends. Mature firms have lower investment needs and pay more dividends. Firms are concerned about their stage that matches with internal capital and tradeoffs cost when considering dividends and investment decisions.

**Dividend Smoothing Theory**

Firms maintain constant dividends more than they cut them. The dividend signaling hypothesis indicates that their dividend policy contains information regarding the future prospects of firms.

Lintner (1956) showed that investors prefer stable dividends. The stock value will change if managers decide to cut dividends in relation to dividend signaling theory.

**Cash flow Uncertainty**

Fazzari et al. (1988) suggested that firms rely on internal capital in a condition of financial constraints because external capital providers face a greater risk from the uncertainty that causes higher external finance cost and more difficulty accessing external funds. Minton and Schrand (1999) suggested that cash flow uncertainty leads to lower capital expenditures and higher external finance cost. Chay and Suh (2009) found that firms reduce dividends due to cash flow volatility.

**Nonlinear relation between dividends and investment**

Deng et al. (2013) found that dividends and investment have a nonlinear relation with the change in uncertain cash flow. They separate cash flow uncertainty into three levels. First, investment and dividends are positive and increase when cash flow uncertainty is low. Second, investment and dividends are negative and decrease when cash flow uncertainty is moderate. Third, investment and dividends are positive and increase again when cash flow uncertainty is extremely high.

**Research Hypotheses**

$H_1$: There is nonlinear relation between dividends and investment with cash flow uncertainty.

$H_2$: Firms manage cash flow uncertainty by external financing.

## Research Methodology

### Data

The Sample uses listed firms in the Stock Exchange of Thailand from 2008 to 2020. The firm-level data on yearly basis are collected from SETSMART and Datastream.

**1. Dependent Variable**

**Investment**

The investment represents how much firms invest in long-term assets for future benefits, this study uses capital expenditures for fixed assets, intangible assets, and other long-term assets (Deng et al., 2013).

I_TA uses capital expenditures divided by lagged total assets (Deng et al., 2013).

**2. Independent Variables**

**Dividends**

Dividends are regular cash dividends payments on the common stock in the current year, which represents how much profit firms distribute to shareholders during the current period (Deng et al., 2013).

Div uses dividends divided by lagged total assets (Deng et al., 2013). Dividends and investment are competing uses with limited internal capital (Dhrymes and Kurz, 1967).

**Cash flow uncertainty**

Cash flow uncertainty refers to insufficient operating cash flow for expected dividends and expected investment (Daniel et al., 2008). Dividends and investment are more reliant on internal capital because firms have more difficulty accessing external capital due to the higher cost of external finance (Fazzari et al., 1988). First, cash flow shortfall is calculated following Daniel et al. (2008) and Deng et al. (2013).

The expected dividend represents how much profit firms expect to distribute to shareholders during the next period, this study uses dividends paid in the previous year.

The previous dividend represents how much profit firms distribute to shareholders during the prior period. Given the long history of dividend-paying firms, they found that managers have incentives to preserve dividends. This study calculates the expected dividend based on the previous dividend, and the expected dividend equals zero for non-dividend paying firms (DeAngelo and DeAngelo, 1990; DeAngelo and DeAngelo, 2006).

The expected investment represents how much firms invest in long-term assets during the next period. It comes from the median of industry capital expenditures divided by the median of lagged total assets in the same industry and then multiplied by the firm's lagged total assets (Deng et al., 2013). Estimating expected investment relative to the industry peers

and all firms in the sample allows capturing the impact of change in the industry on the levels of expected investment and avoids the negative predicted value for investment.

Available cash flow is the cash flow available for expected dividends and expected investment. This study uses the net cash flow from operating activities (Deng et al., 2013).

Second, the volatility of cash flow is measured with a standard deviation of five years' operating cash flow divided by lagged total assets (Chay and Suh, 2009) (Deng et al., 2013).

Rank represents cash flow uncertainty rankings are measured by cash flow shortfall and cash flow volatility, then distributed into ten rankings according to the magnitude of uncertain cash flow. Firms with higher volatility lead to lower levels of capital expenditures (Minton and Schrand, 1999).

**3. Control Variables**

Control variables are also included due to the effect of determinant factors relevant to investment.

(1) External cash (ExtCash) uses the cash flow from external financing divided by lagged total assets. External finance can benefit if firms have limited internal capital (DeAngelo and DeAngelo, 2006).

(2) Operating Cash Flow (CF) uses the net cash flow from operating activities divided by lagged total assets. Firms will invest if they have more available cash flow (Minton and Schrand, 1999).

(3) Previous Investment (Lag I_TA) uses lagged CAPEX divided by lagged two years total assets. Capital expenditures is positive and increases over time for sales growth encouragement (Kato et al., 2002).

(4) Growth Opportunities (MB) uses the market-to-book ratio, which measures the market value to book value of assets. Firms with growth opportunities will invest if they can (Minton and Schrand, 1999).

(5) Size of the firm (Size) uses the natural logarithm of total assets. Large firms have less asymmetric information because they are less financially constrained. Large firms have the more free cash flow to invest in (Minton and Schrand, 1999).

(6) Profitability (ROA) is net income divided by total assets. Firms with high profitability tend to invest to increase firm value (Deng et al., 2013).

(7) Financial Leverage (Lev) is total liabilities divided by total assets. Firms with low leverage have more debt capacity to borrow funds and avoid cutting investment (Daniel et al., 2008).

**4. Dummy Variables**

$Crisis_1$ as a dummy variable for the year 2008-2009 represents the global financial crisis

$Crisis_2$ as a dummy variable for the year 2020 represents the COVID-19 pandemic

## Methodology

### Piecewise Regression

$$I\_TA_{i,t} = \alpha_0 + \alpha_1 Div_{i,t} + \alpha_2 Rank_{i,t} + \alpha_3 Dum_{1_{i,t}} + \alpha_4 Dum_{2_{i,t}} + Div * \left(\alpha_5 Rank_{i,t} + \alpha_6 Dum_{1_{i,t}} + \alpha_7 Dum_{2_{i,t}}\right) + Rank * \left(\alpha_8 Dum_{1_{i,t}} + \alpha_9 Dum_{2_{i,t}}\right) + Div * Rank * \left(\alpha_{10} Dum_{1_{i,t}} + \alpha_{11} Dum_{2_{i,t}}\right) + \alpha_{12} Crisis_{1_{i,t}} + \alpha_{13} Crisis_{2_{i,t}} + Div * \left(\alpha_{14} Rank_{i,t} + \alpha_{15} Crisis_{1_{i,t}} + \alpha_{16} Crisis_{2_{i,t}}\right) + Rank * \left(\alpha_{17} Crisis_{1_{i,t}} + \alpha_{18} Crisis_{2_{i,t}}\right) + Div * Rank * \left(\alpha_{19} Crisis_{1_{i,t}} + \alpha_{20} Crisis_{2_{i,t}}\right) + \alpha_{21} ExtCash_{i,t} + \alpha_{22} CF_{i,t} + \alpha_{23} Lag(I\_TA)_{i,t} + \alpha_{24} MB_{i,t} + \alpha_{25} Size_{i,t} + \alpha_{26} ROA_{i,t} + \alpha_{27} Lev_{i,t} + \varepsilon_{i,t} \quad (1)$$

Given that cash flow uncertainty is different, this study proposes dummy variables to represent the different levels of uncertain cash flow (Deng et al., 2013). The threshold of piecewise regression is determined by (1) plotting investment and dividend sensitivity, which is the coefficient of dividends, to the rankings of cash flow uncertainty. (2) The curve that shows the relationship between dividends and investment with cash flow uncertainty is observed. When the rank is less than 4, the curve is increasing. When the rank is between 4 and 7, the curve is decreasing for Cashshort rank and CFVol rank.

### Cubic Regression

$$I\_TA_{i,t} = \beta_0 + \beta_1 Div_{i,t} + \beta_2 Rank_{i,t} + \beta_3 Rank^2{}_{i,t} + \beta_4 Rank^3{}_{i,t} + Div * \left(\beta_5 Rank_{i,t} + \beta_6 Rank^2{}_{i,t} + \beta_7 Rank^3{}_{i,t}\right) + \beta_8 Crisis_{1_{i,t}} + \beta_9 Crisis_{2_{i,t}} + Div * (\beta_{10} Crisis_{1_{i,t}} + \beta_{11} Crisis_{2\ i,t}) + Rank * (\beta_{12} Crisis_{1_{i,t}} + \beta_{13} Crisis_{2\ i,t}) + Rank^2 * (\beta_{14} Crisis_{1_{i,t}} + \beta_{15} Crisis_{2\ i,t}) + Rank^3 * (\beta_{16} Crisis_{1_{i,t}} + \beta_{17} Crisis_{2\ i,t}) + Div * Rank\ (\beta_{18} Crisis_{1_{i,t}} + \beta_{19} Crisis_{2\ i,t}) + Div * Rank^2\ (\beta_{20} Crisis_{1_{i,t}} + \beta_{21} Crisis_{2\ i,t}) + Div * Rank^3\ (\beta_{22} Crisis_{1_{i,t}} + \beta_{23} Crisis_{2\ i,t}) +$$

$$\beta_{24}ExtCash_{i,t} + \beta_{25}CF_{i,t} + \beta_{26}Lag(I\_TA)_{i,t} + \beta_{27}MB_{i,t} + \beta_{28}Size_{i,t} + \beta_{29}ROA_{i,t} + \beta_{30}Lev_{i,t} + u_{i,t} \quad (2)$$

**To examine how firms manage cash flow uncertainty**

Assume that firms manage cash flow uncertainty through five methods of estimating available cash (Daniel et al., 2008) (Deng et al., 2013).

$$Available\ cash = Dividend\ cutback + Investment\ cutback + Nonoperating\ cash + External\ cash + Cash\ drawdown \quad (3)$$

**How do firms manage cash flow uncertainty**

(1) Estimating cash flow shortfall from the sum of expected dividend and expected investment subtract by available cash flow.

(2) Estimating dividend cutback, investment cutback, non-operating cash, external cash, and cash drawdown.

(3) Estimating available cash from the sum of five methods: dividend cutback, investment cutback, non-operating cash, external cash, and cash drawdown from equation (3).

(4) Cash shortfall is separated into two types: positive shortfall refers to shortfall firms and negative shortfall refers to surplus firms.

(5) All samples are sorted into five groups according to the magnitude of cash flow uncertainty measured by cash flow shortfall and cash flow volatility.

(6) Sum the value of each variable for each group in Panel A for the full sample, Panel B for positive cash shortfall, and Panel C for negative cash shortfall.

To examine how firms manage cash flow uncertainty, the result can be interpreted from the value of each method, suggesting that firms use the method that has the greatest positive value to manage cash flow uncertainty.

## Results and Discussion

### Descriptive Statistics

Table 1 represents the summary statistics. The sample from the Stock Exchange of Thailand over the period of 2008-2020. The financial industry is excluded due to the restrictions and the different criteria of payout policy. In addition, cash flow from operating activities in firm-level data needed to be available. All variables are based on 3,805

observations from 436 listed firms. This table represents the mean, median, standard deviation, minimum, and maximum. The value is reported in billion baht.

Table 1 reports external cash has a positive mean, suggesting that firms primarily raise capital from external cash. Non-operating cash and cash drawdown have a negative mean, indicating that firms rarely obtain additional capital through two methods.

**Table 1** Descriptive Statistics

| Variables | Observations | Firms | Mean | Median | S.D. | Minimum | Maximum |
|---|---|---|---|---|---|---|---|
| I_TA | 3,805 | 436 | 0.0594 | 0.0355 | 0.0758 | 0.0000 | 0.8285 |
| Div | 3,805 | 436 | 0.0427 | 0.0275 | 0.0526 | 0.0000 | 0.7071 |
| Cashshort | 3,805 | 436 | 0.2049 | 0.0217 | 4.2426 | -69.0410 | 57.2730 |
| CashshortTA | 3,805 | 436 | -0.0422 | 0.0061 | 0.2193 | -0.9933 | 0.9685 |
| CFVol | 3,805 | 436 | 0.0641 | 0.0505 | 0.0509 | 0.0017 | 0.5229 |
| Investment | 3,805 | 436 | 0.7860 | 0.1355 | 3.5587 | 0.0000 | 70.7497 |
| Dividends | 3,805 | 436 | 0.4306 | 0.1079 | 1.3618 | 0.0000 | 36.5089 |
| NonOpCash | 3,805 | 436 | -0.2744 | 0.0016 | 3.4775 | -58.8993 | 51.0918 |
| ExtCash | 3,805 | 436 | 0.4843 | 0.0000 | 3.8767 | -46.6432 | 84.8181 |
| CashDrawdown | 3,805 | 436 | -0.0628 | -0.0052 | 2.0382 | -44.5599 | 34.7309 |

## Empirical Results

### Piecewise Regression

Table 2 represents the result of piecewise regression estimated with fixed effects showing that nonlinear relation between dividends and investment. This study expects the coefficient of Div and Rank is positive, the coefficient of Div, Rank and $\mathbf{Dum_1}$ is positive, and the coefficient of Div, Rank and $\mathbf{Dum_2}$ is negative.

4.2.2 Cubic Regression

Table 3 represents the result of cubic regression estimated with fixed effects and shows the nonlinear relation between dividends and investment. This study expects the coefficient of Div and Rank is positive, the coefficient of Div and $\mathbf{Rank^2}$ is negative, the coefficient of Div and $\mathbf{Rank^3}$ is positive.

A nonlinear relation is found between dividends and investment with cash flow uncertainty, supporting Deng et al. (2013). The result demonstrates that investment and dividends are positive and increase when cash flow uncertainty is low, suggesting that firms continue paying dividends and making an investment. Investment and dividends are negative and decrease when cash flow uncertainty is moderate, suggesting that firms decide to reduce

investment to maintain dividends due to limited internal capital. Investment and dividends are positive and increase when cash flow uncertainty is extremely high, suggesting that firms reduce dividends and investment.

The result shows a significant negative relationship between dividends (Div) and investment (I_TA). This indicates that firms will less on investment spending, consistent with Dhrymes and Kurz (1967), who show that dividends and investment are competing uses with limited internal capital.

The result provides a significant negative relationship between cash flow uncertainty (Rank) and investment (I_TA). This indicates that firms spend less on capital expenditures due to greater volatility, supporting the analysis of Minton and Schrand (1999).

Additionally, the COVID-19 pandemic ($\mathbf{Crisis_2}$) has a significant negative relationship with cash flow uncertainty (Rank) and investment (I_TA), suggesting that the COVID-19 pandemic has greatly impacted firms by reducing investment spending (Jie et al., 2021). No effect is shown from the global financial crisis and the COVID-19 pandemic on the relationship between dividends and investment with cash flow uncertainty, supporting Duchin et al (2010), Jie et al. (2021), and related studies in Thailand of Supawathanangkul (2017), Natimakul (2017).

For the control variables, the result provides that external cash (ExtCash) is positively related to investment (I_TA). This implies that firms raise external finance to avoid cutting investment, as also found by DeAngelo and DeAngelo (2006). The result shows a significant positive relationship between operating cash flow (CF) and investment (I_TA). This means that firms keep investing when firms have more operating cash flow, supports Minton and Schrand (1999). The result provides a significant positive relationship between previous investment (Lag I_TA) and investment (I_TA), indicating that capital expenditures are increasing over time to encourage sales growth or productivity following the literature of Kato et al. (2002). The result shows growth opportunities (MB) are positively related to investment (I_TA), indicating that firms make more investment when firms have higher investment opportunities the same as the findings of Minton and Schrand (1999). A significant positive relationship is also found between the size of the firm (Size) and investment (I_TA), indicating that larger firms will spend more on capital expenditures due to lower costs of accessing capital, which is consistent with Minton and Schrand (1999). A significant positive relationship is found between profitability (ROA) and investment (I_TA). This implies that firms can invest when firms have higher profitability, following the studies of Deng et al. (2013). Financial leverage (Lev) is found to

have a significant negative relationship with investment (I_TA), indicating that firms keep investment when firms have more financial flexibility (Holt, 2003).

**Table 2** Piecewise Regression

| Dependent variable: | Cash flow uncertainty measure | |
|---|---|---|
| I_TA | Cashshort | CFVol |
| Div | -0.3254** | -0.2638** |
| Rank | -0.0022** | -0.0016* |
| Dum1 | 0.0443** | 0.0287* |
| Dum2 | 0.0356* | 0.0244* |
| Div x Rank | 0.1178** | 0.0909** |
| Div x Dum1 | 0.6613** | 0.4279* |
| Div x Dum2 | 0.7697* | 0.5368** |
| Rank x Dum1 | -0.0178** | -0.0123* |
| Rank x Dum2 | -0.0073* | -0.0040* |
| Div x Rank x Dum1 | 0.1487** | 0.1270* |
| Div x Rank x Dum2 | -0.2254* | -0.2587** |
| Crisis1 | -0.0128 | -0.0121 |
| Crisis2 | -0.0157* | -0.0101* |
| Div x Crisis1 | -0.1948 | -0.1636 |
| Div x Crisis2 | -0.1157 | -0.0787 |

**Table 2** Piecewise Regression (Cont.)

| Dependent variable: | Cash flow uncertainty measure | |
|---|---|---|
| I_TA | Cashshort | CFVol |
| Rank x $Crisis_1$ | -0.0023 | -0.002 |
| Rank x $Crisis_2$ | -0.0017* | -0.0015* |
| Div x Rank x $Crisis_1$ | 0.0158 | 0.0017 |
| Div x Rank x $Crisis_2$ | 0.0184 | 0.0162 |
| ExtCash | 0.1042** | 0.1035** |
| CF | 0.0320** | 0.0325** |
| Lag I_TA | 0.1965** | 0.1953** |
| MB | 0.0025** | 0.0027** |
| Size | 0.0073** | 0.0098** |
| ROA | 0.0006** | 0.0002** |
| Lev | -0.0455** | -0.0447** |
| Constant | -0.0671** | -0.0615** |
| Observations | 3,805 | 3,805 |
| Number of firms | 436 | 436 |
| RSS | 9.0512 | 9.0693 |
| Loglikelihood | 6,096.3662 | 6,094.4604 |
| F-test | 32.8073** | 32.6455** |
| Overall $R^2$ | 0.2857 | 0.2823 |
| Within $R^2$ | 0.2029 | 0.2021 |

*Note*: Cash flow uncertainty is measured with cash flow shortfall and cash flow volatility. ***, ** and * define as statistically significant at 1%, 5% and 10% level.

**Table 3** Cubic Regression

| Dependent variable: | Cash flow uncertainty measure | |
|---|---|---|
| I_TA | Cashshort | CFVol |
| Div | -0.3614** | -0.3310** |
| Rank | -0.0265** | -0.0231** |
| $Rank^2$ | 0.0056** | 0.0046*** |
| $Rank^3$ | -0.0003** | -0.0002** |
| Div x Rank | 0.3787*** | 0.4222*** |
| Div x $Rank^2$ | -0.0847** | -0.0705*** |
| Div x $Rank^3$ | 0.0036* | 0.0047*** |
| $Crisis_1$ | -0.0100 | -0.0164 |
| $Crisis_2$ | -0.0355* | -0.0454* |

**Table 3** Cubic Regression (Cont.)

| Dependent variable: | Cash flow uncertainty measure | |
|---|---|---|
| I_TA | Cashshort | CFVol |
| Div x Rank x $Crisis_2$ | 0.4921 | 0.8624 |
| Div x $Rank^2$ x $Crisis_1$ | -0.049 | -0.0312 |
| Div x $Rank^2$ x $Crisis_2$ | -0.0829 | -0.1689 |
| Div x $Rank^3$ x $Crisis_1$ | 0.0030 | 0.0022 |
| Div x $Rank^3$ x $Crisis_2$ | 0.0039 | 0.0095 |
| ExtCash | 0.1828*** | 0.1041*** |
| CF | 0.1405** | 0.1460** |
| Lag I_TA | 0.1958*** | 0.1761*** |
| MB | 0.0025** | 0.0026** |

**Table 3** Cubic Regression

| Dependent variable: | Cash flow uncertainty measure | |
|---|---|---|
| I_TA | Cashshort | CFVol |
| Div x $Crisis_1$ | -0.4546 | -0.3131 |
| Div x $Crisis_2$ | -0.725 | -1.1549 |
| Rank x $Crisis_1$ | -0.0058 | -0.0214 |
| Rank x $Crisis_2$ | -0.0167* | -0.0250* |
| $Rank^2$ x $Crisis_1$ | 0.0013 | 0.0047 |
| $Rank^2$ x $Crisis_2$ | 0.0029 | 0.0049 |
| $Rank^3$ x $Crisis_1$ | -0.0003 | -0.0001 |
| $Rank^3$ x $Crisis_2$ | -0.0037 | -0.0088 |

**Table 3** Cubic Regression (Cont.)

| Dependent variable: | Cash flow uncertainty measure | |
|---|---|---|
| I_TA | Cashshort | CFVol |
| Size | 0.0073* | 0.0077* |
| ROA | 0.0002** | 0.0005** |
| Lev | -0.0452*** | -0.0386*** |
| Constant | -0.1021*** | -0.1032*** |
| Observations | 3805 | 3805 |
| Number of firms | 436 | 436 |
| RSS | 9.0515 | 9.0455 |
| Loglikelihood | 6,096.3096 | 6,097.5670 |
| F-test | 28.3949*** | 28.4874*** |
| Overall $R^2$ | 0.2841 | 0.2823 |
| Within $R^2$ | 0.2029 | 0.2035 |

*Note*: Cash flow uncertainty is measured with cash flow shortfall and cash flow volatility. The standard error is reported in parenthesis. ***, ** and * define as statistically significant at 1%, 5% and 10% level.

**How do firms manage cash flow uncertainty**

Table 4 represents the result of how firms manage cash flow uncertainty. Cash flow uncertainty is measured by cash flow shortfall (Cashshort) and cash flow volatility (CFVol). Expected dividend is dividends paid in the previous year. Expected investment is median industry capital expenditures over median lagged total assets, multiplied by firm lagged total assets. Available cash flow is net cash flow from operating activities. Cash flow shortfall is the sum of expected dividends and expected investment subtracted by available cash flow. Dividend cutback is the difference between expected dividends and current dividends. Investment cutback is the difference between expected investment and actual investment. Non-operating cash is net cash flow from investing activities excluding capital expenditures. External cash is net cash flow from financing activities excluding dividends. Cash drawdown is the change of cash and cash equivalent. Equity is net cash from the issue and repurchase of stock. Debt is net cash from the issue and retirement of debt. The other is net cash from the sale of miscellaneous financing activities. Value is reported in million baht. A positive number indicates the source of cash. A negative number indicates the use of cash. The percentage is the proportion of each method to the cash flow shortfall.

To investigate the decisions for solving cash flow uncertainty, firms manage through five methods: cut dividends, cut investment, sell assets, external finance, and adjusted cash balance.

In panel A, all samples are divided into five groups according to the magnitude of cash flow uncertainty. Cash flow shortfall in groups 0 and 1 are negative, and those in groups 2, 3, and 4 are positive. The result shows that dividends have a negative value, and they have a positive value only when firms have the greatest cash shortfall. By contrast, investment has positive value and decreases when cash shortfall increases. This result supports Daniel et al. (2008), who suggest that firms cut investment to solve uncertain cash flow. External cash has the greatest positive value. Non-operating cash and cash drawdown have an extremely negative value. The result suggests that firms mainly raise external financing and do not sell assets and reduce cash balance to manage uncertainty.

In panel B, shortfall firms are represented by positive cash shortfall. The result shows that dividends have a negative value and only have a positive value at the greatest cash flow shortfall, whereas investment has a positive value. This indicates that shortfall firms keep dividends unchanged while cutting investment, supporting Daniel et al. (2008). The result is consistent with Daniel et al. (2008). The result also provides evidence that the relationship between dividends and investment is not linear.

In panel C, surplus firms are represented by negative cash shortfall. The result shows that dividends and investment have a negative value. Investment decreases with an increase in cash surplus. Conversely, dividends first increase and then decrease. This can confirm that dividends and investment have nonlinear relations. External cash has the greatest positive value. Non-operating cash and cash drawdown have an extremely negative value, indicating that surplus firms mainly obtain external finance in response to cash flow uncertainty. Moreover, firms continue to use cash to pay dividends, make investment, increase non-operating assets, and maintain cash balance (Deng et al., 2013). Firms use external cash for managing cash flow uncertainty due to the agency cost of Jensen (1986), suggests that external cash can benefit the agency problem and avoid misallocating free cash flow because debt payments are contractual obligations.

**Table 4** How do firms manage cash flow uncertainty

| Cashshort _Rank | Expected dividend | Expected investment | Available cash flow | Cash Short | Dividend cutback | Investment cutback | Non-operating cash | External cash | Cash drawdown |
|---|---|---|---|---|---|---|---|---|---|
| Panel A Full Sample | | | | | | | | | |
| 0 | 552,581 | 214,298 | 1,409,221 | -642,342 | -89,558 | 29,881 | -491,853 | 96,098 | -186,908 |
| 1 | 243,099 | 222,139 | 702,866 | -237,628 | -63,282 | 56,160 | -235,949 | 135,427 | -129,983 |
| 2 | 195,179 | 526,228 | 645,441 | 75,966 | -48,940 | 104,010 | -174,119 | 262,004 | -66,990 |
| 3 | 362,344 | 602,507 | 452,921 | 511,930 | -28,513 | 156,819 | -82,570 | 464,111 | 2,083 |
| 4 | 217,936 | 1,553,252 | 725,097 | 1,046,091 | 86,955 | 200,154 | 78,655 | 594,705 | 85,623 |
| CFVol _Rank | Expected dividend | Expected investment | Available cash flow | Cash Short | Dividend cutback | Investment cutback | Non-operating cash | External cash | Cash drawdown |
| 0 | 423,439 | 798,307 | 1,830,648 | -608,902 | -80,022 | 34,943 | -496,847 | 97,035 | -164,011 |
| 1 | 231,228 | 476,143 | 881,379 | -174,008 | -55,848 | 66,347 | -213,975 | 131,497 | -102,029 |
| 2 | 383,864 | 644,168 | 936,344 | 91,688 | -49,114 | 102,074 | -157,136 | 274,713 | -78,850 |
| 3 | 304,894 | 583,080 | 385,886 | 502,088 | -13,848 | 131,948 | -78,314 | 456,350 | 5,952 |
| 4 | 227,714 | 616,725 | -98,712 | 943,151 | 55,495 | 211,711 | 40,436 | 592,750 | 42,761 |

*Note*: Cash flow uncertainty measured by cash flow shortfall and cash flow volatility. Panel A represents the result of full sample. Panel B represents the result of positive cash shortfall. Panel C represents the result of a negative cash shortfall. Value is reported in million baht. The percentage is the proportion of each method to cash flow shortfall.

| Cashshort | Expected | Expected | Available | Cash | Dividend | Investment | Non-operating | External cash | | | Cash |
|---|---|---|---|---|---|---|---|---|---|---|---|
| _Rank | dividend | investment | cash flow | Short | cutback | cutback | cash | Equity | Debt | Others | drawdown |
| Panel B Positive cash shortfall | | | | | | | | | | | |
| 0 | 92,730 | 142,718 | 111,673 | 123,775 | -4,819 | 89,280 | -25,258 | 17,402 | 183,346 | -118,606 | -17,571 |
| | | | | | -4% | 72% | -20% | 14% | 148% | -96% | -14% |
| 1 | 116,300 | 280,523 | 262,765 | 134,058 | -6,488 | 87,337 | -22,262 | 20,622 | 186,813 | -123,168 | -8,796 |
| | | | | | -5% | 65% | -17% | 15% | 139% | -92% | -7% |
| 2 | 104,157 | 898,597 | 517,136 | 485,618 | -2,511 | 260,281 | -21,216 | 50,795 | 264,838 | -63,042 | -3,528 |
| | | | | | -1% | 54% | -4% | 10% | 55% | -13% | -1% |
| 3 | 109,681 | 567,117 | 103,254 | 573,544 | -1,415 | 292,224 | -17,840 | 104,363 | 397,506 | -218,558 | 17,265 |
| | | | | | 0% | 51% | -3% | 18% | 69% | -38% | 3% |
| 4 | 267,329 | 614,208 | 74,453 | 807,084 | 41,910 | 361,867 | 2,586 | 129,918 | 376,863 | -149,224 | 43,165 |
| | | | | | 5% | 45% | 0% | 16% | 47% | -18% | 5% |
| CFVol | Expected | Expected | Available | Cash | Dividend | Investment | Non-operating | External cash | | | Cash |
| _Rank | dividend | investment | cash flow | Short | cutback | cutback | cash | Equity | Debt | Others | drawdown |
| 0 | 87,176 | 288,486 | 282,234 | 93,428 | -4,875 | 75,915 | -25,359 | 20,031 | 149,790 | -102,060 | -20,012 |
| | | | | | -5% | 81% | -27% | 21% | 160% | -109% | -21% |
| 1 | 141,427 | 451,648 | 488,942 | 104,133 | -7,437 | 73,168 | -23,705 | 39,716 | 212,583 | -179,327 | -10,865 |
| | | | | | -7% | 70% | -23% | 38% | 204% | -172% | -10% |
| 2 | 179,692 | 581,771 | 241,164 | 520,299 | -2,780 | 277,713 | -18,050 | 52,809 | 247,319 | -34,250 | -2,462 |
| | | | | | -1% | 53% | -3% | 10% | 48% | -7% | 0% |
| 3 | 181,471 | 716,991 | 293,953 | 604,509 | -1,674 | 306,294 | -17,880 | 70,806 | 303,481 | -74,260 | 17,742 |
| | | | | | 0% | 51% | -3% | 12% | 50% | -12% | 3% |
| 4 | 100,430 | 464,267 | -237,013 | 801,710 | 43,443 | 357,900 | 1,003 | 139,739 | 496,193 | -282,702 | 46,132 |
| | | | | | 5% | 45% | 0% | 17% | 62% | -35% | 6% |

| Cashshort | Expected | Expected | Available | Cash | Dividend | Investment | Non-operating | External cash | | | Cash |
|---|---|---|---|---|---|---|---|---|---|---|---|
| _Rank | dividend | investment | cash flow | Short | cutback | cutback | cash | Equity | Debt | Others | drawdown |
| Panel C Negative cash shortfall | | | | | | | | | | | |
| 0 | 331,162 | 109,899 | 1,040,850 | -599,789 | -53,233 | -181,250 | -262,290 | 43,673 | 71,393 | -106,533 | -111,549 |
| | | | | | 9% | 30% | 44% | -7% | -12% | 18% | 19% |
| 1 | 193,587 | 93,450 | 749,570 | -462,533 | -57,153 | -155,320 | -217,734 | 37,091 | 97,444 | -100,106 | -66,756 |
| | | | | | 12% | 34% | 47% | -8% | -21% | 22% | 14% |
| 2 | 129,588 | 106,083 | 460,686 | -225,015 | -23,504 | -81,423 | -167,799 | 28,446 | 99,090 | -23,040 | -56,784 |
| | | | | | 10% | 36% | 75% | -13% | -44% | 10% | 25% |
| 3 | 104,223 | 86,379 | 267,744 | -77,142 | -21,087 | -65,004 | -100,706 | 40,333 | 147,017 | -29,388 | -48,308 |
| | | | | | 27% | 84% | 131% | -52% | -191% | 38% | 63% |
| 4 | 122,383 | 219,451 | 347,416 | -5,582 | -15,037 | -60,971 | -73,316 | 52,482 | 192,883 | -58,308 | -43,315 |
| | | | | | 269% | 1092% | 1313% | -940% | -3455% | 1045% | 776% |
| CFVol | Expected | Expected | Available | Cash | Dividend | Investment | Non-operating | External cash | | | Cash |
| _Rank | dividend | investment | cash flow | Short | cutback | cutback | cash | Equity | Debt | Others | drawdown |
| 0 | 253,523 | 152,982 | 932,480 | -525,975 | -52,607 | -169,316 | -252,299 | 33,223 | 70,095 | -40,928 | -114,144 |
| | | | | | 10% | 32% | 48% | -6% | -13% | 8% | 22% |
| 1 | 153,606 | 111,996 | 665,180 | -399,578 | -55,694 | -133,558 | -211,317 | 35,059 | 83,653 | -46,405 | -71,318 |
| | | | | | 14% | 33% | 53% | -9% | -21% | 12% | 18% |
| 2 | 226,624 | 168,259 | 699,935 | -305,052 | -34,976 | -104,328 | -190,841 | 31,862 | 98,729 | -44,413 | -61,085 |
| | | | | | 11% | 34% | 63% | -10% | -32% | 15% | 20% |
| 3 | 136,428 | 94,173 | 361,282 | -130,681 | -16,250 | -84,352 | -110,249 | 45,296 | 131,719 | -47,666 | -49,179 |
| | | | | | 12% | 65% | 84% | -35% | -101% | 36% | 38% |
| 4 | 110,762 | 87,852 | 207,387 | -8,773 | -10,487 | -52,413 | -57,140 | 56,584 | 223,631 | -137,963 | -30,986 |
| | | | | | 120% | 597% | 651% | -645% | -2549% | 1573% | 353% |

**How do firms obtain external cash**

This study further investigates how firms obtain external cash by observing the sources of external cash from three channels: debt, equity and other channels.

Panel B shows firms with positive cash shortfall. The percentage of debt is extremely high. This indicates that shortfall firms mainly acquire external cash from debt financing, supporting Allen et al. (2005), Daniel et al. (2008), and Deng et al. (2013). This also follows the framework of Myer and Majluf (1984), who suggest that firms prefer debt rather than equity financing to protect owner information because of asymmetric information between managers and investors.

Panel C shows firms with negative cash shortfall. The percentage of debt and equity shows the same proportion. The result suggests that surplus firms acquire external cash from debt and equity financing (Deng et al., 2013).

## Discussion

The first objective is to examine the relationship between dividends and investment with cash flow uncertainty by using piecewise and cubic regressions.

First, a negative relationship between dividends and investment. This is consistent with previous studies (Dhrymes and Kurz, 1967; Minton and Schrand, 1999; Daniel et al., 2008; Deng et al., 2013) that find that dividends and investment are interdependent due to limited internal capital

Second, dividends and investment have a nonlinear relationship with the different levels of cash flow uncertainty due to asymmetric information and agency cost theory. Investment and dividends have a positive relationship and increase when cash flow uncertainty is low, suggesting that firms continue to pay dividends and make an investment. Investment and dividends have a negative relationship and decrease when cash flow uncertainty is moderate, suggesting that firms slightly reduce investment while keeping dividends due to limited internal capital. Investment and dividends have a positive relationship and increase again when cash flow uncertainty is high, suggesting that firms reduce either dividends and investment.

Third, this study finds the different effects of the two crises. The COVID-19 pandemic has a greatly significant impact on lessening investment spending, consistent with Jie et al. (2021) study in Chinese firms. By contrast, the global financial crisis is the external factor for

Thai firms. However, when facing uncertainty, firms prefer reducing investment to cutting dividends. Firms mainly obtain external cash.

The second objective is to examine how firms manage cash flow uncertainty: cut dividends, cut investment, sell assets, and external finance, and reduce cash balance to manage uncertain cash flow.

The result finds that firms obtain external cash to manage cash flow uncertainty (DeAngelo and DeAngelo, 2006). Shortfall firms manage through cut investment and external cash (Daniel et. al, 2008), while the major source of surplus firms is external cash, which is mainly from debt financing.

First, shortfall firms maintain dividends while slightly reducing investment (Daniel et al., 2008). Lintner (1956) suggests that dividends are the first-order relative to investment. By contrast, Deng et al. (2013) argue that shortfall firms reduce dividends to maintain investment. Modigliani and Miller (1961) provide that investment is the first-order importance and dividends are residual.

Second, firms reduce investment in response to cash shortfall due to asymmetric information of Myers and Majluf, (1984). The result supports Fazzari et al. (1988), who suggest that firms rely on internal capital because external finance cost is more expensive.

Third, firms mainly use external finance for solving cash flow uncertainty, consistent with Jensen (1986), who suggests that external finance can generate agency cost due to debt payment obligations. The result supports DeAngelo and DeAngelo (2006), who suggests that firms should maintain low leverage and preserve debt capacity to borrow external capital to avoid dividends and investment reduction.

## Conclusions and Recommendations

### Conclusion

In summary, first, dividends and investment have a nonlinear relationship with the different levels of cash flow uncertainty due to asymmetric information and agency cost theory. This demonstrates that investment and dividends have a positive and increase when cash flow uncertainty is low, suggesting that managers have investment needs when they have opportunities to do and firms avoid overinvesting free cash flow by making dividends due to agency cost theory. Investment and dividends have a negative and decrease when cash flow

uncertainty is moderate, suggesting that firms decide to cut investment to maintain dividends due to limited internal capital. Investment relies on internal capital because of asymmetric information between internal and external finance cost. Investment and dividends have a positive and increase again when cash flow uncertainty is extremely high, suggesting that firms reduce either dividends or investment due to financial constraints. Firms reduce investment because of the effect of increasing cost of external capital relative to internal capital. Firms reduce dividends to use funds for investment opportunities. Second, when facing cash flow uncertainty, external finance is the major source to manage the uncertainty, suggesting that external finance can generate agency cost and avoid misallocating free cash flow due to debt payment obligations.

**Recommendation**

This research can benefit firms and anyone interested in corporate finance. Managers can use both decisions whether dividend decisions or investment decisions match with their available cash flow and their life-cycle stage. Both decisions have the objective of maximizing shareholders' wealth by creating firm value. Managers should also be concerned about debt capacity and source of funds to obtain external cash. Policymakers can improve dividend and investment policies to match with firms at different levels of cash flow uncertainty. However, policies during the global financial crisis and the COVID-19 pandemic are not different from the non-crisis. When facing cash shortfall, firms prefer reducing investment to cutting dividends, and external cash is the main method to manage cash flow uncertainty. Investors can use dividends decision and the capital structure of firms as the factors for considering and selecting good firms for investments. If investors prefer stable income and are concerned about tax benefits, they should invest in dividend-paying firms instead of non-dividend-paying firms. If investors prefer a high return, they should invest in firms with low leverage instead of firms with high leverage. The reason is that firms with high leverage can face financial distress and bankruptcy cost, and firm value will decrease.

Future research recommendations include separating firms into dividend-paying firms and non-dividend paying firms to explore how they manage when facing cash flow uncertainty to clearly explain the difference between both firms. Other proxies for cash flow uncertainty can also be used to investigate the relationship between dividends and investment with the uncertainty of cash flow.

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