# Accruals and volatility in a real options-based investment approach: Evidence from Thai Market

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This study investigates the relationship between year-ahead net working capital accruals as a proxy of investment behavior and expected volatility during the period of 2009 to 2018 of listed non-financial firms in Thailand. I apply a real options-based investment framework to view accruals as a result of investment decision and investigate the impact of firm's expected volatility.

The results show that firms with higher expected volatility have lower level of year-ahead accruals which is consistent with Grenadier and Malenko (2010). Moreover, this study also indicates that high expected volatility period induces distressed firms to invest because they have opportunity to receive a higher return which is consistent with Eisdorfer (2008). In addition, long operating cycle firms prefer to delay their investment during high expected volatility period because they have more possible investment outcomes which is consistent with Arif et al. (2016).

Overall, these results suggest that expected volatility has a pervasive effect to investment decision-making of the firms which is considered as the recognition of accruals.



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Chayaporn Chuenurajit

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# 1. Introduction

## 1.1. Background and Research Motivation

Accruals are fundamental to financial reporting and reflect a company's financial position. Understanding the properties of accruals can provide information that is useful to investors. Prior studies generally consider accruals in three perspectives. The primary outcome of the earnings reporting process is the cash flow, while accruals are viewed as the secondary outcome which is the first perspective of accruals. The reason is that accruals have the role in mitigating timings and matching problems inherent in cash flows since cash flows will less reflect firm performance when the firms' financing activities and working capital investment increase (Dechow, 1994).

Following Sloan (1996), the second perspective is to recognize accruals as a result of earnings and emphasizes that accruals have a greater subjectivity than the cash flow. It shows that the accrual component of earning is less persistent. Xie (2001) supports the findings of Sloan (1996) by dividing accruals into a discretionary and nondiscretionary component and examines that the discretionary accruals are overpriced, indicating that investors recognize earnings inefficiently. Also, Dechow and Dichev (2002) discover that accruals are assumed to be lower quality if they cannot represent to past, present or future cash flows which lead to less persistent in earnings. Based on this reason, it refers that accruals reflect intentional and unintentional mismeasurement.

Furthermore, the third perspective is that accruals represent an investment. The study of Fairfield et al. (2003) states that changes in working capital which are recorded as accruals represent growth in net operating assets and long-term net operating assets. They suggest that accruals are recognized when companies receive earnings and make an investment. Bushman et al. (2011)

examine the implications of the relation between accruals and investment for investment-cash flow sensitivities and find that working capital accruals reflect investment decisions.

While many literatures have considered these perspectives to understand the persistence and the mispricing of accruals, McNichols (2000) and Ball (2013) state that there is few research that enhances this understandings and further investigates the factors that affect the recognition of accruals. Thus, in this research, I fill this gap by adopting a real options-based investment framework to view accruals a result of investment decision and investigate the effect of a prediction of firm's investment choices to firm's accruals.

The definition of accruals is a changes in working capital less depreciation and amortization expense. Sloan (1996) investigates that this definition has strong predictive power for investment decision after controlling firm's characteristics. The findings of Zhang (2007) also support the definition of Sloan (1996) and show that accruals reflect investment decisions of firm management because changes in working capital represent an investment behavior.

Applying the real options based investment approach, the investment opportunity is defined as an option to invest that firms will exercise optimally. Firms have to trade-off between the return from immediate investment and the benefit from postponed investment. By delaying an investment decision, information or economic environment may be better and firms can receive new information that might affect the decision of the investment, while management has the option to stop the project if business conditions are unfavorable which is defined as the option to wait. From this perspective, managers prefer to wait and see until a project is clearly desirable instead of immediate investment. Therefore, higher volatility results in lower investment. Many studies adopt a real options approach to examine

the investment behavior and suggest that investment and volatility have a negative association (Ingersoll and Ross, 1992; McDonald, 2006; Grenadier and Malenko, 2010).

Morover, Eisdorfer (2008) and Arif et al. (2016) use a real options framework to model the investment decisions of financially distressed firms and find that the negative effect of volatility on investment has declined. The reason is that when a firm is in financial distress, shareholders have an incentive to invest because they may have an opportunity to receive a higher return from investing in a risky project, while bondholders carry the costs if market conditions do not go well. This implies that the negative association between accruals and expected volatility becomes weaker when there is a high risk of default.

Furthermore, Arif et al. (2016) state that long operating cycle firms have a greater opportunity to receive various possible accrual investment outcomes. Hosseinimehr and Nourifard (2014) discover that the total accruals of long operating cycle firms are less persistent. This can be implied that longer operating cycle firms prefer to delay their investment due to the higher value of the option to wait. Therefore, the negative association between accruals and volatility is stronger for long operating cycle firms.



However, companies in emerging markets may have different investment decisions since they have different characteristics. Enderwick (2007) and Kvint (2009) suggest that emerging markets countries have a weaker investor protection, unreliable accounting practice, less developed legal system and lack of effective corporate governance compared to developed countries which are used in most of the literature. Previous studies in Thailand investigate the relationship between accruals and future profitability with no further examine the factors that affect firm's accruals (Watcharachaitalosot, 2006; Suteerayongprasert, 2007; Chongcharoensiri, 2016). Due to these reasons, I choose Thailand

as a sample to investigate the relationship of accruals and expected firm volatility. This research applies real options-based investment framework to view accruals as an investment which is a result of firm's characteristics in last year and economic conditions in the investment year. It is consistent with Zhang (2007) and Arif et al. (2016). Therefore, this is the first study that discovers the impact of volatility on investment decision in Thai market.

The research is organized as follows. The first section describes the research objective and research contribution. The second section presents the literature review. The third section provides the hypothesis development. The fourth section presents data set and methodology. The fifth section provides empirical results, and the last section is the conclusion.

## 1.2 Objectives

The purposes of this study are as follows:

- To examine the association between accruals and volatility which reflect to firm's investment decision
- To investigate the association between accruals and volatility in distressed firm
- To investigate the association between accruals and volatility in long operating cycle firm

### 1.3 Research Contributions

This research contributes academically to accounting, economics and finance literature, managers, shareholders, investors and other stakeholders as described below.

First, this research investigates the association between accruals and volatility. Prior researches (e.g. Dechow et al., 1994; Richardson et al., 2005; Zhang, 2007; Dechow et al., 2008) note that accruals are likely affected by the economic conditions but little researches examine the economic factors that impact the recognition of accruals. This research is one of the few studies that discover the association between accruals and volatility.

Second, this research examines the factors that affect investment decisions-making. I apply the real options-based investment approach and consider recording accruals as a result of investment. Each firm has different investment planning based on the distressed position and operating cycle, this research provides an understanding of the investment policy of firm. Also, it is useful and beneficial to many groups of people including managers, shareholders, investors and other stakeholders because they will better understand the implication among these relationships which is suitable with their activisms.



Finally, this research provides an understanding of investment decision-making in Thai market by investigating the empirical results of Thai dataset. Emerging market companies are mostly family-owned businesses and their characteristics are not the same as developed countries. Therefore, this study may be applicable to other countries which have similar characteristics.

## 2. Literature reviews

The accrual accounting is an accounting method that provides more accurate picture of the company's current financial position as allowing managers to use discretionary accounting and judgement to manage the earnings (Schipper, 1989). The study of Sloan (1996) finds that while accruals reflect a component of reported operating income, accruals also reflect growth in net operating assets on the statement of financial position. Accruals are changes in working capital less depreciation and amortization expense. Although, this definition of accruals does not include non-current operating assets, non-current operating liabilities and non-cash financial assets and financial liabilities, Richardson et al. (2005) support Sloan's (1996) definition that these omitted accruals have low reliability that lead to security mispricing. This definition is widely used in many studies (e.g. McDonald, 2006; Ohlson, 2014; Bushman et al., 2015).

Measuring accruals as a changes in working capital, Zhang (2007) suggests that change in working capital represent growth in firm's performance and it is considered as one form of investment. The investment perspective of accruals is related to their earnings over the management of the firm. To emphasize, change in working capital is associated to the firm's business life cycle. During expansion period, the accruals are often positive due to an increasing of inventory account since firms are likely to expand their production capacity to satisfy customer demand. On the contrary, during contraction period, the accruals are often negative due to the decreasing in working capital account because firms have to discount their inventory, write off accounts receivable, and postpone payments on payables. These findings show that working capital accruals have positive relationship with the outcomes of firms' investment activities.

Larson et al. (2017) state that the investment decision-making generates future economic benefits so it is recognized as an asset in the financial statements. The accruals account is recorded when the firms decide to increases their scale of operations since they have to increase the amount of investment for supporting these operations. Similarly, Dechow et al. (2008) show that accruals lead to higher future investment because firms want to raise financing or use internally generated funds. Also, Wu et al. (2010) find that real investment is an important driving force of the accrual anomaly.

Adopting the investment perspective of accruals, Zhang (2007) and Dechow et al. (2008) develop the finding of Sloan (1996) and find that considering accruals from investment behavior supports the real options-based investment approach in three features. The first feature is that firms cannot predict the outcome of working capital accruals perfectly. The second feature is that working capital accruals are unalterable. The last feature is that firms generally have control in the process of recognizing accruals. For example, firms delay their investment by postponing the purchasing of inventory or extending credit to their customers. Therefore, accruals are affected by investment decisions (Dixit, 1992).



To make an investment decision, McDonald and Siegel (1986) and Ingersoll and Ross (1992) suggest that all investment projects have option rights values. Firms have to optimize the option to wait which can change by firm's volatility. Grenadier and Malenko (2010) also adopt a real options based investment framework and suggest that high volatility lowers an investment decision.

In addition, Fairfield et al. (2003) suggest that firms will make a decision to invest when their debt is overvalued which results to high accruals. Similarly, Eisdorfer (2008) has explained that shareholders of distressed firms have an incentive to invest in risky projects more than shareholders

of healthy firms because there are opportunities to receive higher return. Moreover, Arif et al. (2016) find that high volatility increases an investment of financially distressed firms.

To define distressed firm, Altman (1968) discovers the model that predicts business failures by using various financial ratios. After that, he revises his model to incorporate in the emerging market (Altman, 1993) which is the Emerging Market Z-Score model (EM Z-Score Model). Samarakoon and Hasan (2009) suggest that EM Z-Score Model is a good prediction model to evaluate the risk of possible bankruptcy that may occur in emerging markets. Since Thailand is an emerging market (e.g. with a small proportion of institutional investors and high volatility (Mody, 2004; Lerskullawat, 2012)), this is a suitable approach to take. Specially, Meeampol et al. (2014) apply this model in Thailand market and find out that the model can completely predict the sign of corporate distress.

Furthermore, Hosseinimehr and Nourifard (2014) discover that the persistence of total accruals is less in long operating cycles. According to Dechow (1994), the operating cycle is measured by the average of timing between the payment of cash to produce an inventory and cash received from the sale of the inventory. Also, Arif et al. (2016) state that a long operating cycle firm has more opportunity to change their business process and high possible investment outcomes. Hence, high expected volatility lowers an investment decision of long operating cycle firms.

In Thailand, there are some academic works on the accruals quality. Suteerayongprasert (2007) investigates the relationship among components of accruals with future earnings and stock returns and investigates the pricing of components of accruals. Issarawornrawanich (2011) examines the association between corporate governance mechanisms and stock investment risk through accruals quality. Watcharachaitalosot (2006) and Chongcharoensiri (2016) examine the relation of accruals and profitability. However, the literature barely explores the relation between accruals and

volatility which reflects investment decision-making. Therefore, this research tries to provide the contribution to the literature by examining the investor's investment decision patterns in a Thailand stock market.

### 3. Hypotheses development

In the real options-based investment framework, the investment opportunity is viewed as an option to invest. Managers have to decide between immediate investment and postponing investment. If firms decide to invest immediately, they can quickly earn returns. In contrast, if they decide to delay an investment which is viewed as an option to wait, they can gain more information and have the benefit of any improvements in economic conditions. Therefore, the advantage of waiting is greater when the volatility is higher. Firms will be more careful to make an investment decision because they are not sure about the future firm's situation. Motivated by this framework, many studies predict a negative relation between investment and expected volatility and the empirical results from prior studies generally support this prediction (e.g. McDonald and Siegel, 1986; Ingersoll and Ross, 1992; Grenadier and Malenko, 2010). My first hypothesis is as follows:

$H_1$: The level of accruals is negatively associated with volatility.

Arif et al. (2016) investigate that financially distressed firms are likely to invest when the expected volatility is high. Eisdorfer (2008) suggests that shareholders of distressed firms prefer to take a risk to invest because they earn the benefits if the decision goes well whereas bondholders carry the costs if the outcome is not favorable. The findings of Galai and Msaulis (1976) and Jensen and Meckling (1976) state that when volatility is higher, shareholders have more incentive to invest which is a result from the asset substitution problem. My second hypothesis is as follow:

$H_2$: The negative association between the level of accruals and volatility is weaker for distressed firm.

Hosseinimehr and Nourifard (2014) discover that long operating cycle firms decide to invest when the expected volatility is low. Dechow (1994) states that the operating cycle is measured as the average of timing between cash disbursement to produce an inventory and cash received from the sale of an inventory. Longer operating cycle firms have more possible investment outcomes so they prefer to wait and see until a project is clearly desirable instead of immediate investment. Thus, expected volatility has a stronger negative effect on accruals in long operating cycle firms. My third hypothesis is as follows:

$H_3$: The negative association between the level of accruals and volatility is stronger for long operating cycle firms.

## 4. Data & Methodology

### 4.1 Sample and Data

For sample, I use publicly traded Thai firms listed on the Stock Exchange of Thailand (SET). All these firms have financial data from 2009 to 2018. Financial firms and real estate funds are excluded from the sample due to their different accounting policies and characteristics of business operation.

For data, the source of accounting and financial data is obtained from Bloomberg database. The company's data which are stock returns and market capitalization are also from Bloomberg database. The interest rate is from the Bank of Thailand (BOT) website.

Table 1 presents the descriptive statistics that used in an empirical analysis. Panel A shows the summary statistics of the variables before excluding outlier observations. The total number of observations is 3,370. Some variables have lower observation since there are missing data which represents unbalanced panel data. The mean and median of working capital accruals is 0.0191 and 0.0067, respectively. It suggests that firms have positive investment on average in the sample period. The mean and median of expected volatility is 0.0138 and 0.0085, respectively. With respect to other variables in the model, the mean and median of firm size is 1.0905 and 0.7498, respectively. The mean and median of market to book is 1.9788 and 1.2928, respectively. The mean and median of leverage ratio is 0.4226 and 0.4241, respectively. The mean and median of cash flow from operations is 0.0531 and 0.0585, respectively. The mean and median of stock return is 0.0353 and 0.0086, respectively. The mean and median of operating cycle of the firm is 74.2771 days and 53.3777 days, respectively.

Panel B reports the summary statistics of keys variables after excluding outlier observations. They are eliminated at 5% of total observations. As a result, the number of observations is 3,200. The

reason for exclusion is to reduce the skewness of the distribution among data. As shown in Panel B, the mean and median of working capital accruals is 0.0197 and 0.0074, respectively. The mean and median of expected volatility is 0.0110 and 0.0085, respectively. For the other variables, the mean and median of firm size is 1.0038 and 0.7538, respectively. The mean and median of market to book is 1.6572 and 1.2628, respectively. The mean and median of leverage ratio is 0.4411 and 0.4395, respectively. The mean and median of cash flow from operation is 0.0679 and 0.0637, respectively. The mean and median of stock return is 0.0141 and 0.0004, respectively. The mean and median of operating cycle of the firm is 65.2611 days and 53.8477 days, respectively.

**Table 1: Descriptive Statistics of variables**

This table provides the summary of descriptive statistics of variables during 2009 to 2018. It is separated into 2 panels which are A and B. The panel A shows the summary of descriptive statistics of variables before excluding outlier observations while panel B shows the summary of descriptive statistics of variables after excluding outlier observations. The definition of variables is provided in the Appendix (Table A).

*Panel A: Descriptive statistics before excluding outlier observations*

| Variables | Observations | Mean | Median | Min | Max | Std. Dev. |
|---|---|---|---|---|---|---|
| Accruals | 3,370 | 0.0191 | 0.0067 | -4.2764 | 4.0930 | 0.1612 |
| Expected Volatility (%) | 3,350 | 0.0138 | 0.0085 | 0.0003 | 1.4730 | 0.0409 |
| Firm size | 3,370 | 1.0905 | 0.7498 | 0.0343 | 14.4184 | 1.1068 |
| Market to book (times) | 3,370 | 1.9788 | 1.2928 | -2.6776 | 64.5270 | 2.6825 |
| Leverage (times) | 3,358 | 0.4226 | 0.4241 | 0.0026 | 1.7068 | 0.2164 |
| Cash flow from Operations | 3,370 | 0.0531 | 0.0585 | -6.4958 | 4.4175 | 0.2450 |
| Return (%) | 3,370 | 0.0353 | 0.0086 | -1.9694 | 3.3051 | 0.4187 |
| Interest rate (% per year) | 3,370 | 1.9750 | 1.8750 | 1.2500 | 3.2500 | 0.5964 |
| Operating cycle (Days) | 3,370 | 74.2771 | 53.3777 | 0.0000 | 978.1621 | 96.5122 |

*Panel B: Descriptive statistics after excluding outlier observations*

| Variables | Observations | Mean | Median | Min | Max | Std. Dev. |
|---|---|---|---|---|---|---|
| Accruals | 3,200 | 0.0197 | 0.0074 | -0.1553 | 0.2995 | 0.0722 |
| Expected Volatility (%) | 3,200 | 0.0110 | 0.0085 | 0.0020 | 0.0485 | 0.0083 |
| Firm size | 3,200 | 1.0038 | 0.7538 | 0.1680 | 4.2910 | 0.7980 |
| Market to book (times) | 3,200 | 1.6572 | 1.2628 | 0.3317 | 6.4781 | 1.1659 |
| Leverage (times) | 3,200 | 0.4411 | 0.4395 | 0.0881 | 1.7068 | 0.2047 |
| Cash flow from Operations | 3,200 | 0.0679 | 0.0637 | -0.2403 | 0.5756 | 0.1278 |
| Return (%) | 3,200 | 0.0141 | 0.0004 | -0.8093 | 0.8441 | 0.3239 |
| Interest rate (% per year) | 3,200 | 1.9731 | 1.7500 | 1.2500 | 3.2500 | 0.5979 |
| Operating cycle (Days) | 3,200 | 65.2611 | 53.8477 | 1.6075 | 318.3171 | 52.1212 |

### 4.2 Methodologies

My research is designed to include three different sets of regression tests. First is a test of the relationship between accruals and volatility ($H_1$). Second, test of the relationship between accruals and volatility for distressed firm ($H_2$). Third, test of the relationship between accruals and volatility for long operating cycle firm ($H_3$).

- *The relationship between accruals and volatility*

This research follows the method of Arif et al. (2016) to examine the effect of expected volatility on accruals. The following regression model is represented as:

$$\begin{aligned} WC\ Accruals_{i,t+1} = {} & \beta_i + \beta_1 Expected\ Volatility_{i,t} + \beta_2 Firm\ Size_{i,t} + \\ & \beta_3 Market\ to\ Book_{i,t} + \beta_4 Leverage_{i,t} + \\ & \beta_5 Cash\ Flow\ from\ Operations_{i,t} + \beta_6 Returns_{i,t+1} + \\ & \beta_7 Recession\ Indicator_{i,t+1} + \beta_8 Interest\ Rate_{i,t+1} + \\ & Year\ Fixed\ Effects + \varepsilon_{i,t+1} \end{aligned} \quad (1)$$

**Working Capital Accruals** (WC Accruals) is a dependent variable defined as a year-ahead growth in operating working capital scaled by beginning total assets. The reason is that accruals are viewed as result of investment decision. The measurement of the characteristics of the firm and business environment which are expected volatility, firm size, market to book ratio, leverage and cash flows from operations are used as control variables of investment behavior that result in one-year ahead (year t+1). According to Sloan (1996), growth in operating working capital is a proper definition for accruals because it has strong predictive power for investment decision due to their high reliability and low persistence.

To measure **expected volatility**, I use generalized autoregressive conditional heteroskedasticity (GARCH) model, introduced by Engle (1982) and developed by Bollerslev (1986). GARCH model require high-frequency data and long time-series observations. Therefore, I apply a GARCH (1,1) model to daily firm-specific stock returns on the SET Index from 2009 to 2018, then convert the daily expected volatility data to yearly expected volatility data. The calculated pattern follows the prior researches (Schwert, 2002; Eisdorfer, 2008).

Besides, the regression model includes the firm size, market to book, leverage and cash flow from operations which are measured in year t as control variables for the level of accruals. To clarify, **Firm Size** is measured as market capitalization scaled by beginning total assets. **Market to Book** is the equity market value divided by the book value of the equity. **Leverage** is the book value of total liabilities divided by the book value of total assets. **Cash Flow from Operations** is defined as the operating income less working capital accruals, scaled by the beginning of total assets.

In addition, I include two macroeconomic variables to control for the economic impact during the investment year. The first variable is the **recession indicator**. It is a dummy variable set to one when Thailand fall into an economic recession which is announced by The Office of the National Economic and Social Development Council (NESDC). The second variable is the **interest rate** which is the monetary policy rate from the Bank of Thailand (BOT). These variables cover an unexpected investment decision in year t+1 which is a result from unexpected macroeconomic changes during that year.

Furthermore, in order to get more precise test, I have to concern about an unpredicted demand in year t+1 that impact to the investment decision. Hence, **stock returns** is included to be the

proxy of unexpected demand. In addition, I include **year fixed effects** to control for unobservable variables that may affect unexpected investment.

From model (1), I expect to see the significantly negative effect of the expected volatility on year-ahead accruals which provides support to $H_1$ by looking at $\beta_1$.

- *The relationship between accruals and volatility for distressed firms*

To study the effect of expected volatility on year-ahead accruals of distressed firms, I add **distress** variable and an interaction term between Expected Volatility and Distress and in the model (2). Distress score for each firms is calculated by the Emerging Market Z-Score model (EM Z-Score Model) discovered by Altman (1993). The model is provided in Appendix (Table A). Then, I define Distress as a dummy variable set to one when the Z-score for emerging market is below 1.1 in year t which denotes that firm has a very high probability of reaching the stage of bankruptcy. The Altman's Z-score model for emerging market is widely used in many literature in Thailand (e.g. Tangkanjanapas, 2013; Meeampol et al., 2014; Khruachalee et al., 2016). The regression model, with all the control variables, is as follows:

$$
\begin{aligned}
WC\ Accruals_{i,t+1} = {} & \beta_i + \beta_1 Expected\ Volatility_{i,t} + \\
& \beta_2 Expected\ Volatility_{i,t} \times Distress_{i,t} + \beta_3 Distress_{i,t} + \\
& \beta_4 Firm\ Size_{i,t} + \beta_5 Market\ to\ Book_{i,t} + \beta_6 Leverage_{i,t} + \\
& \beta_7 Cash\ Flow\ from\ Operations_{i,t} + \beta_8 Returns_{i,t+1} + \\
& \beta_9 Recession\ Indicator_{i,t+1} + \beta_{10} Interest\ Rate_{i,t+1} + \\
& Year\ Fixed\ Effects + \varepsilon_{i,t+1} \qquad (2)
\end{aligned}
$$



According to model (2), for supporting the test of $H_2$, I expect to see the positive effect of the expected volatility on year-ahead working capital accruals of distressed firms which is ($\beta_1 + \beta_2$) and see whether it is significant by testing F-statistics.

- *The relationship between accruals and volatility for long operating cycle firms*

Concerning the effect of expected volatility on year-ahead accruals of long operating cycle firms, I run a regression between accruals and an interaction term between Expected Volatility and operating cycle in the model (3). **Operating cycle** (Opcycle) is defined as the average of timing between cash disbursement to produce an inventory and cash received from the sale of an inventory (Dechow, 1994). Moreover, I test model (1) separately in each operating cycle quintile. The results is in the following regression equation:

$$
\begin{aligned}
WC\ Accruals_{i,t+1} = {} & \beta_i + \beta_1 Expected\ Volatility_{i,t} + \\
& \beta_2 Expected\ Volatility_{i,t} \times Opcycle_{i,t} + \beta_3 Opcycle_{i,t} + \\
& \beta_4 Firm\ Size_{i,t} + \beta_5 Market\ to\ Book_{i,t} + \beta_6 Leverage_{i,t} + \\
& \beta_7 Cash\ Flow\ from\ Operations_{i,t} + \beta_8 Returns_{i,t+1} + \\
& \beta_9 Recession\ Indicator_{i,t+1} + \beta_{10} Interest\ Rate_{i,t+1} + \\
& Year\ Fixed\ Effects + \varepsilon_{i,t+1}
\end{aligned}
\tag{3}
$$

For the test of $H_3$, I expect to see the significantly negative relationship between year-ahead accruals and the interaction term between Expected Volatility and Opcycle. Furthermore, in the view of the operating cycle lengthens, I expect to see that the negative effect of expected volatility on year-ahead accruals is stronger in high operating cycle quintile to support $H_3$.

In addition, I combine model (2) and model (3) as the following regression:

$$
\begin{aligned}
WC\ Accruals_{i,t+1} = {} & \beta_i + \beta_1 Expected\ Volatility_{i,t} + \\
& \beta_2 Expected\ Volatility_{i,t} \times Distress_{i,t} + \beta_3 Distress_{i,t} + \\
& \beta_4 Expected\ Volatility_{i,t} \times Opcycle_{i,t} + \beta_5 Opcycle_{i,t} + \\
& \beta_6 Firm\ Size_{i,t} + \beta_7 Market\ to\ Book_{i,t} + \beta_8 Leverage_{i,t} + \\
& \beta_9 Cash\ Flow\ from\ Operations_{i,t} + \beta_{10} Returns_{i,t+1} + \\
& \beta_{11} Recession\ Indicator_{i,t+1} + \beta_{12} Interest\ Rate_{i,t+1} + \\
& Year\ Fixed\ Effects + \varepsilon_{i,t+1} \qquad (4)
\end{aligned}
$$

According to model (4), I expect to see the result is the same as presented in model (1), model (2) and model (3) which is consistent with $H_1$, $H_2$ and $H_3$.

## 5. Empirical results

### 5.1 Association between accruals and volatility

The first hypothesis predicts that the level of accruals is negatively associated with volatility. Table 2 provides the regression result of model (1). The coefficient of expected volatility is -3.857 which is negative and statistically significant at 1% level. The result is consistent with the prediction of a real options-based investment approach that firms with higher expected volatility have lower accruals which supports $H_1$. Also, the result supports the findings of Arif et al. (2016) which suggests that firms will be more careful to make an investment decision during the periods of high volatility because they prefer to wait and see instead of immediate investment.

Besides, the coefficient of Market to Book is 0.0185 which is statistically significant and positive at the significance level of 1%, indicating that year-ahead working capital accruals of the firms increase when they have higher current expected growth. The reason is that there are more opportunities to success in the future project so firms decide to invest more. For the year-ahead control variables, the coefficient on Returns is 0.0296 which is positive and statistically significant at 1% level, indicating that firms invest more when they have higher return. I also find positive coefficient value of 0.89 on Interest Rate and statistically significant at 5% level, suggesting that firms decide to invest immediately in high interest rate period. These results are consistent with Eisdorfer (2008). Moreover, the coefficient of Firm size, Leverage, Cash Flow from Operations and Recession Indicator are not statistically significant.

**Table 2: Regression results of expected volatility on working capital accruals**

This table shows regression results of the effect of expected volatility on year-ahead working capital accruals to test the first hypothesis. The definition of variables is provided in the Appendix (Table A).

$$WC\ Accruals_{i,t+1} = \beta_i + \beta_1 Expected\ Volatility_{i,t} + \beta_2 Firm\ Size_{i,t} + \beta_3 Market\ to\ Book_{i,t} + \beta_4 Leverage_{i,t} + \beta_5 Cash\ Flow\ from\ Operations_{i,t} + \beta_6 Returns_{i,t+1} + \beta_7 Recession\ Indicator_{i,t+1} + \beta_8 Interest\ Rate_{i,t+1} + Year\ Fixed\ Effects + \varepsilon_{i,t+1}$$

| VARIABLES | Year-ahead Working Capital Accruals |
|---|---|
| Expected Volatility | -3.857*** |
| | (0.9410) |
| Firm size | 0.0060 |
| | (0.0074) |
| Market to Book | 0.0185*** |
| | (0.0057) |
| Leverage | -0.0142 |
| | (0.0297) |
| Cash Flow from Operations | 0.0039 |
| | (0.0116) |
| Returns | 0.0296*** |
| | (0.0069) |
| Recession Indicator | -0.0080 |
| | (0.0064) |
| Interest Rate | 0.890** |
| | (0.4280) |
| Constant | -0.0275* |
| | (0.0160) |
| Observations | 3,145 |
| R-squared | 0.021 |

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

**5.2 Association between accruals and volatility for distressed firms**

This section examines whether the negative effect of volatility on accruals is weaker for distressed firm. Panel A of Table 3 shows the regression results of model (2). To find the impact of working capital accruals on volatility for distressed firm, I test F statistics and provide the result in Panel B. According to Panel B of Table 3, the coefficient on the Expected Volatility plus the coefficient on the interaction term between Expected Volatility and Distress (Expected Volatility x Distress) which is ($\beta_1 + \beta_2$) is 0.0061. It is positive and statistically significant at 5% level. This is consistent with Eisdorfer (2008) and Arif et al. (2016) which note that financially distressed firms decide to invest in risky projects since they provide an opportunity for shareholders to receive higher return. Thus, this result provides strong support for $H_2$ which is the negative association between the level of accruals and volatility is weaker for distressed firm.

Moreover, according to Panel B of Table 3, the coefficient of Firm size is 0.0083 which is positive and statistically significant at 1% level, indicating that big firms invest more than small firms. The coefficient on Recession indicator is -0.0062 which is negative and statistically significant at 10% level, suggesting low investment during a recession. Furthermore, the coefficient of expected volatility is statistically negative significant and other variables which are Returns and Interest rate are also statistically positive significant and have consistent results as described in Table 2.

**Table 3: Regression results of the interaction between expected volatility and financially distressed on accruals**

This table shows regression results of the effect of expected volatility on year-ahead working capital accruals for distressed firms to provide support for the second hypothesis. It is separated into 2 panels which are A and B. Panel A shows regression results that tests the relationship of expected volatility and financially distressed on year-ahead working capital accruals. Panel B shows the F statistics result of the impact of expected volatility on year-ahead working capital accruals for distressed firm ($\beta_1$+$\beta_2$). The definition of variables is provided in the Appendix (Table A).

$$WC\ Accruals_{i,t+1} = \beta_i + \beta_1 Expected\ Volatility_{i,t} + \beta_2 Expected\ Volatility_{i,t} \times Distress_{i,t} + \beta_3 Distress_{i,t} + \beta_4 Firm\ Size_{i,t} + \beta_5 Market\ to\ Book_{i,t} + \beta_6 Leverage_{i,t} + \beta_7 Cash\ Flow\ from\ Operations_{i,t} + \beta_8 Returns_{i,t+1} + \beta_9 Recession\ Indicator_{i,t+1} + \beta_{10} Interest\ Rate_{i,t+1} + Year\ Fixed\ Effects + \varepsilon_{i,t+1}$$

*Panel A: Interaction of expected volatility and financially distressed on accruals*

| VARIABLES | Year-ahead Working Capital Accruals |
|---|---|
| Expected Volatility | -0.172** |
| | (0.0762) |
| Expected Volatility x Distress | 0.178** |
| | (0.0742) |
| Distress | 0.0207* |
| | (0.0115) |
| Firm size | 0.0083*** |
| | (0.0024) |
| Market to Book | 0.0014 |
| | (0.0009) |
| Leverage | 0.0142 |
| | (0.0140) |
| Cash Flow from Operations | 0.0006 |
| | (0.0057) |
| Returns | 0.0210*** |
| | (0.0036) |
| Recession Indicator | -0.0062* |
| | (0.0032) |
| Interest Rate | 0.669*** |
| | (0.2120) |
| Constant | -0.0096 |
| | (0.0078) |
| Observations | 3,145 |
| R-squared | 0.028 |

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1



*Panel B: F-Statistics of the impact of expected volatility on accruals for distressed firm*

| VARIABLES | Year-ahead Working Capital Accruals |
|---|---|
| Expected Volatility + (Expected Volatility x Distress) | 0.0061 |
| F-test | 2.40 |
| P-value | 0.0172 |

**5.3 Association between accruals and volatility for long operating cycle firms**

This section examines whether the negative effect of volatility on accruals is stronger for long operating cycle firms. The regression result of model (3) is shown in table 4. Panel A of Table 4 presents the coefficient of -5.359 on the interaction term between Expected Volatility and Operating cycle (Expected Volatility x OpCycle) which is negative and statistically significant at 5% level, indicating that long operating cycle firms prefer to delay their investment decision because they have more opportunities to receive higher possible investment outcome. This is consistent with the prior research (Hosseinimehr and Nourifard, 2014). Besides, the coefficient on expected volatility and other variables which are Market to Book and Returns are statistically positive significant at 1% level and have the same results as presented in Table 2 and Table 3.

In addition, to examine more clearly about the effect of the interaction term between operating cycle and expected volatility on the year-ahead working capital accruals, Panel B of Table 4 presents the regression of accruals on expected firm volatility and controls variables as model (1) by each operating cycle quintile. Column (1) to Column (5) of Panel B show the regression results from lowest operating cycle quintile to highest operating cycle quintile.



According to Panel B of Table 4, the results show that the coefficient on Expected Volatility of the first operating cycle quintile is 0.677 (Column 1) which is statistically positive significant. Then, the coefficients on Expected Volatility is statistically negative significant in higher operating cycle quintile that shown in the fourth and the fifth operating cycle quintile (Column 4 and Column 5). These results provide strong support for the third hypothesis which is the negative association between the level of accruals and volatility is stronger for long operating cycle firms.

**Table 4: Regression results of the interaction between expected volatility and operating cycle on accruals**

This table shows regression results of the effect of expected volatility on year-ahead working capital accruals for long operating cycle firms to support the third hypothesis. It is separated into 2 panels which are A and B. Panel A shows regression results that tests the relationship of expected volatility and operating cycle on year-ahead working capital accruals. Panel B shows regression results of expected volatility on accruals from model (1) by each operating cycle quintile. The results are shown in ascending order from lowest operating cycle quintile (low operating cycle firms) in Column (1) to highest operating cycle quintile (high operating cycle firms) in Column (5). The definition of variables is provided in the Appendix (Table A).

$$WC\ Accruals_{i,t+1} = \beta_i + \beta_1 Expected\ Volatility_{i,t} + \beta_2 Expected\ Volatility_{i,t} \times Opcycle_{i,t} + \beta_3 Opcycle_{i,t} + \beta_4 Firm\ Size_{i,t} + \beta_5 Market\ to\ Book_{i,t} + \beta_6 Leverage_{i,t} + \beta_7 Cash\ Flow\ from\ Operations_{i,t} + \beta_8 Returns_{i,t+1} + \beta_9 Recession\ Indicator_{i,t+1} + \beta_{10} Interest\ Rate_{i,t+1} + Year\ Fixed\ Effects + \varepsilon_{i,t+1}$$

*Panel A: Interaction of expected volatility and operating cycle on accruals*

| VARIABLES | Year-ahead Working Capital Accruals |
|---|---|
| Expected Volatility | -4.494*** |
| | (1.0050) |
| Expected Volatility x OpCycle | -5.359** |
| | (2.9330) |
| Opcycle | -0.0181 |
| | (0.0116) |
| Firm size | 0.0058 |
| | (0.0074) |
| Market to Book | 0.0172*** |
| | (0.0057) |
| Leverage | -0.0147 |
| | (0.0297) |
| Cash Flow from Operations | 0.0035 |
| | (0.0116) |
| Returns | 0.0272*** |
| | (0.0070) |
| Recession Indicator | -0.0094 |
| | (0.0065) |
| Interest Rate | 0.652 |
| | (0.4420) |
| Constant | -0.0192 |
| | (0.0165) |
| Observations | 3,145 |
| R-squared | 0.023 |

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

**Table 4: Regression results of the interaction between expected volatility and operating cycle on accruals (cont.)**

*Panel B: Regression results of expected volatility on accruals categorized by operating cycle quintile*

| OpCycle Quintile | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|
| VARIABLES | Year-ahead Working Capital Accruals | | | | |
| Expected Volatility | 0.677*** | -0.0015 | -0.262 | -0.363** | -1.196* |
| | (0.2610) | (0.1200) | (0.5730) | (0.1790) | (1.1550) |
| Firm size | 0.0093 | 0.0007 | -0.0055 | 0.0097 | 0.0133 |
| | (0.0143) | (0.0110) | (0.0274) | (0.0111) | (0.0217) |
| Market to Book | 0.0022 | 0.0130* | -0.0005 | 0.0091 | 0.0156 |
| | (0.0093) | (0.0072) | (0.0191) | (0.0074) | (0.0142) |
| Leverage | -0.0739 | 0.0176 | 0.445*** | 0.00798 | 0.122 |
| | (0.0751) | (0.0546) | (0.1260) | (0.0516) | (0.0801) |
| Cash Flow from Operations | -0.0236 | -0.126*** | 0.233*** | -0.0133 | -0.0028 |
| | (0.0364) | (0.0294) | (0.0607) | (0.0281) | (0.0234) |
| Returns | 0.0558*** | 0.0153 | -0.0529** | 0.0426*** | 0.0386** |
| | (0.0161) | (0.0125) | (0.0265) | (0.0112) | (0.0185) |
| Recession Indicator | 0.0152 | -0.0247** | 0.0021 | -0.0332*** | -0.0578*** |
| | (0.0132) | (0.0112) | (0.0230) | (0.0102) | (0.0213) |
| Interest Rate | 0.446 | 1.538* | 0.0715 | -0.210 | 3.480*** |
| | (0.9610) | (0.8140) | (1.5920) | (0.7260) | (1.3040) |
| Constant | 0.0196 | -0.0370 | -0.177*** | 0.0011 | -0.145*** |
| | (0.0403) | (0.0306) | (0.0669) | (0.0262) | (0.0414) |
| Observations | 618 | 630 | 621 | 637 | 629 |
| R-squared | 0.046 | 0.072 | 0.069 | 0.060 | 0.056 |

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Moreover, in order to make sure that the results are consistent, I combine the model (2) and model (3) as shown in model (4) and test the regression model. The result from this regression is presented in Table 5. It is not different as previously described in the analysis of the results from Table 2, 3 and 4. Therefore, it can be concluded that the results from all model are precise and consistent. To sum up, the coefficient of expected volatility is negative and statistically significant at 1% level. The coefficient on the interaction term between Expected Volatility and Distress (Expected Volatility x Distress) is positive and statistically significant at 1% level. Also, the coefficient on the interaction term between Expected Volatility and Operating cycle (Expected Volatility x OpCycle) is negative and statistically significant at 1% level. Besides, the other significant variables which are Market to book Equity, Returns and Interest Rate are positive and statistically significant at 5%, 1% and 5% level, respectively. Thus, these results provide strong support for $H_1$, $H_2$ and $H_3$.

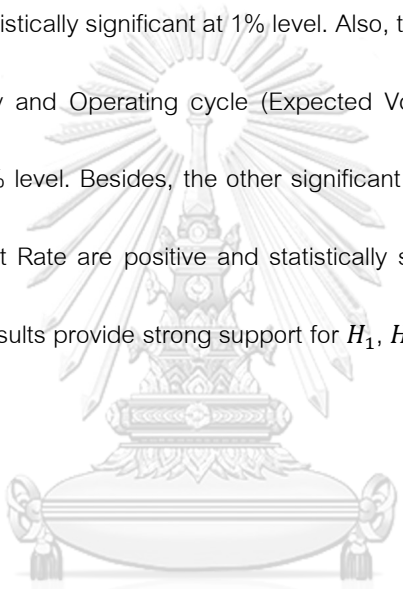

**Table 5: Regression results of expected volatility on accruals and other control variables**

This table shows regression results of the relationship between expected volatility on year-ahead working capital accruals and other control variables. The definition of variables is provided in the Appendix (Table A).

$$WC\ Accruals_{i,t+1} = \beta_i + \beta_1 Expected\ Volatility_{i,t} + \beta_2 Expected\ Volatility_{i,t} \times Distress_{i,t} + \beta_3 Distress_{i,t} + \beta_4 Expected\ Volatility_{i,t} \times Opcycle_{i,t} + \beta_5 Opcycle_{i,t} + \beta_6 Firm\ Size_{i,t} + \beta_7 Market\ to\ Book_{i,t} + \beta_8 Leverage_{i,t} + \beta_9 Cash\ Flow\ from\ Operations_{i,t} + \beta_{10} Returns_{i,t+1} + \beta_{11} Recession\ Indicator_{i,t+1} + \beta_{12} Interest\ Rate_{i,t+1} + Year\ Fixed\ Effects + \varepsilon_{i,t+1}$$

| VARIABLES | Year-ahead Working Capital Accruals |
|---|---|
| Expected Volatility | -4.241*** |
| | (1.0900) |
| Expected Volatility x Distress | 3.222*** |
| | (1.0380) |
| Distress | 0.0533*** |
| | (0.0197) |
| Expected Volatility x OpCycle | -8.211*** |
| | (2.0890) |
| Opcycle | 0.0198* |
| | (0.0110) |
| Firm size | 0.0047 |
| | (0.0056) |
| Market to Book | 0.0095** |
| | (0.0038) |
| Leverage | -0.0256 |
| | (0.0254) |
| Cash Flow from Operations | -0.0036 |
| | (0.0097) |
| Returns | 0.0367*** |
| | (0.0062) |
| Recession Indicator | -0.0077 |
| | (0.0054) |
| Interest Rate | 0.757** |
| | (0.3630) |
| Constant | -0.0003 |
| | (0.0139) |
| Observations | 3,145 |
| R-squared | 0.033 |

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

## 6. Conclusion

The purpose of this paper is to examine the relation between accruals and volatility which reflect to firm's investment decision. The data are collected from Stock Exchange of Thailand (SET) during 2009-2018. This research views working capital accruals as a result of investment decision and adopts a real options-based investment framework which suggests that firms prefer to wait and see instead of immediate investment during high volatility period. My findings confirm that the expected firm volatility has statistically impact on the firm's accruals. When the volatility of firm is higher, the year-ahead working capital accruals become lower and vice versa.

Moreover, I find that the negative effect of expected volatility on year-ahead working capital accruals is weaker for financially distressed firms. This implies that firm management decides to invest more if the firm faces a financial distress situation. In addition, this paper finds that the negative effect of expected volatility on year-ahead working capital accruals is more pronounced for long operating cycle firms. This implies that longer operating cycle firms do not decide to invest immediately, they prefer to wait until a project is clearly desirable. Specially, my findings provide evidence to confirm that firm's expected volatility affects investment behavior which is viewed from year-ahead accruals. However, this paper has different views from prior accrual literatures because I examine the result from information that is known before which is consistent with Zhang (2007) and Arif et al.(2016), whereas others focus on identifying managerial discretion from information which is known in the same year (e.g. Dechow et al., 2008; Zang, 2011; Chen et al, 2012).

My findings provide an understanding of the cross-sectional and time-varying economic factors that impact on the accruals of the firm which is benefit to many groups of people including managers, shareholders, investors, and other stakeholders. In addition, it can help researchers for

predicting accruals based on firm's characteristics and economic conditions. Besides, this research focuses on the data in Thailand which is emerging market so that the results may be applicable to other countries which have same characteristics.

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# Appendix

Table A: Variable definitions

| Variables | Definition |
|---|---|
| Working Capital Accruals | Net change in operating working capital (Change in accounts receivable + Change in inventories + Change in other current assets) – (Change in accounts payable + Change in other current liabilities), scaled down by beginning of total assets. |
| Expected Volatility | Expected volatility is calculated by using a GARCH (1,1) model to daily firm-specific stock returns and convert to yearly data. |
| Distress | Distress is a dummy variable set to one when EM Z-Score of the company is less than 1.1 in year t.<br>Z-Score for emerging market is calculated as:<br>$Z = 3.25 + 6.56X_1 + 3.26X_2 + 6.72X_3 + 1.05X_4$<br>Whereas; $X_1$ = Current Assets - Current Liabilities / Total Assets<br>$X_2$ = Retained Earnings / Total Assets<br>$X_3$ = Earnings Before Interest and Taxes / Total Assets<br>$X_4$ = Book Value of Equity / Total Liabilities<br>If $Z > 2.6$ = safe zone (low chance of bankruptcy)<br>$1.1 < Z < 2.6$ = grey zone (moderate chance of bankruptcy)<br>$Z < 1.1$ = distress zone (high chance of bankruptcy) |
| Operating Cycle | Operating Cycle is calculated by average accounts receivable divided by (sales/360), plus average inventory divided by (cost of goods sold/360). |
| Firm size | Firm size is measured as market capitalization in year t scaled down by beginning of total assets. |
| Market-to-Book Equity | The equity market value divided by the book value of the equity. |
| Leverage | The value of total liabilities divided by the value of total assets. |
| Cash Flow from Operations | Operating income less working capital accruals, scaled down by beginning total assets. |
| Returns | The fiscal year return for the firm's stock. |
| Recession Indicator | Dummy variable set to one when Thailand fall into an economic recession which is announced by The Office of the National Economic and Social Development Council (NESDC). |
| Interest Rate | The rate refers to the monetary policy rate from the Bank of Thailand (BOT). |

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| | |
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| DATE OF BIRTH | 27 September 1994 |
| PLACE OF BIRTH | Bangkok, Thailand |
| INSTITUTIONS ATTENDED | Chulalongkorn University |
| HOME ADDRESS | 91/359 Maneerin Village, Rattanathibet Road, Sai ma, Mueang, Nonthaburi, Thailand |