การควบคุมราคาหุ้นก่อนถึงวันหมดอายุหุ้นใบสำคัญแสดงสิทธิ; หลักฐานจากตลาดหลักทรัพย์ไทย

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วิทยานิพนธ์นี้เป็นส่วนหนึ่งของการศึกษาตามหลักสูตรปริญญาวิทยาศาสตรมหาบัณฑิต
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Stock price management prior to warrant expirations; Evidence from Stock Exchange of Thailand

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หัวข้อวิทยานิพนธ์	การควบคุมราคาหุ้นก่อนถึงวันหมดอายุหุ้นใบสำคัญแสดงสิทธิ; หลักฐานจากตลาดหลักทรัพย์ไทย
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อาจารย์ที่ปรึกษาวิทยานิพนธ์หลัก	อาจารย์ ดร.ธนวิต แซ่ซือ

คณะพาณิชยศาสตร์และการบัญชี จุฬาลงกรณ์มหาวิทยาลัย อนุมัติให้นับวิทยานิพนธ์ฉบับนี้เป็นส่วนหนึ่งของการศึกษาตามหลักสูตรปริญญาวิทยาศาสตรมหาบัณฑิต

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วัฒนพาศน์ รุ่งจรูญ : การควบคุมราคาหุ้นก่อนถึงวันหมดอายุหุ้นใบสำคัญแสดงสิทธิ; หลักฐานจากตลาดหลักทรัพย์ไทย. (Stock price management prior to warrant expirations; Evidence from Stock Exchange of Thailand) อ.ที่ปรึกษาหลัก : อ. ดร.ธนวิต แซ่ซือ

การแทรกแซงของ บริษัท ในตลาดหุ้นเกิดขึ้นทั่วโลกผ่านการเปิดเผยข้อมูลการดำเนินงานด้านบัญชีและการเงินที่ใช้ประโยชน์จากความไร้ประสิทธิภาพของตลาดที่มีอยู่ มันเกิดจากความไม่สมดุลของข้อมูลที่ยังคงมีอยู่ระหว่างฝ่ายต่าง ๆ มักจะทำให้เกิดการสูญเสียที่หลีกเลี่ยงไม่ได้กับนักลงทุน การวิจัยนี้ตรวจสอบผ่านเครื่องมือทางการเงินที่ช่วยให้เกิดความกระจ่างว่าการจัดการราคาของ บริษัท ดำเนินการอย่างไรในตลาดหุ้นไทยโดยเฉพาะก่อนวันใช้สิทธิ การผันผวนของราคาหุ้นก่อนวันหมดอายุของใบสำคัญแสดงสิทธิจะถูกตรวจสอบเพื่อกำหนดลักษณะการปรับราคาและระดับความอ่อนไหว ผลแสดงให้เห็นว่าผลตอบแทนที่ผิดปกติเชิงลบเกิดขึ้นในช่วงเวลา [42, 84] วันก่อนที่ใบสำคัญแสดงสิทธิ ITM จะหมดอายุ ตัวแปรขององค์กรพิสูจน์แล้วว่ามีผลกระทบต่อระดับความอ่อนไหวของการเคลื่อนไหวในราคาหุ้นซึ่งเป็นผลมาจาก บริษัท มีอัตราส่วน D/E สูง CGR และ MCAP แสดงให้เห็นถึงความต้านทานต่อการเคลื่อนไหวของราคาหุ้นติดลบ การปรับราคามีความเป็นไปได้ที่จะได้รับผลกำไรจากการเคลื่อนไหวของราคาหุ้น อย่างไรก็ตามทางงานวิจัยจำเป็นต้องมีข้อมูลเพิ่มเติมเกี่ยวกับวิธีการดำเนินการจัดการเพื่อยืนยันทฤษฎีนี้ ผู้ลงทุนควรตระหนักถึงความเสี่ยงและหลีกเลี่ยงการซื้อขายในทางตรงกันข้ามของทิศทางของการเคลื่อนไหวในราคาหุ้นในช่วงเวลาที่ใบสำคัญแสดงสิทธิใกล้วันหมดอายุ

สาขาวิชา การเงิน ลายมือชื่อนิสิต .....

ปีการศึกษา 2562 ลายมือชื่อ อ.ที่ปรึกษาหลัก .....

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Firm intervention in the stock market appears globally through information disclosure, accounting and financial operations exploiting the existing market inefficiency. It stems from information asymmetry that persists between parties often causing inevitable loss to investors. This research investigated through financial tools contributing clarification how firms' price manipulation operate in Thai stock market particularly prior to warrant expiration date. Abnormal return pattern prior to warrant expiration date is monitored in order to determine price manipulation appearance and sensitivity level. The result shows that negative additional abnormal return occurred in [42, 84] days time window prior to ITM warrant expiration. Specific corporate variables proven to have impact on the share price movement sensitivity level with result from firms contain high D/E ratio CGR and MCAP illustrate resistance toward the negative price movement. The abnormal share price movements near expiry dates are consistent with what one would expect to see if prices were indeed manipulated. However, additional information on how the manipulation is conducted is required in order to confirm the theory. Investors should be aware of the risk and avoid trading against the direction of the price movement near the warrant expiration date.

Field of Study: Finance Student's Signature .....

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วัฒนพาศน์ รุ่งจรูญ

สารบัญ

หน้า

1. Introduction

Firm intervention in the stock market appears globally through information disclosure, accounting and financial operations exploiting the existing market inefficiency. It stems from information asymmetry that persists between parties often causing inevitable loss to investors. This research investigated through financial tools contributing clarification how firms' price manipulation operate in Thai stock market. In particular, we observed European-style call warrants issued by listed firms in the Stock Exchange of Thailand (SET) to identify the cross-instrument manipulation in the stock price. Furthermore, we aim to elaborate market issuers' incentive on executing price manipulation referring to past research. We monitored firm abnormal return pattern prior to warrant expiration date in order to determine price manipulation appearance and sensitivity level. Our prediction is that price manipulation in emerging market such as Thai market has higher chance to occur with firm abnormal return change unconventionally (either positive or negative depending on the issuer position) 42 and 126 trading days prior the warrants expiration date.

Warrants issuance is an alternative option chosen by firms which lack credibility to finance through equity. Firms portray warrants as sweetener often attached to corporate bonds inducing investors' fund. Investors benefit significantly from purchasing warrants as a long-term investment due to its lifespan. They receive the right to buy fixed amounts of newly issued shares at maturity date (or multiple predetermined dates) at an agreed price written by the issuer firm, called strike price. However, investors can also detach the warrant from the corporate bond and trade it independently to gain profit from gearing. These positive outcomes heavily rely on the principle which relates the warrant strike price and the underlying stock price at the warrant's maturity date. As for investors, profitability from

warrant exercise occurs when the underlying stock price rises above the strike price at expiration. In addition, warrant holders have the option to sell warrant before maturity date, realising the profit prior to expiration date from the warrant premium. On the other hand, the benefits to the issuers are two-fold. First, issuer gains profit from the sale of warrants at issuance, secondly, possibly when warrants are exercised depending on circumstances. The profit from a warrant exercise is situational which the issuer tend to capitalise on by steering market information in their favour. One of the big concerns for issuer is share dilution effect with respect to the new share issuance. The scale of share dilution effect ranges from severe losses in EPS and capital to none. This depends on the gap between capital raised and number of new shares being issued. This leads firm to execute price manipulation at certain period in order to protect shareholders from loss. Warrant issuance creates opportunity for every parties involved, for example, giving a young growth firm financing alternative, and giving buyers opportunistic profit through trade and exercise.

Price manipulation relationship with warrants depends on the level of profitability and loss from new share issuance at exercise date. It is significantly crucial for the firm to counteract the dilution effect to protect losses in shareholder value. The key components lie in the level of warrant strike price and the price of underlying stock which together determine dilution existence and profitability from new share issuance. Price manipulation operates in two different ways where manipulation direction depends on firm incentives. Positive manipulation is expected when firm try to discourage holders from exercising warrant through share price increase. Whereas, negative manipulation aims to refrain holder from exercising by influencing the stock price to fall. Whether the manipulation exists, it should exist in the incentive driven manner. Firm management must weigh all the profit and loss from all the possible outcomes and decide whichever best benefits shareholders

of the firm. Generally speaking, there are many ways for the firm's management to manipulate stock price. The firm manager can manipulate the stock price by producing good and bad announcements prior the warrant exercise date. Alternatively, management can manipulate stock price by releasing false news, though this could hurt firm's credibility in the long run. Financial operations such as share repurchase allow firm to influence price through indirect signaling. Others include the sale or purchase of stock from CEO or major shareholders. All of these methods are valid only when there is information asymmetry between parties assuming that the market is not perfectly efficient. Findings of price manipulation related to warrants have been studied but still lack consensus result comparing to other financial events. Additional findings will provide better understanding to firm behaviour and strategy in the market leading to higher market efficiency.

Asset price manipulations share the same goal on capitalising information asymmetry from buyers but deviate from each other in certain factors. For warrant issuers, they aim to counteract the dilution effect and maximise shareholders' profit. Their ability to determine the firm performance over the buyers give them significantly higher advantage over their counterpart. If our findings uncover that firms manipulate share price but by decreasing the underlying stock price. This will imply that firms do not focus only on share dilution counter. We can assume that they may have other incentive to act unconventionally regarding to dilution effect. Price manipulation on warrants is crucial for many stakeholders such as retail investors, institutional investors, firms or issuers of assets. Retail investors will face high risk from high degree of manipulation due to increase in volatility. This party suffer most from information asymmetry but not from amount of capital loss. Whereas, Fund managers will suffer most from capital loss regarding of their asset agreement with

their clients. The issuers gain the most benefit from either high or low degree as they are the market maker in this scenario. In general, issuer hold the highest stake and also control over warrant issuance which offer them higher profit opportunity than other stakeholders.

In this paper, we will investigate stock price manipulation prior to warrant expirations using evidence from Stock Exchange of Thailand. We aim to explore firms' method and motivation in manipulating stock price. We look at European style call warrants issued by listed firms in SET to find out if there is a cross-instrument manipulation. Our approach is to analyse firms' stock price pattern and trading volume to identify issuer firms' price manipulation signal in the market. We anticipate that the issuer firms' stock price pattern at 42 and 126 trading days and trading volume prior the asset expiration date will change regarding to issuers' incentive. If the test shows significant result, we can claim that information asymmetry exist in Thai market and the market is not perfectly efficient. This research will contribute to better understanding of Thai market to all the stakeholders in the market.

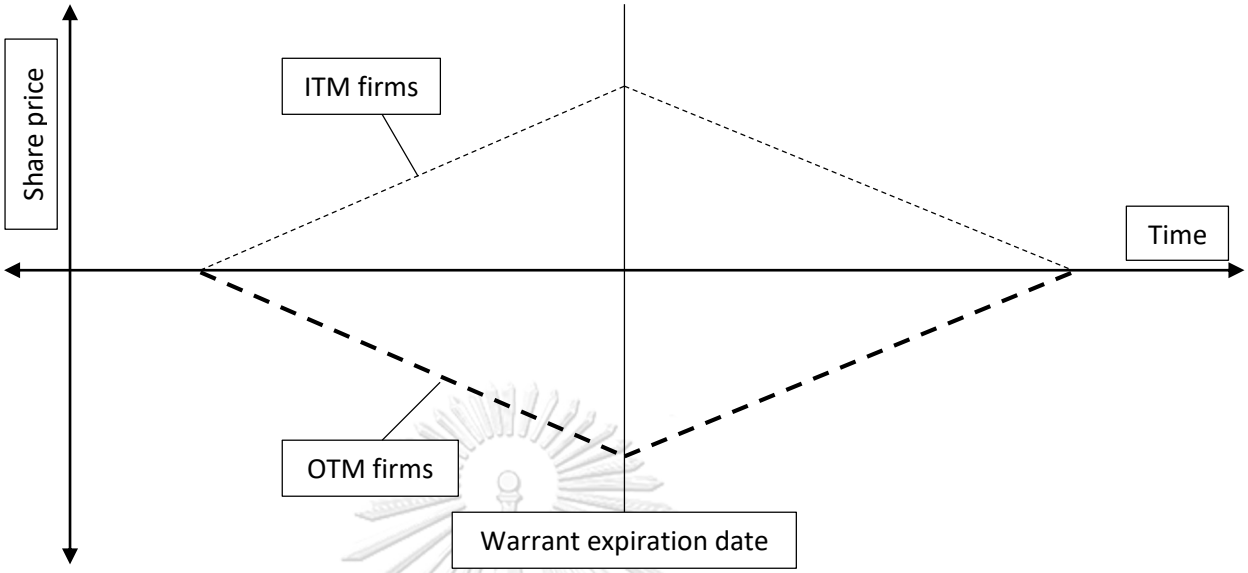
1.1 Background

Warrants

Warrants operate almost identical to option in that both instruments give the holder the right to buy (or sell) fixed amounts of shares at a certain date and price. However, there are major differences between the two instruments. First, warrants can only be issued by the listed company itself unlike options which are often issued freely by third party issuer. Firms issue warrants as an alternative way to raise capital, and written terms and conditions

to provide best interest for both parties. In addition, warrants also typically have longer maturity date which can last up to 15 years, whereas option maximum maturity date is between 2 to 3 years. This short maturity of options is preferable as a hedging instrument compared to warrant due to higher turnover rate. On the contrary, warrants have the ability to yield higher return despite of higher risk. Statistically speaking, warrants are more suitable for long-term investment. Additionally, firms often attach warrant with a security such as corporate bond to induce investors. This type of package is called "unit offering". Unit offering give investors an alternative option to invest with gearing mechanic but as a long-term investment comparing to option. Nevertheless, warrant can be detached from the bond and trade independently after it is bought, giving investor flexibility and liquidity if needed. Furthermore, warrant issuance and option issuance cause different effects to the existing shareholders. Warrants cause new share issuance when exercised which lead to dilution effect in the existing share and directly to the underlying share price. Options, on the other hand, do not have dilution effect as the issuer are obligated to provide equity to buyer when maturity date reach. Existing shareholder benefit from option issue by gaining insights on the firm performance and subsequently yield higher return or hedge depending on price movement. If the firm issue the option, this brings the management and shareholders' attention to the warrant maturity date. Dilution effect is considered a threat from existing shareholder because earning per share (EPS) and ownership will decrease depending on various factors (underlying stock price; exercise price; quantity of the newly issue share at the exercise date). On the other hand, the dilution effect could also benefit the firm in the long run if the capital received yield returns in the future leading to stock price increase.

Figure 1: Expectation of share price activity near warrant expiration period



Reference: Mary E. Barth; Kurt H. Gee; Doron Israeli and Ron Kasznik 2017. Stock price Management and share issuance: Evidence from equity warrants (April 27, 2017). Stanford University Graduate School of Business Research Paper No. 17-34

1.2 Objective

The goal of this paper is to investigate firm price manipulation prior the warrant expiration date. Price manipulation is proven to exist in the warrant market due to prevention of dilution effect and benefits to current shareholders (Mary E. Barth et al. 2017). However, many studies are based in developed markets and price manipulation in Thai market is still a mystery. We will monitor issuers' past behaviour through firms' abnormal return and trading volume change 42 and 126 trading days before warrant expiration date. Abnormal return and equity trading volume of selected firms' observation is crucial as it determine the firm's intervention in stock price despite the market trend. After the market trend has been minimised, we focus on the warrant position prior the expiration to understand firm incentive. At prior of warrant maturity date, share price acts as a signal to price manipulation since it determines the warrant value whether it will be in the money

(ITM) or out of the money (OTM). Dilution effect from ITM warrants implies significant concern for the management and existing shareholder in this scenario. Therefore, price manipulation is needed at pre-maturity date to counteract it (Kothari et al. 2016). Moreover, we implement various corporate factors into our method to search for specific characteristics contain in firms engaging in price manipulation. Since, it provides information which proven beneficial for future research.

2. Literature review

2.1 Firm issuance

Company financing signifies various future possibility and opportunity for every party. In the financial world, firm which enter the market signifies the need of capital to pursue specific objectives (Hansen & Crutchley, 1990); (How & Howe, 2001); (Taggart Jr, 1977). Taggart Jr (1977) discovered firm financing decision are influenced by certain factors and circumstances. The study finds that firms issue decisions depend on long-term debt capacity and desire of permanent capital. Debt and Equity (D/E) ratio signifies firm financing decision which management aim is to stabilise the balance sheet regarding to financial constraints. Timing strategies may affect the decisions as well (Aboody & Kasznik, 2000); (Cohen & Zarowin, 2010); (Howe & Su, 2001). Decline earnings is another factor which motivate firm capital issuing (Hansen & Crutchley, 1990). In addition, there are coefficients which have the ability to reflect firm financial constraints (Hadlock & Pierce, 2010). Hadlock and Pierce (2010) findings stated that size and age are crucial to firm financial constraints and argue that cash flow sensitive is ineffective. On the other hand, Kaplan and Zingales

(1995) beg to differ by stating the opposite. Both research strengthen the legitimacy of financial constraint affection on issuance decision.

Small cap firms suffer from financial constraints and tend to approach external financing. Since the assets and earnings depict low credibility comparing to glamour firms. Financial instruments such as warrants are implement to induce investors by small young firms (Howe & Su, 2001); (Schultz, 1993); (Chemmanur & Fulghieri, 1997). Unit warrants is one of most common asset use to offer a long-term investment to investors but is considered as high risk compare to corporate bond because of the gearing effect. This is because they were issued by high risk firms (Schultz, 1993). Thus, the market perspective of warrants is negative and biased due to the undiversified risk (Whited & Wu, 2006). In addition, High risk firms tend to issue underpriced "units" offering (equity and warrants) while lower risk firms issue underpriced equity alone during their initial public offerings (IPO) (Chemmanur & Fulghieri, 1997). Firms which issue units offering are more prone to inconsistent earnings in the future than firms issue equity only. Hansen and Crutchley (1990) found that the there is a positive correlation between amount of capital issued by the firm with chance of downturn earnings firms in the long term. According to Chemmanur and Fulghieri (1997), these firms are commonly listed by low reputation underwriters. Moreover, risky firms' existing shareholders benefit from the issuance by being able to sell their existing shares in order to reduce their risk regardless of unit offering or not.

2.2 Information asymmetry

Lakonishok, Shleifer, and Vishny (1994) claimed that contrarian (value) investment strategies give abnormal returns in the market due to lack of market efficiency. Investors

believe firm intrinsic value will reflect the stock price inevitably in the future which support this theory. Even though, this theory is still a controversial topic since people consider value as fundamentally a riskier investment. Additionally, individual investors are discerned as naïve due to their biased behavior and stock overvaluation (Siew Hong Teoh, Ivo Welch, & Tak Jun Wong, 1998b). This represent individual biased which institutional managers should be able to overcome. Typically, most of the managers still prefer glamour stocks over value because, they are facing time constraint or prudent factor or both. In theory, firms which undergo IPO contain 2 characteristic traits. First, the equity offering price is consider as underpriced. Second, IPO firms gain significantly high attention from the market (Ritter, 1991). Investor judgment is opaque from this factor which derive from lack of past data has been recorded by newly enter firm (Chan, Jegadeesh, & Lakonishok, 1996).

Analysts also have strong influence in the market through their future earnings forecast which can be biased. This was proven systematically by Dechow and Sloan (1997), which elucidate how naïve contrarian strategies investors appear in the market. It was speculated that many analysed firm returns were caused by extrapolation (LSV theory). Dechow and Sloan (1997) strongly inform that the analysts' earnings forecast have major impact on the stock price future increase. However, the analysts are not immune to earnings forecast error but are more capable of forecasting the shift of buy and sell recommendation. In general, the market is too pessimistic on expected long-run growth rate (E {g}) and vice versa (La Porta, 1996). This leads to low E {g} portfolio outperform the high E {g} portfolio.

Firm issue warrants at their IPOs in the market is have two implications. First, young firms issue warrants at their IPOs to prevent manager allocating the firm's money in non-

profit projects. On the contrary, signaling hypothesis prove that choice of securities issue represents information asymmetry (How & Howe, 2001). Moreover, firm performance decline after going through IPOs stage (Jain & Kini, 1994); (Ritter, 1991). The measurement of P/E ratio, market-to-book ratio and earning per share decrease subsequently. Evidently, there is a strong correlation between the firms post-IPO performance decrease with shareholder equity retention shift, especially from the founders (Jain & Kini, 1994). A third characteristic trait of IPO firm is underperformance comparing to market peer. Ritter (1991) control samples over 3 years provide consistent result on long-term underperform in post-IPO firm. Peer stocks in the market yield 61.9 percent returns comparing to post IPO firms which has only 34.5 percent return. The consistency of the test provided empirical data that investors are over optimistic about young firm earnings potential and firms capitalised on the opportunity. Similarly to IPO firm, SEO firm also fail in producing abnormal stock returns and net income comparing to non-issuer firms.

2.3 Price management

Price manipulation by firms can be identified in to three which consist of action based, information based, and traded based (Allen & Gale, 1992). All these strategies lead to one goal which is to change share price accordingly generating profitability. Stock individual return can be predicted through past earnings. Jegadeesh (1990) emphasise that the predictability of individual stock is close to the real returns in the experiment (2.49 percent marginal error). Firm which currently perform well tend to outperform underperforming firms in the market in the next 3-12 months period (Jegadeesh & Titman, 1993). Through this finding, it can be concluded that Investor expectation is biased to earning announcements (Siew Hong Teoh, Ivo Welch, & Tak J Wong, 1998a) ; (Chan et al.,

1996). Furthermore, winner firm continue to gaining abnormal return, while loser firm continue to having negative return subsequently. However, this pattern stops after two years. Accruals Manipulation (AM) and Real Activities Manipulation (RAM) are two key methods managers use to orchestrate stock price. Manager prefer to use RAM during equity offering even though it is more costly than AM. Real activities manipulation has a larger impact on company post-performance due to direct effect on the firm cash flow (Cohen & Zarowin, 2010). Kothari, Mizik, and Roychowdhury (2015) research found post stock market SEO underperformance is correlated with the RAM On the contrary, using balance sheet accruals approach instead of cash flow approach will likely to contaminate the findings. Earning management is measured using partitioning variable. If the variable is correlated with certain factors (M&A or Discontinued project). This will give an error or biased result, which lead to earning management existence when there is none (Hribar & Collins, 2002).

Past empirical data explains that management price manipulation strategy tend to cause firm failure in producing future positive abnormal stock returns and net income than non-issuer firms (Teoh et al., 1998a). Investors would have better opportunistic gains from investing in non-issuer firm (Loughran & Ritter, 1995). There are many theories to support this statement. Market responds to the new information from firms and react respectively regardless of the stock past records, data and other factors (Chan et al., 1996). Information asymmetry between investors and firm management explains the large drifts in the firm's future return. Moreover, Teoh et al. (1998a) research stated that firm which decided to issue IPO in the most "aggressive" quartile experience average of 15-30 percent lower stock return than firms decided to issue in most "conservative" quartile. In addition, conservative quartile IPO firms also have approximately 20% higher chance to issue seasoned equity offering in the next five years than aggressive quartile.

Historical data shows that management price manipulation strategy tend to cause firm failure in producing future positive abnormal stock returns and net income than non-issuer firms (Teoh et al., 1998b). Investors would have better opportunistic gains from investing in non-issuer firm (Loughran & Ritter, 1995). There are many theories support this statement. Market responds to the new information from firms and react respectively regardless of the stock past records, data and other factors (Chan et al., 1996). Information asymmetry between investors and firm management explains the large drifts in the firm's future return. Moreover, Teoh et al. (1998a) research stated that firm which decided to issue IPO in the most "aggressive" quartile experience average of 15-30 percent lower stock return than firms decided to issue in most "conservative" quartile. In addition, conservative quartile IPO firms also have approximately 20% higher chance to issue seasoned equity offering in the next five years than aggressive quartile.

Small growth firms commonly experience difficulty in financing externally. Financing small firms are considered high risk investment due to high exposure of information asymmetry. Therefore, these young firms tend to offer units offering[6] instead of equity alone. Howe and Su (2001) examined the effect of warrant exercise reduction announcements by young and small firm. The result shown that these announcements provide surprisingly positive feedbacks such as increase in warrant price, abnormal returns in the future, lower stock price decline comparing to equity financing only. Whereas, Howe and Wei (1993) focus on how the market react to firm warrants extension announcement. The warrant price rise after the announcement as the authors anticipate implementing option pricing theory and firms gain abnormal returns in the future on average. Stock price

also increase due to the warrants' maturity span increase. Although, in perfectly efficient market, warrants extension announcement should have no impact on the market reaction.

In previous research Aboody and Kasznik (2000), Barth, Gee, Israeli, and Kasznik (2017) stated that firm management orchestrate the stock price to prevent dilution in the existing shares. Shareholder perceive dilution effect as a threat due to share value drop. Thus, management implement anti-dilutive solution to reverse the share dilution effect through announcement timing and earning management. Chourou and Saadi (2009) found significant evidence of firm manipulation share price in 632 unscheduled stock option with 43% are cross listed in the U.S. They stated that listed U.S. firm associated Canadian regulation are likely to deliberately decrease share price 30 days prior the grant date. Consider option strike price is relative to underlying stock price giving the holders low strike price option. Share price then stabilise 30 days after the grant date determining full price manipulation cycle. Hence, CEOs receive 'in the money' option immediately after the option. In the U.S. market where market is expected to be highly efficient, manipulation of stock option exercise still exist. Specifically, in firms that have weak corporate governance. The probability of backdating option exercise to occur increase significantly in respect to CEOs abuse private information to generate opportunistic profit (Cicero, 2009).

In order to determine if the warrant is underpriced (ITM) or overpriced (OTM), Barth et al. (2017) address that when firm strike price (K) > firm intrinsic value (V) signifies the warrant as anti-dilutive and when K < V the warrant is mark as dilutive. According to past research, firm intrinsic value will be reflected in the share price (P) in the long run. Therefore, companies intentionally schedule positive return earnings prior the warrant expiration date

to create K > P > V scenario. On the other hand, firms deliberately announce loss causing stock price to decline prior warrant maturity date. This is to discourage warrant holders to exercise by orchestrate an OTM situation.

As warrants are issued in the market globally, there are several papers containing empirical data of management manipulate price in order to gain lucrative profits from the exercisers such as Barth et al. (2017), Chourou and Saadi (2009), Aboody and Kasznik (2000) research. Many of the research of price manipulation investigation observe price pattern return but do not take warrant expiration date into consideration. Plus, the warrant included paper had been conducted only in developed market such as the U.S. market where these markets share similar characteristics. This paper distinguishes itself from past research by tackling whether price manipulation prior warrant expiration date occurs in SET which is an emerging market. Emerging market is expected to have higher chance of share price manipulation than developed market due to the fact that the market is less efficient and information asymmetry is higher.

3. Hypotheses

Price manipulation near expiration of warrant derived from the dilution effect and capital raised caused when the warrants are exercised. When warrants are exercised, current shareholders risk of decrease in EPS, share price and ownership. This leads to management being pressured by the underlying shareholders to counteract the dilution effect. On the contrary, firms will prefer new share issuance if the amount of capital raised is large enough to compensate the loss and also yields return. Management decide to manipulate underlying stock price through announcements (Barth et al., 2017). The release of

announcements is time strategically shifting share price into their favour at specific period. Information asymmetry then arise between the issuer and buyer causing buyers to be expose to higher risk than they should be.

Equity trading volume is one of the price manipulation signals which we expect to increase near expiration date. The trading volume unconventional increase signifies firm intention to intervene with underlying stock price. As firm intentionally release information regarding of their incentive to lure investors to trade their stock heavily. The direction of stock price movement depends on their incentives mentioned in the previous paragraph. However, we want to differentiate price manipulation trading volume from regular trading volume. In order to do so we implement fixed timeframe to distinguish price manipulation from conventional trading volume. If the trading volume is high only at the interest period, then we can assume that price manipulation exists. Altogether with the firm incentives, then we can predict firm manipulation appearance and the direction they aim for with high consistency.

In SET, public float is low, with estimated half of the total shares are held by institutional firms with both local and international in each firm. This explains firms' lack of transparency through public offering. Major shareholders hold the majority voting power over minor shareholders which create opportunities for firm to manipulating share price. The cause of share price manipulation derived from the share dilution effect after warrant expiration date. Dilution effect lower shareholder value inside the firm which cause them to pressure management to engage price manipulation. This is due to major shareholders have significantly higher sensitivity to firm beneficial due to their high stake in the firms. Whether

the incentive is to counteract the dilution effect or persuade capital raised, the major shareholders will try to maximise their profitability and their decision will be absolute.

3.1 Development

The stocks we chose to conduct our hypotheses derived from SET with each of them require to have a warrant expired between Jan 2014 - Dec 2018. Our prediction suggests manipulation through stock price movement will happen near warrant maturity date into issuers' favour. If the warrant is ITM a few months before the maturity date, the firms will favour share price decrease to discourage warrant exercise at maturity. As exercising warrants creates share issuance which leads to share dilution if the warrants continue to be ITM until maturity, manipulating share price downward could change the warrant status from ITM to OTM and avoid share dilution. Whereas, firms with OTM warrants months prior to expiration would prefer share issuance. In such case, firms will favour share price increase to induce warrant exercise instead. Barth et al. (2017) hypotheses proven that price manipulation through share returns exist in the developed market such as the U.S. market according to market inefficiency. Regarding of the circumstances, Stock Exchange of Thailand (SET) is define as an emerging market which consider to be a richer subject for price manipulation test. Manipulation activity should be easier to perform and more frequent comparing to developed markets, as information asymmetry gap between retail investors and market makers is larger in emerging market. In order to detect price manipulation, we need to observe firms' share price pattern prior warrants expiration date. We select stock price abnormal movement as a signal of firm manipulation to possibly various firms' strategies to manipulate price (Barth et al., 2017). For example, firm could deliberately and timely release favourable announcements, earning management in both

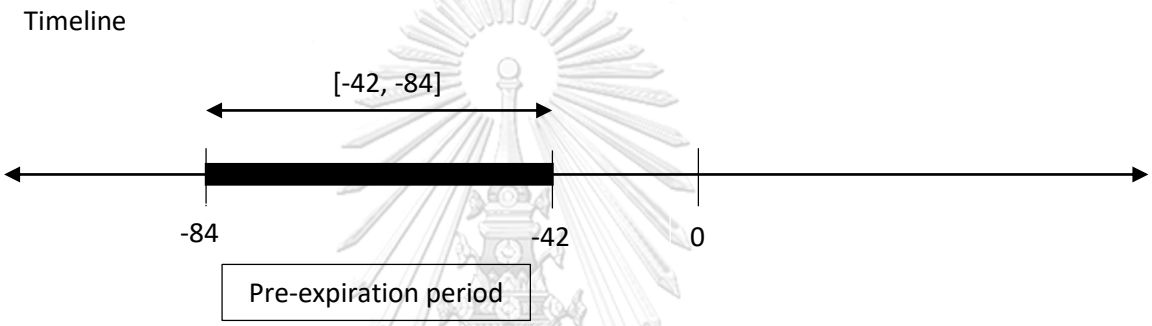
accrual and operative, lobbying analyst forecasts to deceive investors. To avoid making any further assumptions about firms specific strategies, we use stock price as a more direct and consistent indicator of price manipulation regardless of the firm chosen method (Fama & French, 1992).

However, share returns may not be the best measurement for identifying price manipulation regarding to the market trend. Firm that correlate with the market trend or index can be affected by the spillover effect from the market yielding inconsistent hypothesis result. For example, manipulating share price downward in bull market require high effort and resource from manipulators in order to accomplish. Nevertheless, stock returns generated by market trend may still persist despite firms' best effort. Consequently, we prefer specific measurement of share returns which can minimise market effect. Thus, Alpha Jensen abnormal return model is chosen as manipulation measurement (Jensen, 1968). As specific firm or industry have abnormal return higher or lower than others, our method require a time window to minimise biasness and stock relation with the market.

We anticipate abnormal activity in stock returns to occur between 42 and 84 trading days [-42,-84] before warrant expiration date (2 months to 4 months in calendar). Firstly, warrant shortest lifespan last for 6 months after issue date. It is infeasible to observe abnormal price pattern over 6 months period (132 trading days). Furthermore, our time window derived from assumptions based on firm exposure to economic macro factors and time constraint. At farther time window, firm stock price has higher risk of changing direction by macro factor which can jeopardise manipulative firm's effort. For example, if firm manipulated share price to decrease at 6 months prior warrant expiration. Such firm will

allow itself to be expose to share price increase from market volatility for 6 months. Additionally, manipulated share price is difficult to contain partially due to share price stabilisation theory. Whereas, manipulation at closer time window bear greater risk of achieving ineffective result due to time constraint. We assume that our selected time window [-42,-84] is logically fit as a signal to address share price manipulation prior warrant expiration.

Figure 2: Illustrated of observation period in warrant timeline.



Nevertheless, besides our main selected time window, we will test price manipulation in various windows within 6 months prior to warrant expiration confirm this assumption. In addition, dummy variable $PreExp_{i,t}$ is implemented as an event trigger. It helps us distinguish firm's manipulated abnormal returns from the regular abnormal returns at our selected time window [-42,-84]. $PreExp_{i,t}$ equal to 1 at 42 to 84 trading days prior warrant expiration date and equal to 0 on other days.

Hypothesis 1 derived from Alpha Jensen regression model focusing on finding share price's abnormal return:

$$R_{i,t} - R_{f,t} = \alpha_{i,1} + \alpha_{i,2}\, PreExp_{i,t} + \beta_i(R_{m,t} - R_{f,t})$$

Where

$R_{i,t} = return\ on\ asset\ i\ at\ time\ t$

$R_{f,t} = 5\ yrs\ gov't\ bond\ yield\ at\ time\ t$

$R_{m,t} = market\ return\ at\ time\ t$

$PreExp_{i,t} = dummy\ variable\ on\ asset\ i\ at\ time\ t$

The model disintegrates the typical Alpha Jensen into $\alpha_{i,1}$ and $\alpha_{i,2}$. Abnormal return during the normal period signifies as ($\alpha_{i,1}$) and additional abnormal return during [-42,-84] prior warrant expiration date is represented by ($\alpha_{i,2}$). If share price manipulation exist at [-42,-84] time window, the additional abnormal return ($\alpha_{i,2}$) will be different from zero. However, $\alpha_{i,2}$ will equal to 0 if there is no additional abnormal return generated by issuers. We expect that price manipulation additional abnormal return ($\alpha_{i,2}$) will be statistically significantly different from zero and use t-test running on cross sectional data of $\alpha_{i,2}$ in order to find significance difference between abnormal return during the normal period and during the selected time window [-42,-84]. Our hypothesis 1 stated that hypothesis null is $\alpha_2 = 0$ and hypothesis alternative is $\alpha_2 \neq 0$.

Hypothesis (1): Stock price manipulation exists prior to warrant expiration date.

$\boldsymbol{H_0}$: $\alpha_2 = 0$

$\boldsymbol{H_a}$: $\alpha_2 \neq 0$

Hypothesis 2 aim to test firms' abnormal trading activity prior the warrant expiration. We want to separate the abnormal trading volume caused by firm manipulation from normal trading volume. Nevertheless, second hypothesis require an alternative approach due to stock size variation. As firms' size and trading volume correlate to each other, a simple test result would be biased. For example, a firm with large market capitalisation yielding negative abnormal trading volume will affect the test result toward downward direction significantly. Whereas, it would require many average firms sharing negative abnormal trading volume to give similar impact to the test outcome. Therefore, our second hypothesis require an alternative approach to transform the input data into appropriate unit which is ratio. We use the ratio of average trading volume during warrant pre-expiration window to average trading volume outside the pre-expiration window to measure the abnormal trading volume.

$$V_i = \frac{average\ trading\ volume\ inside\ PreExp\ period}{average\ trading\ volume\ outside\ PreExp\ period}$$

Where

$V_i = trading\ volume\ ratio$

In order to test whether abnormal trading activity exists during the selected warrant pre-expiration window, we run the standard t-test to find significance level for V_i. For our null hypothesis, V_i has to be equal to 1 which prove that there is no abnormal trading activity at 42 to 84 trading days prior warrant maturity time window. Whereas, V_i has to be higher than 1 if there is a positive abnormal trading activity at $PreExp$ for alternative hypothesis. We predict that the abnormal trading activity will increase 42 to 84 trading days prior warrant expiration.

Hypothesis (2): The abnormal trading activity exists during the [-42,-84] window prior to warrant expiration. This, together with the previous hypothesis, confirms that manipulation in share price exists due to firm managing stock price to counteract loss from warrants being exercised.

$\boldsymbol{H_0}$: $V_i = 1$

$\boldsymbol{H_a}$: $V_i > 1$

Share price manipulation strategy depends on overall capital raised and share dilute after warrants have been exercised. In order to determine if the warrant will be exercised or not we refer to Mary E. Barth et al. (2017) KPV theory. Where warrants strike price represent as (K), stock price as (P) and firms' intrinsic value as (V). In order to determine firms' manipulation incentive we need to observe the relation between firms' intrinsic value (V) and warrants strike price (K). Firms assess whether scenario has higher profitability for the existing shareholders. Additionally, warrant issuers are in best position to valuate K and V relation over other party. As they hold private information possession advantage.

There are two possible outcomes which are strike price is higher than intrinsic value K > V or strike price is higher than intrinsic value K < V prior warrant expiration. When K > V, warrant exercise is considered as anti-dilutive, capital raise by warrant exercise will bring the value of current share up. On the contrary, when K < V the warrant exercise is considered dilutive. New shares issued by warrant exercise will dilute the profit as well as the existing share value while capital raise per share is lesser. Regardless, Firms are not capable of manipulating neither K nor V. In addition, V is difficult to measure due to market frictions and imperfect market information. Instead, share price (P) is our best estimation of V reflecting firms' intrinsic value in the long-term without making any specific assumptions

on the share price or firms. We acknowledge that the share price P may deviate from the intrinsic value V in the actual market, however, we will assume here that the market is sufficiently efficient and that the price deviation will occur in only a short period of time and return to the intrinsic value in the long-term.

In order to identify dilutive warrants, we need to observe warrant status prior to the expiration date. There are only two type of warrant status which are ITM and OTM. Warrant is considered as ITM when stock price is higher than strike price and OTM when stock price is lower than strike price. Earliest day of our time window (84 trading days before warrant maturity) is selected for each firm to determine warrant status by subtracting share price with strike price. Warrant is identify as ITM if the result is positive and as OTM if the result is otherwise negative. Warrant status acts as a signal for dilutive or anti-dilutive prediction prior the expiration date. Thus, warrant is expect to be dilutive when it is considered as ITM and anti-dilutive as OTM. Consequently, ITM firms manipulate share price downward to prevent share dilution. Whereas, OTM firms manipulate share price upward to induce share issuance.

Given these assumptions, we predict dilutive warrants to have positive abnormal returns at warrant pre-expiration and negative at post-expiration. On the contrary, anti-dilutive warrants would have negative abnormal returns at [-42,-84] and positive at post-expiration. The opposite direction after manipulation depict share price stabilisation according to our assumption. Share price (P) and intrinsic value (K) can only deviate for short period and eventually converge each other. When warrants are going to be exercise and dilution effect is certain, firm management weigh the benefits between capital raised per new share (K) and the cost of new share issuance (V). If the cost (V) which reflected by share price (P) in

the long run yield higher benefit. Then firm gain incentive to discourage warrant holders from exercise to counter dilution effect. In order to counteract share dilution effect, firms need to decrease share price using negative price manipulation. We identify firms' incentive to counteract share dilution effect by checking whether the price P is higher than K at 84 trading days prior to warrant expiration, and we call such event ITM corresponding to the warrant being in-the-money at 84 trading days prior to its expiration. In such event, the negative price manipulation will likely occur as share dilution effect outweighed capital raised causing firm to deliberately decrease the share price. On the contrary, if the dilution effect is not significant enough, firm must receive higher benefit from capital raised in this scenario. As such, the positive price manipulation will likely occur. We identify the event by the out-of-the-money (OTM) at 84 trading days prior to warrant expiration. In other words, OTM is the dummy having the opposite value as ITM.

Table A: Represent variation of KPV theory scenarios with details on warrant dilutive, warrant status, shareholder profitability, manipulation direction and firm's incentive.

Number	Scenario	Dilutive	ITM/OTM	Shareholder profit on exercise	Manipulation direction +/-	Incentive
1	K > P > V	X	OTM	✓	+	Induce exercise
2	K > V > P	X	OTM	✓	+	Induce exercise
3	P > V > K	✓	ITM	X	-	Prevent exercise
4	P > K > V	X	ITM	✓	None	No manipulation
5	V > P > K	✓	ITM	X	-	Prevent exercise
6	V > K > P	✓	OTM	X	None	No manipulation

For example: Strike price (K) = $10.00; Stock price (P) = $9.50; Intrinsic value (V) = $9.00. In this scenario, the warrant is considered out of the money (OTM). Firm will prefer warrant to be exercise to create situational profit as anti-dilutive (K > V). In order to achieve this goal firm need P > K resulting in warrant become ITM. Thus, we predict the direction of the P manipulation will be positive. Whereas, if (P) is $11.00 and (V) is $12.00 holding (K) the same. The warrant is considered as ITM but prove to be dilutive (K < V). We assume that price manipulation will be negative forcing warrant to be OTM.

Table A further illustrates all possible orders of P, K, V in which scenario 3, 4, 5 describe the case of ITM warrant and scenario 1, 2, 6 describe the OTM warrant. ITM scenario 3, 5 and OTM scenario 1, 2 have already been explained by the incentive of firms to intervene the price. For the two remaining scenarios (4, 6), we claimed that they have low probability of occurrence and firms also lack incentive to intervene the price in these scenarios. Firstly, the share price (P) should reflect firms' intrinsic value (V) over time. Both parameters can deviate from each other by manipulator intervention, but will converge after certain amount of time, hence, the gap between P and V should not be large enough for the warrants' strike price (K) value to be conveniently between P and V. Secondly, both scenarios would yield benefit toward firms without intervention. Scenario 4 has warrant status as ITM but warrant is antidilutive (P>K>V). Hence, firm gain profit if the warrant exercised if the ITM status continues to hold to maturity. Scenario 6 has warrant status as OTM but warrant is dilutive (V>K>P). Warrant holders perceive strike price as overprice and reluctant to exercise. Both situations favour firm without price manipulation. Firms have no incentive to intervene unless they want to reduce risk by lower share price movement. However, share price manipulation occurrence probability is low due to high effort and resource requirement.

For hypothesis 3, we want to test whether there is a difference between price manipulation abnormal return between ITM warrants and OTM warrants, again by ITM and OTM we mean at 84 trading days prior to warrant expiration date. We use $\alpha_{i,2}$ from running regression on hypothesis 1 using a single warrant expiration date. Each alpha represents firm price manipulation on each warrant. We breakdown $a_{i,2}$ into γ_1 , γ_2 and ITM dummy. Where γ_1 measure firm manipulation in the OTM warrants and γ_2 measure how firm behavior deviates between ITM and OTM warrants. The ITM dummy represents warrant manipulation trigger event which will be 1 when warrants are considered in the money (ITM) and 0 when out of the money (OTM) at 84 trading days before warrant expiration.

Hypothesis (3): Negative price manipulation exists when warrants are ITM prior expiration date. As mentioned above, ITM warrants exercised address firms of share dilution effect which firms want to prevent it by discouraging holders from exercising warrants. On the other hand, positive price manipulation occurs for the OTM warrant event.

3.1 $\boldsymbol{H_0}: \gamma_1 + \gamma_2 \geq 0 \qquad \boldsymbol{H_a}: \gamma_1 + \gamma_2 < 0$

3.2 $\boldsymbol{H_0}: \gamma_1 \leq 0 \qquad \boldsymbol{H_a}: \gamma_1 > 0$

$$\alpha_{i,2} = \gamma_1 + \gamma_2 ITM_i$$

Where:

$\gamma_1 = abnormal\ Jensen\ alpha\ contributed\ from\ ITM\ value$

$\gamma_2 = abnormal\ Jensen\ alpha\ in\ the\ case\ of\ warrant\ OTM\ value$

$ITM_i = dummy\ varriable\ equals\ to\ 1\ if\ warrants\ are\ ITM\ at\ 84\ trading\ days\ prior\ to\ expiration\ date$

Corporate variables is one of the key to determine substantial factors driven firm to manipulate share price prior warrant expiration. Thus, we want to test $\alpha_{i,2}$ whether firm corporate related characteristics have impact on price manipulation. In order to do so, we implement 4 factors into the model which are debt-to-equity (D/E) ratio, public float level, market capitalisation and CG rating. D/E ratio represents the firm financing structure through debt and equity. High value of D/E ratio suggests that firm is at financial distress and would prefer equity financing to raise capital. In this case, high D/E ratio firms would benefit from warrant being exercised. Public float level can determine majour shareholder power level. We anticipate manipulation to happen more easily in low public float firm. Similarly, firms with low market capitalisation weigh share issuance as more beneficial. Corporate Governance Rating is a factor addressing overall CG structure for each firm which we predict manipulation to occur in bad CGR firms.

$$\alpha_{i,2} = \gamma_1 + \gamma_2 ITM_i + dDE_i + pPF_i + qPF_i * ITM_i + m\log(MCAP)_i + n\log(MCAP)_i * ITM_i + \lambda CGR_i + \kappa CGR_i * ITM_i$$

Debt and Equity ratio is a measurement of how firm finance itself which we can observe firm financial constraint through it. High D/E ratio signifies firms heavily financing themselves with debt over equity. Firms with high D/E ratio prefer to raise capital at warrant expiration date regardless of the warrant status. In order to balance the debt level, they would manipulate share price upward.. Furthermore, even if warrants have already been in ITM status prior to maturity, deep ITM warrant status has lower exposure of status change. If the price manipulation does in fact influenced by D/E, we expect the price manipulation to occur in the upward direction regardless of the warrant status. In hypothesis 4, we test D/E ratio level within the firm where DE_i represents D/E ratio of firm i. The parameter d

measure the effect of D/E ratio to the abnormal Alpha Jensen. We predict high D/E ratio firms to positively manipulate the share price to encourage warrant exercise more than low D/E firms.

Hypothesis (4): High D/E exist in firm causing firm financial with constraints to manipulate share price prior warrant expiration date

$\boldsymbol{H_0}: d \leq 0 \qquad \boldsymbol{H_a}: d > 0$

Another corporate factor is the ownership within the firm which identifies the level of information asymmetry. We use public float as an indicator to distinguish if the firm ownership has manipulative impact on the share price or not. Price manipulation occur when existing shareholders agree to counteract share dilution effect which is easier for low public float firm to perform. For firms with low public float, majour shareholders have strong influence on firm policy and decision. Majour shareholders' incentive to counter share dilution effect derived from to their high stake in the firm. This expose them to high level of sensitivity of beneficial and loss. If ITM warrant are exercised, majour shareholders will suffer loss from lower share value. Inevitably, shareholders pressure the management to manipulate share price as a resolution. Altogether, we assume that low public float firms have high chance of approaching price manipulation due to their incentives.

For hypothesis 5, we measure firm public float using PF_i as public float measurement. Unlike the D/E ratio, we add PF_i as well as the interaction term between PF_i and ITM_i to observe the effect of the public float to the price abnormal Alpha Jensen. We predict the price manipulation to be more pronounce in both ITM and OTM cases when

the public float is low as firms are at relatively high stake at the benefit or loss of warrant exercise.

Hypothesis (5): Low public float level interprets firm price manipulation behaviour according to major shareholders' high level of sensitivity to firm beneficial and loss

5.1 $\boldsymbol{H_0}: p \geq 0 \qquad \boldsymbol{H_a}: p < 0$

5.2 $\boldsymbol{H_0}: q \leq 0 \qquad \boldsymbol{H_a}: q > 0$

Market capitalisation represents firm size comparing to other firm in the market. Firm with high market capitalisation has less probability of manipulation regarding to their wealth and size. High market capitalisation (MCAP) firm require large profitable deal to attract their attention. If the decision lead to inconsiderable profit, large MCAP firm would not take interest in the matter and likely to ignore the situation. In other words, it require significant amount of profitability or loss for firm with large market capitalisation (MCAP) to consider resolution for specific incident. In hypothesis 6, we test the significance of MCAP toward warrant expiration. Our prediction is that firm with large MCAP will ignore the repercussion of exercised warrant. Whereas firm with low MCAP will prefer to intervene and manipulate share to their preferred direction before expiration date.

As market capitalisation between firms are large, we implement $\log(x)$ to reduce the gap between them. Hence, firm market capitalisation (MCAP) is measure by $\log(MCAP)_i$ with the parameter represent by m. We expect m to be negative with the level of MCAP determine the strength of the parameter. Negative m signifies reduction in $\alpha_{2,i}$ (additional

abnormal return) for OTM warrant firms. $\alpha_{2,i}$ is expect to be positive from OTM firms manipulating share price upward attempting to change warrant status. The higher the firm MCAP determine the stronger level of decrease in $\alpha_{2,i}$. Similarly to hypothesis 5, interaction term is added between $\log(MCAP)_i$ and ITM_i to test the effect of warrant status toward additional abnormal return. Parameter for $\log(MCAP)_i * ITM_i$ represent by n expect to be positive with low MCAP firms and negative with high MCAP firms. The effect is reverse regarding to the interaction term of ITM which positive n suggest reduction in negative $\alpha_{2,i}$ generating from share price manipulation.

Hypothesis (6): Market capitalisation determines firm size compare to others in the market. Firm with large market capitalisation should not be concern about warrants being dilutive.

6.1 $\boldsymbol{H_0}: m \geq 0 \qquad \boldsymbol{H_a}: m < 0$

6.2 $\boldsymbol{H_0}: n \leq 0 \qquad \boldsymbol{H_a}: n > 0$

The next step we want to test the overall firm performance correlation with the share price manipulation activity. Corporate governance rating (CGR) depicts the firm overall corporate governance structure decency performance based on Thai Institute of Directors (IOD). IOD exclusively reports SET stocks with 3 or higher CGR annually. Thus, we pool firms score 2 or lower in the same group. Firms with low CGR score should expose to price manipulation activity higher than firm with higher CGR according to our prediction. Hypothesis 7 aim to test whether the CGR value affect the share price manipulation prior warrant expiration in SET or not. We use CGR_i as a measurement of Corporate Governance Rating and λ as a parameter for CGR_i. Addition of interaction term of ITM_i is attached to

CGR_i to observe manipulation on both warrant statuses with κ as parameter. Our prediction is the higher the level of CGR_i would make price manipulation less pronounce. Firms with high CGR_i will yield high value of parameters opposite direction toward the additional abnormal return and low CGR_i yield lower parameters value generating lower resistance.

Hypothesis (7): Corporate Governance Rating (CGR) reflect firm corporate governance performance. The lower the CGR mean the higher the chance of price manipulation.

7.1 $\boldsymbol{H_0}: \lambda \geq 0 \qquad \boldsymbol{H_a}: \lambda < 0$

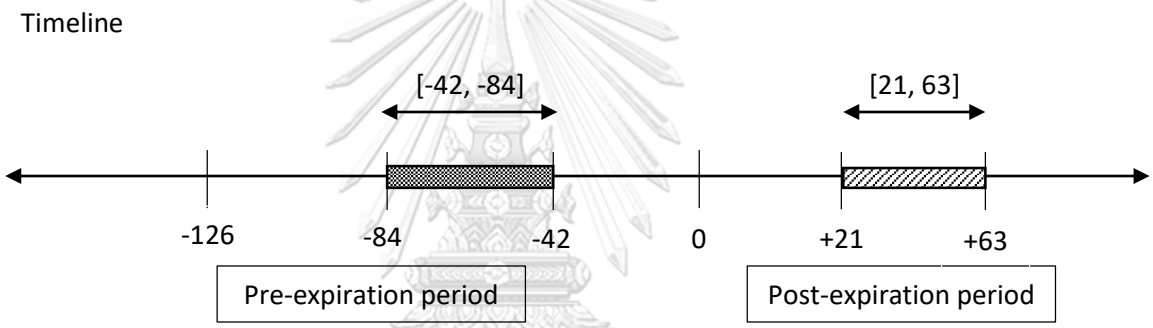
7.2 $\boldsymbol{H_0}: \kappa \leq 0 \qquad \boldsymbol{H_a}: \kappa > 0$

3.2 Robustness check

For robustness check, we add pre and post warrant expiration timeframes to test whether different time windows yield similar result or not. If alternative time window determines if share price manipulation exist outside our interest period which is between 42 and 84 [-42, -84] trading days prior warrant expiration date. We want to conduct hypotheses on new 5 time windows prior warrant expiration date and 1 post-warrant expiration date. Prior warrant expiration observations locate at [-1,-42], [-84,-126], [-1,-84] and [-42,-126] respectively. Whereas, post warrant expiration locate at [21, 63]. The post period estimate of one calendar month further from the trigger event providing time for share price to stabilise from the previous intervention and/or share dilution effect. We expect certain pre-expiration periods to be significant due to the time window locate inside and near our test window [-42, -84]. In addition, our method to check result consistency is to test 3 hypotheses (hypothesis 1-3) at each time period and compare the results. On the

other hand, post robustness test result should yield insignificant according to our assumptions. As firm intervention on share price prior the expiration date should cease after the warrants had been exercised due to declining manipulation motivation. Thus, post-robustness result represents share price stabilisation. Although, pre-warrant expiration period can yield similar results to our main observation period. Since the timeframes are near or overlapping each other.

Figure 3: Illustrated of robustness check period in warrant timeline.



4. Summary of data statistics

We collect warrant data from 1st June 2014 until 1st June 2018 and additional stock data from SETSMART. SETSMART webpage is an official Stock Exchange of Thailand providing members access to financial information about Thai market including warrants. The detail of warrant issuers such as issue date, expiration date, quantity of warrants first and last trading day are available up to maximum of 5 years in SETSMART. All of the information mentioned have daily trading data except for CG related information such as D/E ratio, Public Float and Market Capital. These information disclose in quarter. For the Corporate Governance Rating data, we use the Thai Institute of Director (IOD) annual report.

The report only disclose CGR from 3 to 5 rating and undisclosed firms with CGR at 2 and lower. Hence, our data identify those firms as one same category.

There is an estimated average of 95.8 warrants active per year in the SET over the past 5 year period starting from 1st June 2014 to 1st June 2018. All the warrants were issued by 139 firms out of total 757 listed firms in SET (total number of listed firms in 2018). This suggests that 18.36% of firms in SET chosen equity financing through warrant over the past 5 years equivalent to 3.67% annually. The table represents an increase in warrant popularity over time with comparison from each year. Furthermore, our risk-free rate data derived from ThaiBMA website which is an official state website providing government bond yield daily data. Five years government bond yield is selected as a risk free rate for our regression model. In addition, market return given from SET index represent model market return. We obtain SET index, individual stock daily return and corporate variables from SETSMART.

Table 1: Information on SET warrants between 1st June 2014 to 1st June 2018

Year	# issued	# expired	# active
2014	22	16	78
2015	50	20	108
2016	24	29	103
2017	27	28	102
2018	12	26	88
Average	27	23.8	95.8

Source: https://www.setsmart.com/ism/allSecuritiesTable.html/
https://www.setsmart.com/ism/stockComparisonTrading.html/

After data screening process, the data pool acquires 114 eligible warrants out of 121 warrants (94.21% out of total) expired during the 5 years period between 1st June 2014 and 1st June 2018. During the process, we take into account of eliminating still active warrants and delisted warrants. In addition, specific warrant or stock which lack data in majour department such as R_{it} (return on asset) will be dropped as well since abnormal return is vital to the hypotheses. As a result, we dropped 4 default warrants (3.3%) and 3 insufficient data warrants (2.48%) respectively. At pre-warrant expiration date, 57 out of 114 (50%) warrants are considered ITM and 57 out of 114 (50%) warrants are OTM. According to our analysis, the warrant status changes at the expiration date with 51 out of 114 warrants (44.74%) are ITM and 63 out of 114 warrants (55.26%) are OTM. The duration difference between our observations is 4 calendar months showing 5.26% change in warrant status. The increase in quantity of OTM warrants suggest a good probability of share price manipulation occurrence to prevent share dilution.

Table 2: Table represent categorisation of warrant active between 1st June 2014 – 2018. The detail include how data separate into each group and drop due to various reasons.

Condition	Number	Percentage	Explanation
Eligible	114	94.21%	Expired between 1st June 2014 – 1st June 2018
Delisted	4	3.3%	Warrants have been delisted
Insufficient	3	2.48%	Insufficient or undisclosed stock data
Total	**121**	**100%**	

Table 3: This table show overview of eligible ITM and OTM warrants status including how the percentage change in warrant status for 114 eligible warrants.

Warrant status	Quantity at Pre-expiration	Percentage (%)	Quantity at expiration date	Percentage (%)	Change in percentage
ITM	57	50%	51	44.74%	5.26%
OTM	57	50%	63	55.26%	
Total	**114**	**100%**	**114**	**100%**	

Figure 4: A graph representing example of stock price pattern with potential of ITM manipulation prior warrant expirations. The price drop unconventionally prior expiration date causing warrant to be OTM.

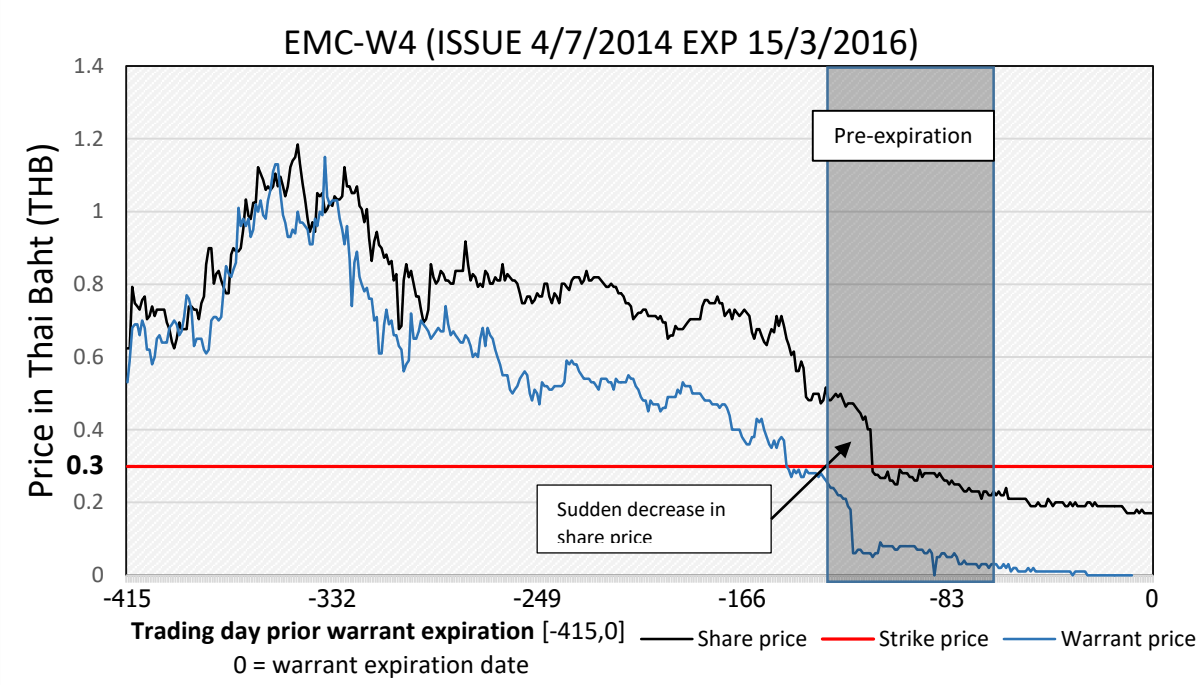
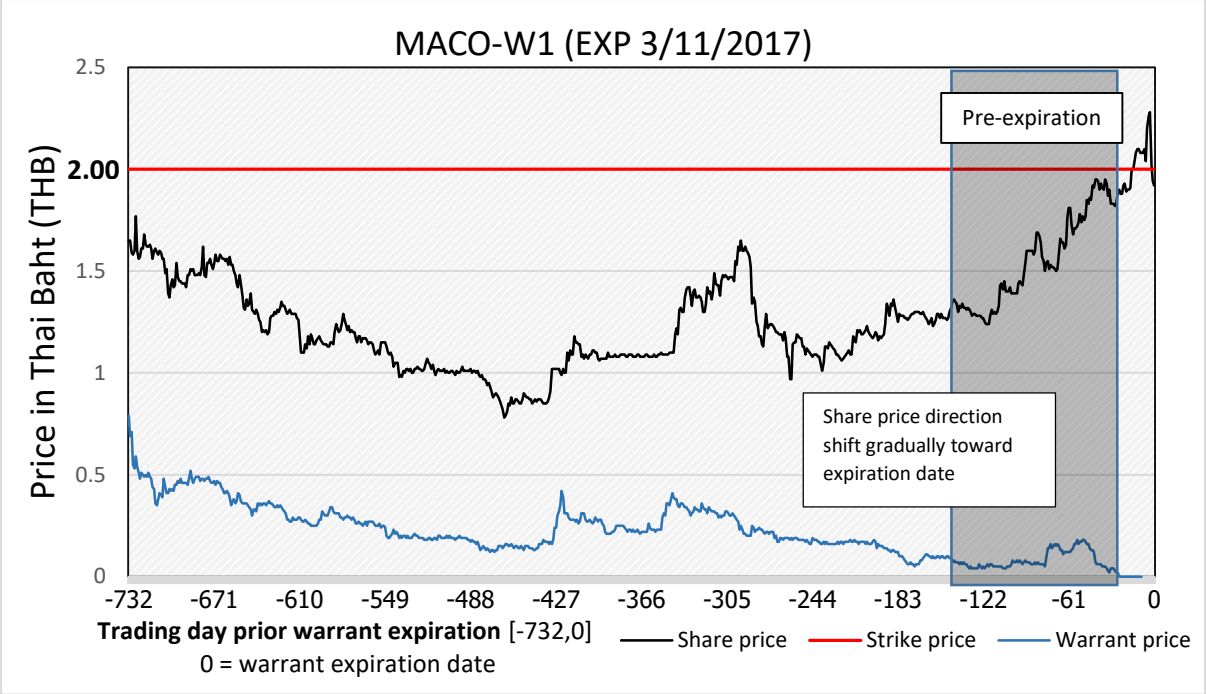


Figure 5: A graph representing example of stock price pattern with potential of OTM manipulation prior warrant expirations. The share price significantly increase prior expiration date.



Note: Time move forward toward right

4.1 Empirical Result

Table 4 shows the overview result from 114 observations on hypotheses 1-3 at different time windows. The numbers reported in column (1) PreEXP represents the additional abnormal return ($\alpha_{i,2}$) at pre-expiration ($PreExp$) time window, detecting if the abnormal return in selected firm exists referencing from Alpha Jensen model. The result depicted negative abnormal return for all time windows but statistically significant at 5% significance level in only [-1,-42] and [-1,-84] windows. The time window [-1,-42] (yields -0.096**) and [-1,-84] (yields -0.063**) both share a trait of being nearer to the expiration date than any other time windows. Distance from expiration date has impact on the level of $\alpha_{i,2}$ as result on windows share negative $\alpha_{i,2}$. The closer the date to the expiration date exhibits the higher chance of firm which issued warrant would yield higher $\alpha_{i,2}$ value. Nevertheless, time window [-1,-42] result has stronger negative coefficient than [-1,-84].

This furthers confirm that firms gain negative abnormal closer to the warrant expiration than our expectation.

Hypothesis 2 aims to investigate the abnormal trading activity at pre-expiration window, using the ratio of the average trading volume inside pre-expiration ($PreExp$) and the average trading volume outside the pre-expiration period. Using ratio as the tool to measure abnormal trading activity eliminates the inconsistency generate by difference in firm size in our observation. According to Table 4 column (2) Volume, the result reveals no statistically significant abnormal trading volume ratio for every time window, with p-values fail to reach 0.1 (10%). Hence, abnormal trading volume activity prior warrant expiration is not detected prior to warrant expiration date.

For the third hypothesis, we implemented warrant status factor to investigate its further impact to the additional abnormal return ($\alpha_{i,2}$) at $PreExp$. Our prediction suggests both side of manipulation to occur based on firm's situational incentives. Firm manipulates share price to change warrant status prior warrant expiration date. ITM firms perform negative share price manipulation to transfrom ITM warrants to OTM and OTM firms manipulate share price upward to achieve warrant ITM status. Thus, there are two parameters to identify manipulation direction for the model. Column (3) ITM and (4) OTM in Table 4 report the coefficients for testing hypothesis 3.1 ($\lambda_1 + \lambda_2$) and 3.2 (λ_1), respectively, as well as their standard errors. The result shows that there is no sign of significance with p-value higher than 0.1 (10%) at any warrant statuses or time windows. Based on this result, warrant status cannot explain the additional abnormal return as we earlier predicted.

Table 4: Illustration of empirical result overview for hypothesis 1, 2 and 3 from 114 observations.

Table 4: Overview result from all hypotheses test				
114 observations				
Time window	(1) PreEXP	(2) Volume[1]	(3) ITM	(4) OTM
[-1,-42]	-0.096**	-0.026	-0.098	-0.094
	(0.057)	(0.112)	(0.084)	(0.079)
[-42,-84]	-0.039	0.102	-0.05	-0.029
	(0.042)	(0.136)	(0.06)	(0.06)
[-84,-126]	-0.001	0.059	-0.044	0.043
	(0.054)	(0.132)	(0.077)	(0.078)
[-1,-84]	-0.063**	0.092	-0.061	-0.065
	(0.035)	(0.136)	(0.049)	(0.049)
[-42,-126]	-0.005	0.115	-0.031	0.022
	(0.048)	(0.119)	(0.068)	(0.069)

* p < 0.1, ** p < 0.05, *** p < 0.01

Standard errors are in parentheses

[1] The result show the difference mean value from hypothesis. We converted mean volume from 1 to 0 as shown on Table 4. The value on model 2 address value differentiate from 0.

In the analyses beyond this point, we further implement a control on the eligible warrants by dropping extreme ITM and OTM warrants from the test data. Our aim is to improve the test result by screening out warrants with extremely high requirement for manipulation. As the ease of changing warrant status comes at different level, it is irrational for firm to manipualte share price when the difference value between share price (P) and strike price (K) is large. We label warrant with large gap between P and K (P value exceed 50% threshold, for example if K is equal to 1. We drop warrants with P value at 1.5 and higher or 0.5 and lower) as extreme warrants. After the screening process, the observation number reduced from 114 to 51 observations. Hypothesis 1-3 are re-tested and the results are reported in Table 5. Negative additional abnormal return (column (1) PreEXP) yields significant on primary time window [-42,-84] with value of -0.061 (6.1%) and p-value less than 0.1. Meanwhile, other time windows yield insignificant result. Column (2) Volume

reports the result for testing Hypothesis 2 which also yield insignificant result. The result confirms that no abnormal trading activity is detected prior to warrant expiration date.

Relatively, hypothesis 3 tests warrant status impact toward additional abnormal return and it yields a crucial result. Firms with warrant ITM warrant status have high negative parameter of -0.173** with p-value stands below 0.05. This inteprets that the share price return is abnormally lower for ITM firms in the [-42,-84] window prior to warrant expiration date. In addition, the window located closer to expiration period, i.e. [-1,-42], gives reversal result as parameter from ITM is become positive, however, the result is not significant at any considered significance levels. This reversal of effect can be caused by the share price stabilisaition where the gap between share price and intrinsic value converge to each other. It also explains the insignificant result found in the longer period namely [-1,-84] that includes [-1,-42] as the negative effect in [-42,-84] is offset by the positive effect [-1,-42]. Furthermore, at [-42,-84] OTM parameter yields positive suggesting that firm gain price upward when warrant status is OTM, but again, it fails to reach statistical significance level. Our prediction of share price manipulation prior warrant expiration date has potential to be partially true as our findings of negative abnormal return is in line with some of the hypothesised firms' incentives. ITM warrant status is found to be an essential key factor signaling firm negative price movement direction. However, the findings lack empirical evidence to confirm price manipulation existence as we only detected price movement pattern. There is no clear evidence of price manipulation originating from firms nor warrant holders during the pre-expiration windows.

Table 5: Illustrate test on hypotheses 1-3 on 51 observations. The extreme ITM and OTM warrants are excluded.

Table 5: Exclude extreme ITM and OTM warrants				
51 observations				
Time window	(1) PreEXP	(2) Volume	(3) ITM	(4) OTM
[-1,-42]	0.037	0.074	0.159	-0.024
	(0.086)	(0.183)	(0.15)	(0.106)
[-42,-84]	-0.061*	0.0271	-0.173**	0.017
	(0.048)	(0.182)	(0.072)	(0.06)
[-84,-126]	0.026	-0.077	-0.017	0.057
	(0.063)	(0.181)	(0.099)	(0.083)
[-1,-84]	-0.009	0.088	-0.034	0.008
	(0.054)	(0.187)	(0.085)	(0.071)
[-42,-126]	-0.013	0.003	-0.051	0.014
	(0.025)	(0.176)	(0.059)	(0.049)

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

Table 6 aims to identify characteristic of firm with additional abnormal share price return in warrant pre-expiration period. Our prediction suggests that variation of corporate variables such as D/E ratio (dDE_i), Public float ($pPF_i \; and \; qPF_i * ITM_i$), Market capitalisation ($m\log(MCAP)_i + n\log(MCAP)_i * ITM_i$) and Corporate Governance Rating ($\lambda CGR_i + \kappa \, CGR_i * ITM_i$) are critical. The model used is identical to the model $\alpha_{i,2} = \gamma_1 + \gamma_2 ITM_i$ (in hypothesis 1) with four additional corporate factors added. Additional abnormal return data consisting of 51 observations at primary time window [-42,-84] is used. The test result from Table 6 shows that ITM factor proven to be solely significant in model (1) and (2). The significant level improves further if there are less additional corporate factors. D/E ratio factor yields overall positive parameter d signaling positive additional abnormal return positive correlation. However, the result is not statistically significant with highest p-value for d still above 0.1. The result fails to conform to our prediction that D/E ratio influences abnormal share price movement prior warrant expiration date.

Public float (pPF_i and $qPF_i * ITM_i$) has two versions with one attached to ITM_i. Table 6 illustrates that both pPF_i and $qPF_i * ITM_i$ are insignificant to $\alpha_{i,2}$. The first verison pPF_i gives minor impact with parameter p equal between 0.002 and 0.003. Public float with interaction term $qPF_i * ITM_i$ yields similar result with parameter q range between -0.006 and -0.005. Both versions meant to test our prediction that public float level reduces the intensity of firm manipulation on the share price, but fail to do so due to the lack of significant result.

Market capitalisation (MCAP_i) representing the firm size is predicted to have effect on the additional abnormal return. Larger firms require high stake position as incentive to perform share price manipulation. In addition, high market captipalistion firms have the luxury to generate profit from alternative method unrelated to share issuance from warrant event. Table 6 depicts two versions of (MCAP_i) and ($\mathrm{MCAP} * ITM_{i_i}$) implemented with log function on MCAP_i to reduce level of size variation. The coefficients of $\log(MCAP)$ and $\log(MCAP)_i * ITM_i$ give scattered but all positive values. All models yield insignificant result suggesting that market capitalisation shares no significant impact to the abnormal share price movment at [-42,-84].

Corporate governance rating (λCGR_i) is the last corporate factor chosen to test the impacts to the manipulation. We expect high CGR_i to be less exposed to share price manipulation. The parameter is expected to have the reducing effect toward additional abnormal return regarding to the warrant status. Table 6 shows the coefficient of CGR_i being negative, and coefficient of $CGR_i * ITM_i$ being positive in each model. However, the

results are shown to be insignificant with p-value lower than 0.1. Intepretation for CGR_i is that the factor shares no correlation with the abnormal price movement.

Table 7 illustrates cluster analysis representing corporate variables and warrant status movement between tertiles. First tertile consists of firms with lowest additional abnormal return ($\alpha_{i,2}$) from 51 observations including negative value. Whereas, the second tertile contain higher $\alpha_{i,2}$ and third tertile contain highest $\alpha_{i,2}$ respectively. The aim for cluster analysis is to identify if there is correlation of selected factors with the $\alpha_{i,2}$ regardless of our regression. As regression integrate all observation together and calculate the significance. Alternatively, cluster analysis detects the significance level differently by grouping obsevation and observe movement across tertile. Table 7 warrant status observation shows level of ITM status and corporate factors at three time windows dropping [-1,-84] and [-42,-126]. All time windows [-1,-42], [-42,-84], [-84,-126] share identical period equivalent approximately to two calendar months and do not overlap each other. ITM status is higher for first tertile at further time windows with [-42,-84] yield 65% which is 30% increase from [-1,-42] 35%. From the data, OTM warrant status increase near warrant expiration date. This suggest warrant status changed between 42 days prior warrant expiration.

Additionally, corporate variable movement shows different effect individually. All data show at Table 7 is calculate in average for each group. D/E ratio proven to be resistance to changes across time window. Highest D/E ratio locate at the middle tertile rejecting our expectation of high D/E ratio signifies price manipulation upward regardless of the warrant status. Public float cluster analysis test also yields identical result to the regression model.

The average value of public float slightly change over time and there is no critical difference between each tertile on each time window. However, MCAP result proven otherwise with top tertile for window [-1,-42] and [-84,-126] have highest market capitalisation for top tertile and lowest for bottom tertile. Primary time window [-42,-84] result is reversal to others revealing top tertile with lowest MCAP an and bottom tertile with highest MCAP. Our intepretation is that firms with downward abnormal price movement share the characteristic of small market capitalisation, while the possibly upward share price manipulation is common among large MCAP firms. The result is evident as the average MCAP for tertile is reverse order on the primary time window. To elaborate further, share issuance is critical for small MCAP firms as it has high probability to create share dilution effect. Thus, small MCAP firms located in the top tertile in primary time window are urged to manipulate share price downward preventing loss in share value. On the contary, firms with high MCAP have higher resistance to share dilution than smaller firms. Unlike small firms, share issuance benefits large firms more with capital raise from warrant being exercised. Thus, the MCAP reversal effect addresses the predicted connection between MCAP and abnormal share price movement prior warrant maturity date.

Table 7: Illustration of cluster analysis representing corporate variables and warrant status movement between tertile. First tertile consist of firm with lowest additional abnormal return (start from negative if exist) and ascending.

Table 7: Cluster Analysis: Based on Alpha2							
Time window	Tertile	Avg Alpha2	# ITM	# OTM	DE	PF	MCAP
[-1,-42]	1	-0.378	35%	65%	0.895	0.456	23065.84
	2	0.037	24%	76%	1.179	0.438	17800.64
	3	0.420	41%	59%	0.901	0.445	7495.85
[-42-84]	1	-0.373	65%	35%	0.919	0.409	7402.56
	2	-0.066	24%	76%	1.272	0.420	15834.74
	3	0.255	35%	65%	0.855	0.493	25108.33
[-84,-126]	1	-0.378	59%	41%	0.966	0.472	23127.50
	2	0.037	18%	82%	1.165	0.495	17719.22
	3	0.420	47%	53%	0.892	0.441	7792.41

Time window	Tertile	Avg Alpha2	CGR				
			>=2	3	4	5	Total
[-1,-42]	1	-0.378	41%	35%	18%	6%	100%
	2	0.037	35%	24%	24%	18%	100%
	3	0.420	24%	53%	18%	6%	100%
[-42-84]	1	-0.373	41%	35%	18%	6%	100%
	2	-0.066	29%	41%	18%	12%	100%
	3	0.255	24%	41%	24%	12%	100%
[-84,-126]	1	-0.378	41%	35%	18%	6%	100%
	2	0.037	41%	18%	29%	12%	100%
	3	0.420	24%	53%	18%	6%	100%

Note: Data for corporate variables calculate as average for each tertile

We want to further test the impact of corporate variables on price manipulation through cluster analysis. Unlike previous table, the result on Table 7.1 to Table 7.4 (see appendix) rank the corporate factors into tertile ranging from tertile 1 representing firms with lowest value to tertile 3 representing firms with highest value. According to Table 7.1, the result of average additional abnormal return ($\alpha_{i,2}$) for primary window shows that the third tertile (firms with highest D/E ratio group) has average positive $\alpha_{i,2}$ of 0.003. Other pre-expiration windows ([-1,-42] and [-84,-126]) show opposite result where tertile 3 yields negative $\alpha_{i,2}$. Furthermore, the table breaks down the $\alpha_{i,2}$ by warrant status to observe $\alpha_{i,2}$ specifically on OTM and ITM statuses. Window [-42,-84] yields positive $\alpha_{i,2}$ at 0.094 for OTM firms with the third tertile outperforming other tertiles in the same time window. However, the percentage of OTM warrants increases at closer time window toward expiration date which may be caused by the opposite share price direction as portray at [-42,-84] where all tertiles for ITM warrant yield negative $\alpha_{i,2}$.

Table 7.2 represents factor analysis focusing on firms' public float. The result shows random effect with each tertile share different average $\alpha_{i,2}$. We focus on our main time

window where warrants with ITM status for top and bottom tertiles give negative additional abnormal return. Due to the mixed result, we cannot find enough evidence to support our previously claimed impact of public float factor on $\alpha_{i,2}$.

Table 7.3 portrays firm's market capitalisation impacts on share price. Average additional abnormal return gives mixed result which conforms to our expectation only partially. Both [-1,-42] and [-84,-126] share same order of average $\alpha_{i,2}$ in tertile ranking lowest to highest but [-42,-84] gives negative $\alpha_{i,2}$ for first and last tertiles. For warrant status section, the result is mixed and difficult to confirm correlation between the corporate factor and the triggered event. Regardless of time window, bottom tertile for OTM status yields the highest $\alpha_{i,2}$ and top tertile yields the lowest. Whereas, negative $\alpha_{i,2}$ is detected 42 days before warrant expiration and continue toward expiration date for tertile 1. Additionally, ITM status average of $\alpha_{i,2}$ at the primary time window shows resistance toward negative share price movement with top tertile yields the highest negative $\alpha_{i,2}$ and lower at lower tertile. This suggests ITM firms with higher MCAP have lower probability for price manipulation. Overall, the result addresses MCAP offsetting impact toward the negative abnormal share price movement exclusively.

Table 7.4 represents cluster analysis on corporate governance rating toward share price manipulation. The result for average additional abnormal return suggests negative trend will likely occur at [-42,-84] but not at other windows. We observe further into warrant status in [-42,-84] where ITM firms have all negative $\alpha_{i,2}$ across tertile and most negative for lowest CGR firms. On the contrary, OTM firms have scattered result with no windows share the same $\alpha_{i,2}$ direction. We interpret that CGR reduces the negative share price

movement for ITM firms as high CGR firms yield higher (less negative) $\alpha_{i,2}$ than lower CGR firms at [-42,-84].

4.2 Post-robustness check

Post-robustness check provides comparison between primary time window [-42,-84] and post-warrant expiration date time window. The time window selected for post-expiration date is 21 to 63 days [21,63] sharing same number of trading days with the primary window in pre-expiration period. The period immediately after the expiration is avoided to exclude any spillover effects from warrant expiration date. For instance, share price fluctuation due to the capital being raised caused by warrant exercise should be excluded as it is not a direct cause of price intervention. Table 8 illustrates the comparison results for 114 and 51 observations on additional abnormal return and warrant status between the two windows. Result for 114 observations shows [21,63] window results are significant at p-value lower than 0.05. The PreEXP negative parameter suggests that negative additional abnormal return trend continues after the trigger event. In addition, OTM parameter yields negative yield the same result as primary time window but with significificance below 0.05. The analysis from screening out the extreme warrant status yields different result with [21,63] yields no significant result. The negative trend still applies for PreEXP and ITM but not OTM. However, all results are not statistically significant which supports that no price intervention occurs beyond warrant expiration and the price stabilisation is weak.

Table 8: Illustration of comparison between primary time window and post-roobustness result on hypothesis 1 and 3.

Table 8. Post robustness check			
114 observations			
Time window	(1) PreEXP	(2) ITM	(3) OTM
[-42,-84]	-0.096** (0.057)	-0.098 (0.084)	-0.094 (0.079)
[21,63]	-0.074** (0.038)	-0.0235 (0.054)	-0.125** (0.054)
51 observations			
Time window	(1)	(2)	(3)
[-42,-84]	-0.061* (0.048)	-0.173** (0.072)	0.017 (0.06)
[21,63]	-0.046 (0.055)	-0.074 (0.072)	-0.007 (0.086)

* p < 0.05, ** p < 0.01, *** p < 0.005
Standard errors are in parentheses

5. Conclusion

The test results determine that there is negative abnormal price movement according to the warrant status prior to warrant expiration date. Empirical evidence addresses that ITM firms experience negative additional abnormal return 42 to 84 trading days prior expiration date. However, as suggested by the regression analysis on the corporate variables, all of DE ratio, PF, MCAP, and CGR are proven to be insignificant for the share price movement. However, cluster analysis on MCAP, CGR and DE ratio represent otherwise with clear sign of share price movement resistance at primary time window. This indirectly implies that firms with high MCAP likely prefer warrant to be exercised due to lower exposure to share dilution effect than small MCAP firm. CGR factor has similar effect where high CGR firms show lower additional abnormal return possibly due to less manipulation as the management difficulty arise in good corporate structure. Whereas, high

D/E ratio firms' incentives derived from share issuance preference, as firms aim to balance their financing, align with positive abnormal return on share price.

Our theory of connection between KPV is in line with the empirical test results. Firms are driven to manipulate share price to discourage warrant holders to exercise regarding to event profitablility, whereas firms' manipulation to encourage warrant exercise is unlikely. Incentives derived from prevention of new share issuance, which lead to capital gain and share dilution effect, vary on firm size, DE ratio and CGR. Overall, this research provides new evidence on abnormal return of share price which partially in line with the firms' incentive to manipulate stock price near warrant expiration in the Stock Exchange of Thailand (SET). To be specific, the negative abnormal return on share price occurred with increased probability for stocks with ITM warrants two to four months before expire. Nonetheless, we cannot confirm share price manipulation existence originating from warrant issuer nor warrant holders as additional information to directly detect price manipulation is require. The practical implication from the result is that Investors should be aware and avoid trading against the direction of the negative abnormal return pattern near warrant expiration date.

Before ending, the author would like to make a few suggestions for readers and those who will use this work to research further into the topic. Further test improvement can be made by implementing additional variables to identify the characteristics which drive the firm manipulation performance. Since the observation period for this work lasts equivalent to 5 calendar years, beta adjustment has probability of impact toward the test result. Sample size can be enlarged, for instance, increasing observation period to be above 5 years. As our sample size reduced dramatically after extreme warrant screening.

Additionally, other emerging market warrants combination would improve the result with higher data quantity reducing inconsistency from small data size.

Appendix

Table 6.1 Correlation coefficient between corporate factors								
51 observations								
Parameters	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1. constant	0.017 (0.06)	-0.001 (0.08)	-0.197 (0.254)	-0.330 (0.489)	0.107 (0.192)	-0.133 (0.402)	-0.162 (0.228)	-0.171 (0.433)
2. ITM	-0.191** (0.094)	-0.189* (0.095)	0.172 (0.331)	-0.025 (0.74)	-0.482 (0.343)	-0.391 (0.546)	0.173 (0.327)	-0.346 (0.579)
3. DE		0.012 (0.035)	0.012 (0.037)	0.013 (0.039)				0.009 (0.037)
4. PF			0.003 (0.004)	0.003 (0.004)			0.003 (0.004)	
5. PF·ITM			-0.006 (0.005)	-0.005 (0.006)			-0.006 (0.005)	
6. MCAP				0.017 (0.051)		0.018 (0.048)		0.021 (0.05)
7. MCAP·ITM				0.014 (0.072)		0.023 (0.065)		0.018 (0.069)
8. CGR					-0.03 (0.06)			
9. CGR·ITM					0.094 (0.106)			

* p < 0.05, ** p < 0.01, *** p < 0.005
Standard errors are in parentheses

Table 6.2 Correlation coefficient between corporate factors								
51 observations								
Parameters	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
1. constant	-0.318 (0.458)	0.08 (0.212)	-0.075 (0.304)	-0.268 (0.444)	-0.358 (0.461)	-0.272 (0.427)	-0.124 (0.342)	-0.351 (0.495)
2. ITM	-0.224 (0.6)	-0.477 (0.347)	-0.102 (0.513)	-0.068 (0.72)	0.005 (0.741)	-0.272 (0.573)	-0.108 (0.519)	0.027 (0.753)
3. DE	0.011 (0.039)	0.012 (0.036)					0.013 (0.039)	0.009 (0.04)
4. PF			0.003 (0.004)	0.003 (0.004)	0.002 (0.004)		0.003 (0.004)	0.003 (0.004)
5. PF·ITM			-0.006 (0.005)	-0.005 (0.006)	-0.004 (0.006)		-0.005 (0.005)	-0.004 (0.006)
6. MCAP	0.071 (0.07)			0.014 (0.049)	0.059 (0.071)	0.068 (0.068)		0.036 (0.064)
7. MCAP·ITM	-0.041 (0.091)			0.019 (0.069)	-0.033 (0.091)	-0.033 (0.086)		0.005 (0.074)
8. CGR	-0.087 (0.067)	-0.026 (0.061)	-0.027 (0.061)		-0.078 (0.087)	-0.088 (0.084)	-0.023 (0.063)	-0.035 (0.07)
9. CGR·ITM	0.119 (0.139)	0.093 (0.107)	0.077 (0.109)		0.103 (0.139)	0.112 (0.136)	0.078 (0.110)	

* p < 0.05, ** p < 0.01, *** p < 0.005
Standard errors are in parentheses

Table 7.1 Cluster Analysis: D/E ratio							
Time window	Tertile	Avg D/E	Avg Alpha2	# ITM	Alpha2	# OTM	Alpha2
[-1,-42]	1	0.158	-0.029	29%	0.254	71%	-0.147
	2	0.698	0.115	29%	0.466	71%	-0.031
	3	2.119	-0.006	41%	-0.005	59%	-0.007
[-42-84]	1	0.112	-0.138	41%	-0.290	59%	-0.043
	2	0.655	-0.049	35%	-0.135	65%	-0.002
	3	2.279	0.003	47%	-0.099	53%	0.094
[-84,-126]	1	0.111	0.420	35%	0.107	65%	-0.009
	2	0.659	0.037	47%	-0.195	53%	0.215
	3	2.252	-0.378	41%	0.081	59%	-0.014

Table 7.2 Cluster Analysis: Public Float							
Time window	Tertile	Avg PF	Avg Alpha2	# ITM	Alpha2	#OTM	Alpha2
[-1,-42]	1	0.198	0.072	24%	-0.008	76%	0.096
	2	0.462	-0.140	41%	0.030	59%	-0.259
	3	0.679	0.148	35%	0.565	65%	-0.079
[-42-84]	1	0.198	-0.128	53%	-0.192	47%	-0.056
	2	0.463	0.028	47%	-0.091	53%	0.135
	3	0.662	-0.084	24%	-0.295	76%	-0.019
[-84,-126]	1	0.267	0.101	47%	0.117	53%	0.086
	2	0.471	-0.159	41%	-0.233	59%	-0.107
	3	0.671	0.138	35%	0.058	65%	0.181

Table 7.3 Cluster Analysis: Market Capitalisation							
Time window	Tertile	Avg MCAP	Avg Alpha2	# ITM	Alpha2	#OTM	Alpha2
[-1,-42]	1	786	-0.112	29%	-0.007	71%	-0.156
	2	3640	0.059	24%	0.447	76%	-0.061
	3	43937	0.133	47%	0.226	53%	0.050
[-42-84]	1	778	-0.151	41%	-0.246	59%	-0.085
	2	3631	0.015	35%	-0.152	65%	0.106
	3	43937	-0.048	47%	-0.126	53%	0.022
[-84,-126]	1	833	-0.100	47%	0.027	53%	-0.214
	2	3646	0.067	29%	-0.064	71%	0.122
	3	44159	0.113	47%	-0.030	53%	0.240

Table 7.4 Cluster Analysis: Corporate Governance Rating							
Time window	Tertile	Avg CGR	Avg Alpha2	# ITM	Alpha2	#OTM	Alpha2
[-1,-42]	1	2.0	-0.090	29%	0.242	71%	-0.228
	2	3.0	0.082	35%	0.262	65%	-0.017
	3	4.0	0.088	35%	0.131	65%	0.064
[-42-84]	1	2.0	-0.040	24%	-0.329	76%	0.050
	2	3.0	-0.111	59%	-0.175	41%	-0.019
	3	4.0	-0.033	41%	-0.081	59%	0.001
[-84,-126]	1	2.0	-0.077	29%	-0.098	71%	-0.069
	2	3.0	0.069	41%	-0.036	59%	0.143
	3	4.0	0.088	53%	0.044	47%	0.137

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