ARE DERIVATIVE WARRANTS PROFITABLE?

BY

MR. MATHEE PRASERTKIJAPHAN

AN INDEPENDENT STUDY SUBMITTED IN PARTIAL
FULFILLMENT OF THE REQUIREMENTS FOR
THE DEGREE OF MASTER OF SCIENCE
PROGRAM IN FINANCE (INTERNATIONAL PROGRAM)
FACULTY OF COMMERCE AND ACCOUNTANCY
THAMMASAT UNIVERSITY
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ENTITLED

ARE DERIVATIVE WARRANTS PROFITABLE?

was approved as partial fulfillment of the requirements for
the degree of Master of Science (Finance)

on 11 MAY 2018

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Independent study title	ARE DERIVATIVE WARRANTS PROFITABLE
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Degree	Master of Science (Finance)
Major field/Faculty/University	Master of Science Program in Finance (International Program) Faculty of Commerce and Accountancy Thammasat University
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Academic year	2017

ABSTRACT

The purpose of this study is to investigate the profit of issuers who issue derivative warrants into Thai market by using the data set of derivative warrants traded on the Stock Exchange of Thailand (SET). Once issuers issue derivative warrants into the market, they have important commitment to manage their risks by hedging the underlying stocks. The profit which is earned by issuers will be the cost until the maturity. So, we measure the profit of issuers by cumulative profit incur along the life of derivative warrants from the first day until maturity. We examine on what risk factors determining the profit of issuers in Thai derivative warrants market. Moreover, we investigate how many days the retail investors need to hold derivative warrants before they sold them to make the profit. The result shows that most of issuers can make profit from issuing both call derivative warrant and put derivative warrant. The profit of issuers come from exposing in gamma risk and rho risk for call derivative warrants and exposing delta risk, gamma risk and rho risk. Additionally, retail investors always make loss from trading both of derivative warrants with any brokerage firms if they hold derivative warrants more than 30 days.

Keywords: derivative warrants, delta-hedging, option pricing model

ACKNOWLEDGEMENTS

I would like to express my deepest and sincerest gratitude to my respected advisor, Professor Arnat Leejmakdej, DBA., who gave me for supporting in this research and study. His guidance helped me throughout the process of my independent study. Moreover, I would like to thank my committees: Ajarn Wasin Siwasarit, Ph.D. and Ajarn Visit Ongpipattanakul, DBA., for their comments and encouragement to make this independent study completely. I am very thankful to Mr. Chonladet Khemarattana to help me to collect the data used in this research. Finally, I would like to sincerely thank to my parents for supporting me throughout the course of Master in Finance (MIF) at Thammasat University.

Mr. Mathee Prasertkijaphan

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CHAPTER 1
INTRODUCTION

Derivative Warrants (DW) are one of derivative securities that gives rights to the buyers to buy or sell the underlying securities in the future at pre-set price (exercise price) and quantity at specified time. It is specified by the issuers. The issuers of derivative warrants can be any financial institutions which are authorized by the regulators. Derivative warrants are traded in equity market same as the index option traded in future market. While index options require retail investors to have a future account which impose strict requirement on clients, retail investors can easily trade DW by opening a cash account. This feature makes derivative warrants trading which is especially attractive to small retail investors. As Chung and Hseu (2006) said that derivative warrants are a means of repackaging securities into smaller units which are easily to access to small retail investors. However, it has only issuers who is able to take short position but retail investors cannot take short position.

In Thailand, an exchange traded derivative warrants is different from other markets because Thailand is emerging market. It has only asset management firms that can issue derivative warrants into the market. They have been traded in Stock Exchange of Thailand since 2009. Over 8 years, the market of derivative warrants has significantly grown. In 2012 (Jan-Dec), the monthly trading value was approximately 6,116.68 million baht with the number of derivative warrants of 284. In 2016 (Jan-Dec), the monthly trading value was approximately 55,250 million baht with the number of derivative warrant of 1,064. The number of derivative warrant in 2012 and 2016 are shown in figure1 and figure2 respectively. So, the number of derivative warrant approximately increased 4 times and the trading value approximately increased 9 times over the past eight years. This result implied that the derivative warrant market has higher competition and issuers have some incentives to issue derivative warrants. Once issuers issue derivative warrants, they have important commitment to manage their risks by hedging the underlying stock. So, issuers can also face many risks such as risk from moving of underlying stock price, risk from changing in implied volatility, risk from changing of the rate of time premium decay, risk from changing in price of an

option resulting from the change in the underlying price, risk from changing in interest rates and risk from branding issuers who issued DW into the market. So, the profit which is earned by issuers will be the cost until the life of derivative warrants is expired. This profit doesn't occur from the difference between the market price and the first price but the profit is compensation of issuer who is bearing their risk after DW issuances. However, there is still not much study about the profit of issuers from derivative warrants issuance while the number of derivative warrants issuing in SET is continuous increasing.

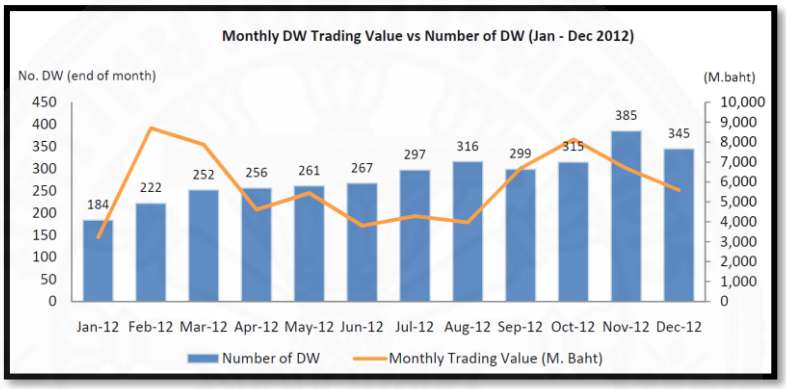

Figure1.1: Derivative warrant trading value on SET and the number of derivative warrant in 2012[1]

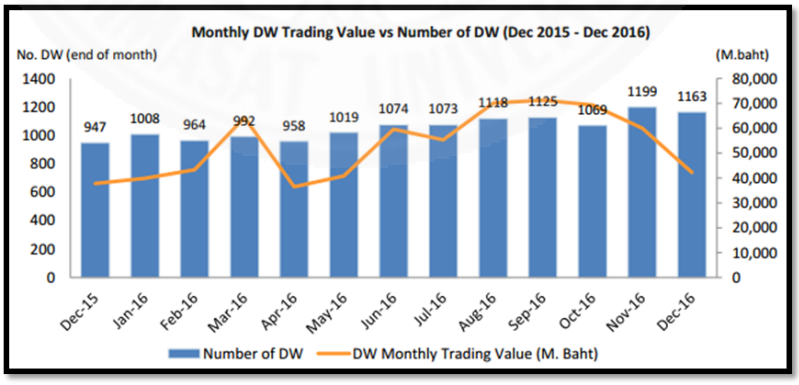

Figure1.2: Derivative warrant trading value on SET and the number of derivative warrant in 2016[2]

[1](Derivative warrant trading value and the number of derivative warrant in 2012 (SET)

[2](Derivative warrant trading value and the number of derivative warrant in 2016 (SET)

So, the purpose of this study is to examine the profit of issuers compensated with the risk of issuing in Thai DW market and study about the profit of retail investors by using the assumption. The assumption is retail investor who will buy DW at the first day of DW and then hold it until maturity of DW. Moreover, we will find how many days that retail investors need to hold derivative warrants before they are sold to make the profit. Therefore, if there are the profitable issuances, we will study risk factors determining the profit of issuers in Thai DW markets. Furthermore, this research tries to verify 2 empirical questions as following:

1) Are derivative warrants profitable in Thai market?
2) What are risk factors that explain the profit of issuers in Thai market?

For the contribution, we would like to provide more appropriate methodology to examine the profit of issuer in Thai DW market by simulating the profit of issuers. Then, regulators may use this as guidelines for the regulatory action. Moreover, we daily adjust the delta to reflect the changing price of underlying stocks.

CHAPTER 2
REVIEW OF LITERATURE

There are some studies about the valuation of the derivative warrants but they are still not much study about the profit of issuers from issuing derivative warrant into Thai market while the number of derivative warrants issuing in The Stock Exchange of Thailand (SET) is continuous increasing. From increasing of the number of derivative warrants, they imply that issuers have some incentives from issuing DW. Issuers may receive the profit which compensate their risk bearing from issuing DW. So, this study analyzes the related literature among the price of derivative warrant and the risk of issuers from issuing DW.

2.1 Literature review on derivative warrant pricing

Shu and Zhang (2001) study about the relationship between the implied volatility and realized of volatility of S&P 500 index. They compare the implied volatility and realized of volatility which are calculated from Black-Scholes model and Heston model. Their result is the implied volatility calculated from Black-Scholes model more explained power than the implied volatility calculated from Heston model although Black-Scholes model is unrealistic model because it assumes constant volatility. For the Asian stock markets, Hung and Chen (2002) study about the pricing of derivative warrant in Taiwan market. They use two models that are Black-Scholes model and Stochastic Volatility model to compare the pricing of derivative warrants by the method of pair-wise t-test to identify the percentage pricing error of derivative warrants. Their result is the warrant overpriced when the interest rate is higher. For the basic properties on option pricing, Perignon (2006) study the basic properties on option pricing that an increase of underlying stock price increases the value of call options or decrease the value of put options by using all transaction prices for five option contracts written on the European, French, German, Swiss and British. He concludes that the effect of market microstructure such as bid-ask bounce and rational tactics for trading in the market can use to explain about the violation of the option pricing.

Li and Zhang (2011) study about why the price of derivative warrants is higher than the price of option with same of underlying securities, exercise price and maturity date in Hong Kong market. They use six factors such as trading volume, bid-ask spread, contract size, turnover ratio, number of standard liquidity measures and illiquidity measure from Amihud (2002) to describe their purpose. So, they conclude that the price of derivative warrant are more expensive than the price of option because the liquidity and the holding period return for short term of derivative warrant are greater than the liquidity and the holding period return for long term of option. Moreover, they provide more reason about the overprice phenomenon of derivative warrants because they are more illiquid than options in view of higher hedging costs for liquidity providers. After one year, Fung and Zeng (2012) use the conclusion from Li and Zhang (2011) to extend study about the pricing of derivative warrants in Hong Kong market. Their purpose is to investigate that the price of derivative warrants are overpriced or not. If the issuers are setup the price of derivative warrant overpriced, they will create an upward bias in the price of warrants. They focus on three ways to identify this point. The first things is comparing between implied volatility and realized volatility for derivative warrant and options. The second things is to investigate the information content of implied volatility on the future of realized volatility for derivative warrant and options. The last things is to investigate the relationship between delta-hedged profit or loss on short position for derivative warrant and options and the deviation of implied volatility from realized volatility. Their result is consistent with li and Zhang (2011)'s conclusion. It is the price of derivative warrants that are overpriced and higher than the price of options especially for ITM (in the money).

2.2 Literature review on risk from derivative warrant issuance

Green and Figlewski (1999) study about market risk and risk models for a Financial Institution writing options. They compare between return and risk in writing options with and without hedging. Their result show that uncompleted models and incorrect implied volatility forecast can provide a lot of risk exposure for issuers. Chung and Hseu (2006) study about the effect of introduction from 1997 to 2004 in the view point of return, risks, trading activity of underlying stocks. They find that abnormal return at the announcement day but it decrease after the announcement day. This result

is opposite with Aitken and Segara (2005) which find negative abnormal returns on announcement date of derivative warrants. Moreover, they study about DW issuances of a popular underlying stock. They find that the demand of hedging effect with the underlying stock prices is significant.

Wongsirikul (2013) study about the pricing error from different issuers which are determined by using 2 valuation models: Black-Scholes (BS) and Cox Square Root (CSR). She divide issuers into 2 groups by using the credit rating as follows: High credit rating groups and Low credit rating groups. Her result was MBKET which has the highest percentage pricing errors of BS and CSR model for high credit rating groups. It mean that MBKET gains some premium from investors. For the low credit rating groups, KGI have the highest percentage pricing errors of BS and CSR. It mean that KGI gains some premium from investors. So, this result can be implied that the branding of derivative warrant affects with the price of derivative warrants.

CHAPTER 3
THEORETICAL FRAMEWORK

This study empirically examines the profit of issuers compensated with the risk of issuing in DW Thai market which is based on the theoretical Black - Scholes model. For the Black-Scholes model, it is derived by Black and Scholes (1973). They derive the formula to determine the option pricing. Under this model, it has many assumptions. For example, the option pricing formula can only use the European options and can only exercise at the maturity. No dividend are paid out during the life of options. It has constant volatility. The price of underlying assets follow the Geometric Brownian motion with constant drift and volatility.

$$\frac{ds}{s} = r_f dt + \sigma dW \tag{1}$$

where dW is Wiener process, rf is risk-free and σ is volatility which is assumed to be constant. The price of European call and put which is based on underlying stock and single stock future with a strike price of K is given by European Option based on underlying stock.

$$C(S,t) = S_t N(d_1) - Ke^{-r_f T} N(d_2) \tag{2}$$

$$P(S,t) = Ke^{-r_f T} N(-d_2) - S_t N(-d_1) \tag{3}$$

$$d_1 = \frac{\ln\left(\frac{S}{X}\right) + (r + \frac{\sigma^2}{2})(T)}{\sigma\sqrt{T}} \tag{4}$$

$$d_2 = d_1 - \sigma\sqrt{T} \tag{5}$$

where t is transaction date of derivative warrant, T is time between the transaction date and the exercise date which is based on the calendar day, $N(d_1)$ and $N(d_2)$ are cumulative normal distribution function. So, it has only one parameter (σ)

which is to estimate in this model. The implied volatility can be calculated by solving σ in this model.

CHAPTER 4
DATA

The data used in this study are divided into 4 main things. The first things is derivative warrants which is obtained from the Stock Exchange of Thailand market (SETSMART). The sample period of the collected data is from January 1, 2016 to December 31, 2016. This date is the issued date of derivative warrant. The data consist of the 2,512 derivative warrants that are listed on the Stock Exchange of Thailand (SET) issued from total 119 underlying stocks. For the details of each derivative warrants, they was collected as followed: daily open price, daily bid price, strike price, last trading date and trading date. Moreover, the volatility used in Black-Scholes model is calculated from Historical Volatility. The second things is the underlying stocks which was obtained from Thomson Reuters Datastream. The sample period of the collected data is the trading date of derivative warrant from the issued date to the last trading date. The data consist of the 119 underlying stocks that are listed on the Stock Exchange of Thailand (SET). For the details of each underlying stocks, they was collected as followed: daily open price, daily closed price, daily bid price, daily ask price and Trading date. The third things is risk-free rates which was obtained from Bank of Thailand (BOT) by using T-Bill for 1 month. The sample period of the collected data is the trading date of derivative warrant between the issued date and the last trading date. The last things is the credit rating of issuers which was obtained from the Stock Exchange of Thailand (SET). These credit ratings are disclosed by TRIS rating, Standard & Poor's global rating and Fitch Ratings.

Table 4.1 Issuers and types of 2512 derivative warrants in 2016

No	Issuer Name	Issuer Code	Symbol	Credit Rating	Derivative Warrants		Total
					Call	Put	
1	Bualuang Securities	01	BLS	AA	298	249	547
2	Phatra Securities	06	PTSEC	A-	101	26	127
3	Asia Plus Securities	08	ASPS	A-	226	52	278
4	Kasikorn Securities	11	KS	AA(tha)	194	70	264
5	KGI Securities	13	KGI	A-	229	50	279
6	Thanachart Securities	16	TNS	A+	28	-	28
7	SCB Securities	23	SCBS	AA(tha)	123	33	156
8	Finansia Syrus	24	FSS	BBB+(tha)	99	-	99
9	RHB OSK Securities	27	RHBS	BBB+	81	23	104
10	Macquarie Securities	28	MACQ	A-(tha)	274	28	302
11	Maybank Kim Eng	42	MBKET	AA+(tha)	222	86	308
12	KT ZMICO Securities	18	KTZ	BBB+	20	-	20

CHAPTER 5
RESEARCH METHODOLOGY

The purpose of research methodology is to examine the profit of issuers compensated with the risk of issuing in Thai DW market. For example, we test on what are risk factors from issuing DW such as risk from moving of underlying stock price (Delta risk), risk from changing in implied volatility (Vega risk), risk from changing of the rate of time premium decay (Theta risk), risk from changing in price of an option resulting from the change in the underlying price (Gamma risk), risk from changing in interest rates (Rho risk) and risk from branding issuers who issued DW into the market could explain the profit of issuer. If there is the profitable DW issuances, we will study risk factors determining the profit of issuers in Thai DW markets by testing as below hypothesis:

Hypothesis I: There are some risk factors from issuing DW that could explain the profit of issuers. From the profit of issuers, it determine from 2 parts. The first parts is the profit from issuing the derivative warrant of issuer at the first date. The last parts is the profit from hedging of underlying stock by adjusting the daily delta as the following conditions.

First conditions: If the current of delta is greater than the previous of delta, we will buy the underlying stock into the portfolios.

Second conditions: If the current of delta is less than or equal the previous of delta, we will sell the underlying stock from the portfolios.

Regression analysis

$$\begin{aligned}\text{Profit} = {} & \beta_0 + \beta_1[\text{Delta risk}] + \beta_2[\text{Gamma risk}] + \beta_3[\text{Vega risk}] \\ & + \beta_4[\text{Rho risk}] + \beta_5[\text{Theta risk}] + \beta_6[\text{Issuer}]\end{aligned} \tag{6}$$

where

$$\pi_{T,C} = \sum_{t=0}^{T-1} (\Delta_{t+1} - \Delta_t)(S_{t+1} - S_t)e^{r_f(T)} + ((C_0^T - C_0)e^{r_f T}) \quad (7)$$

$$\pi_{T,P} = \sum_{t=0}^{T-1} (\Delta_{t+1} - \Delta_t)(S_{t+1} - S_t)e^{r_f(T)} + ((P_0^T - P_0)e^{r_f T}) \quad (8)$$

$$\text{Delta risk for call } = N(d_1) = N\left(\frac{\ln\left(\frac{S}{X}\right) + \left(r + \frac{\sigma^2}{2}\right)(T)}{\sigma\sqrt{T}}\right) \quad (9)$$

$$\text{Delta risk for put } = N(d_1) - 1 = N\left(\frac{\ln\left(\frac{S}{X}\right) + \left(r + \frac{\sigma^2}{2}\right)(T)}{\sigma\sqrt{T}}\right) - 1 \quad (10)$$

$$\text{Gamma risk for call and put} = \frac{N'(d_1)}{S\sigma\sqrt{T}} \text{ where } N'(d_1) = e^{\left(\frac{-(d_1)^2}{2}\right)} * \frac{1}{\sqrt{2\pi}} \quad (11)$$

$$\text{Vega risk for call and put} = S\sqrt{T}N'(d_1) \text{ where } N'(d_1) = e^{\left(\frac{-(d_1)^2}{2}\right)} * \frac{1}{\sqrt{2\pi}} \quad (12)$$

$$\text{Rho risk for call } = XTe^{r_f T}N(d_2) \quad (13)$$

$$\text{Rho risk for put } = -XTe^{-r_f T}(1 - N(d_2)) \quad (14)$$

$$\text{Theta risk for call } = -\frac{SN'(d_1)\sigma}{2\sqrt{T}} - r_f Xe^{-r_f T}N(d_2) \quad (15)$$

$$\text{Theta risk for put } = -\frac{SN'(d_1)\sigma}{2\sqrt{T}} + r_f Xe^{-r_f T}N(-d_2) \quad (16)$$

For issuer variables, they will use the credit rating of issuers which was obtained from the Stock Exchange of Thailand (SET). These credit ratings are disclosed by TRIS rating, Standard & Poor's global rating and Fitch Ratings. These credit ratings are

converted from character to number by using Altman's Z-score method. It will be mapping average number of Z-Score with each credit rating of issuers. Furthermore, all risk factors such as delta risk, gamma risk, vega risk, rho risk and theta risk will be divided by standard deviation of each risk factors to convert units of each risk factors to be same units and compare the effect of each risk factors.

CHAPTER 6
EMPIRICAL RESULTS

This section reports the empirical results of returns of 2512 derivative warrants, 1895 call derivative warrants and 617 put derivative warrants, listed in the Stock Exchange of Thailand in 2016. The empirical result can be summarized in term of issuers and retail investors. For issuer side, it will come from 2 parts. The first parts is the profit from issuing the derivative warrant of issuer at the first date. The last parts is the profit from hedging of underlying stock by adjusting the daily delta. For retail investor side, we assume that they will buy at the first day of issuing of derivative warrants and hold them until the maturity day. Moreover, the empirical result show the profit/loss of retail investors if they hold derivative warrants as following: 3 days, 5 days, 7 days, 15 days and 30 days. Section 6.1 present summary statistics of profit of issuers and retail investors. Section 6.2 present result of regression analysis.

6.1 Summary Statistics of profit of issuers and retail investors

From the result of table 6.1 to the result of table 6.9, they show the summary statistics of derivative warrants traded in 2016 both issuers and retail investors. There are 2512 derivative warrants which are written on 119 underlying stocks. This derivative warrants are issued by 12 issuers. The result of table 6.1 presents that all issuers have a number of derivative warrants which make profit more than loss from issuing derivative warrants both of derivative warrants. The result of table 6.2 shows that most of issuers can make profit from issuing both of derivative warrants except 3 issuers: Phatra Securities (PTSEC), Thanachart Securities (TNS) and SCB Securities (SCBS). For Phatra Securities (PTSEC), they make loss -0.291 THB per a derivative warrant from issuing put derivative warrants. For Thanachart Securities (TNS), they make loss -0.3242 THB per a derivative warrant from issuing call derivative warrants. For SCB Securities (SCBS), they make loss -0.2799 THB per a derivative warrant from issuing put derivative warrants. This result is consistent with the result of table 6.3 and the result of table 6.4. The result of table 6.3 shows that all retail investors have a number of derivative warrants which make loss more than profit from trading both of

derivative warrants with all brokerage firms. The result of table 6.4 presents that all retail investors make loss from holding them until the maturity.

From the result of table 6.5 to the result of table 6.9, they present that retail investors need to trade with brokerage firms and how many day retail investors need to hold derivative warrants to make profit. The result can be divided into 5 cases. The first cases is holding derivative warrants 3 days. Retail investors can make profit 0.0078 THB per a derivative warrant from trading put derivative warrants with Bualuang Securities (BLS) and make profit 0.0015 THB per a derivative warrant from trading call derivative warrants with Finansia Syrus (FSS). The second cases is holding derivative warrants 5 days. Retail investors can make profit 0.0206 THB per a derivative warrant from trading put derivative warrants with Bualuang Securities (BLS). The third cases is holding derivative warrants 7 days. Retail investors can make profit 0.0081 THB per a derivative warrant from trading put derivative warrants with Bualuang Securities (BLS) and make profit 0.0015 THB per a derivative warrant from trading call derivative warrants with KT ZMICO Securities (KTZ) and make profit 0.0029 THB per a derivative warrant from trading call derivative warrants with SCB Securities (SCBS). The fourth cases is holding derivative warrants 15 days. Retail investors can make profit 0.0175 THB per a derivative warrant from trading call derivative warrants with KT ZMICO Securities (KTZ). The last cases is holding derivative warrants 30 days. Retail investors can make profit 0.0026 THB per a derivative warrant from trading put derivative warrants with RHB OSK Securities (RHBS). Additionally, we found that retail investors always make loss if they hold call derivative warrants or put derivative warrants more than 30 days.

Table 6.1 Number of Profit and Loss for Issuers of Derivative Warrants

Units: Number of Derivative Warrants

Symbol	Issuer Code	Derivative Warrants						Total
		Call			Put			
		Total	No. of Profit	No. of Loss	Total	No. of Profit	No. of Loss	
BLS	1	298	207	91	249	189	60	547
PTSEC	6	101	65	36	26	14	12	127
ASPS	8	226	190	36	52	45	7	278
KS	11	194	143	51	70	50	20	264
KGI	13	229	190	39	50	43	7	279
TNS	16	28	19	9	-	-	-	28
KTZ	18	20	14	6	-	-	-	20
SCBS	23	123	102	21	33	26	7	156
FSS	24	99	89	10	-	-	-	99
RHBS	27	81	58	23	23	20	3	104
MACQ	28	274	219	55	28	20	8	302
MBKET	42	222	187	35	86	75	11	308

Table 6.2 Descriptive Statistics for the profit of issuers

Units: THB per 1 DW

Issuers	Type	Mean	Med	Max	Min	Std. Dev.	Skew.	Kurto.
BLS	Call	0.1004	0.2106	4.9351	-10.1906	1.3125	-4.5464	35.552
	Put	0.5411	0.3261	11.0255	-8.9185	1.7069	1.2975	16.5391
PTSEC	Call	0.0091	0.2088	4.0564	-7.4688	1.214	-2.4223	15.4412
	Put	-0.291	0.559	2.8177	-8.1638	2.6914	-1.3346	1.6745
ASPS	Call	0.4874	0.3342	22.988	-6.7144	1.9261	7.2034	85.092
	Put	0.8509	0.8527	12.1165	-15.8012	3.4818	-1.5883	12.1893
KS	Call	0.2093	0.2863	5.4401	-10.3213	1.1428	-3.4876	40.5147
	Put	0.7021	0.6866	9.0981	-7.6592	1.9392	-0.0538	8.5992
KGI	Call	0.4336	0.4016	8.0461	-7.4555	1.2416	0.4781	17.3835
	Put	0.9472	1.1511	6.8431	-11.6524	2.7796	-2.2841	9.0018
TNS	Call	-0.3242	0.2533	1.0618	-8.0127	1.975	-2.9957	9.1967
	Put	-	-	-	-	-	-	-
KTZ	Call	0.1624	0.3209	2.1896	-1.9565	0.9468	-0.4806	1.1922
	Put	-	-	-	-	-	-	-

Units: THB per 1 DW

Issuers	Type	Mean	Med	Max	Min	Std. Dev.	Skew.	Kurto.
SCBS	Call	0.3138	0.3651	6.0941	-4.6929	1.1515	-0.4762	10.3578
	Put	-0.2799	0.5484	9.8691	-12.5121	4.4388	-1.2399	3.1306
FSS	Call	0.4797	0.3842	5.7601	-2.7284	0.9434	1.1739	11.9338
	Put	-	-	-	-	-	-	-
RHBS	Call	0.1698	0.3267	3.803	-7.8502	1.4401	-2.3903	12.6774
	Put	0.7202	0.9215	4.3061	-8.1776	2.1739	-3.115	13.839
MACQ	Call	0.2746	0.3258	8.6945	-7.6399	1.3905	-1.1683	16.0705
	Put	0.176	0.7213	3.6511	-9.8553	2.7121	-2.2835	6.813
MBKET	Call	0.4645	0.4236	12.0647	-8.6238	1.3493	1.6897	35.7143
	Put	0.743	0.7427	6.6344	-6.9222	1.4678	-1.1118	11.4248

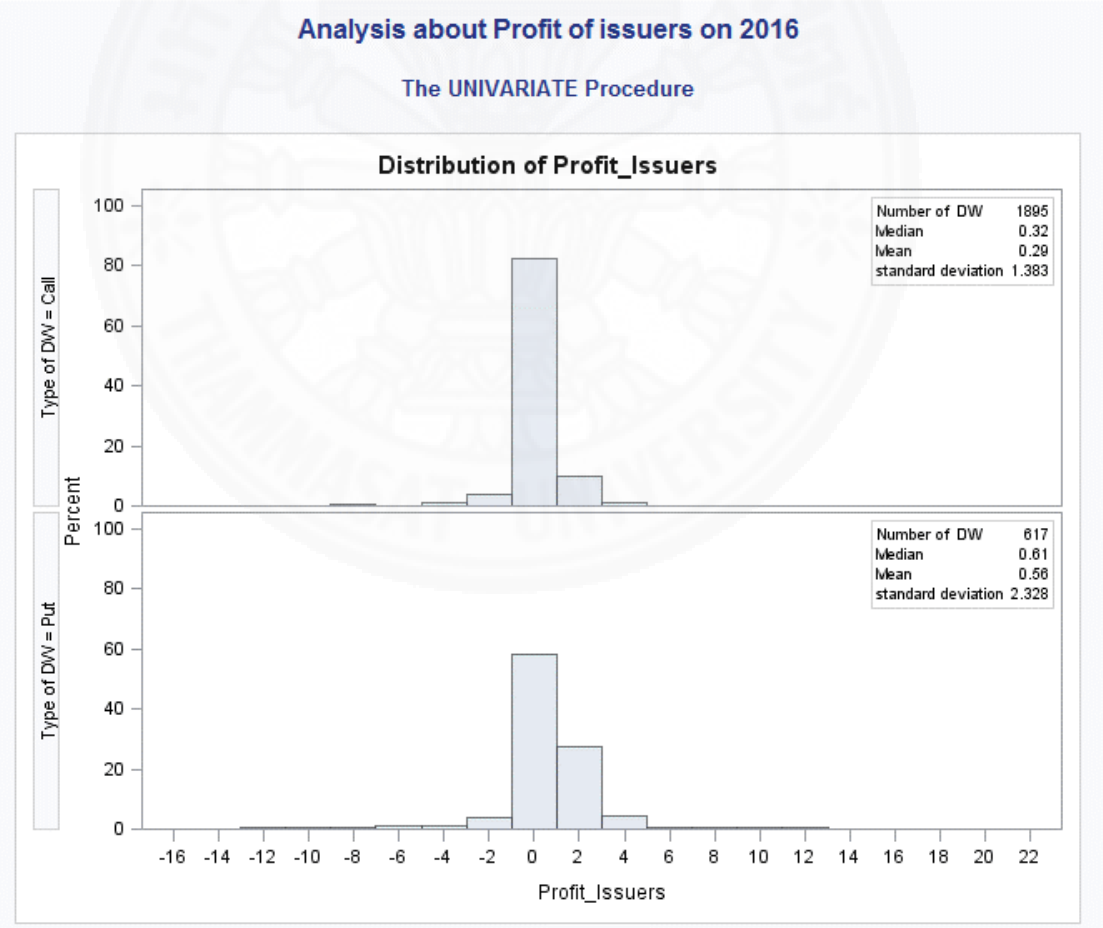

Figure 6.1: Distribution of profit of issuers

Table 6.3 Number of Profit and Loss for Retail Investors of Derivative Warrants

Units: Number of Derivative Warrants

Symbol	Issuer Code	Derivative Warrants						Total
		Call			Put			
		Total	No. of Profit	No. of Loss	Total	No. of Profit	No. of Loss	
BLS	1	298	106	192	249	39	210	547
PTSEC	6	101	36	65	26	9	17	127
ASPS	8	226	38	188	52	5	47	278
KS	11	194	64	130	70	14	56	264
KGI	13	229	42	187	50	7	43	279
TNS	16	28	5	23	-	-	-	28
KTZ	18	20	3	17	-	-	-	20
SCBS	23	123	17	106	33	4	29	156
FSS	24	99	8	91	-	-	-	99
RHBS	27	81	21	60	23	1	22	104
MACQ	28	274	53	221	28	2	26	302
MBKET	42	222	34	188	86	9	77	308

Table 6.4 Descriptive Statistics for the profit of retail investors

Units: THB per 1 DW

Issuers	Type	Mean	Med	Max	Min	Std. Dev.	Skew.	Kurto.
BLS	Call	-0.1074	-0.175	1.66	-1.15	0.4158	0.9185	1.8354
	Put	-0.4127	-0.43	1.33	-1.47	0.4595	0.1412	0.2763
PTSEC	Call	-0.1164	-0.15	2.24	-1.41	0.5747	0.9472	2.3157
	Put	-0.2673	-0.51	2.78	-1.63	1.005	1.0735	1.8796
ASPS	Call	-0.2319	-0.33	2.28	-0.99	0.4645	2.4512	7.9792
	Put	-0.6025	-0.73	2.2	-1.4	0.5897	2.674	9.7168
KS	Call	-0.1049	-0.18	3.26	-1.59	0.5986	1.5438	5.7734
	Put	-0.5516	-0.645	1.2	-1.73	0.5996	0.69	0.4712
KGI	Call	-0.2708	-0.35	2.05	-1.17	0.4682	1.8195	4.9059
	Put	-0.722	-0.84	0.8	-1.67	0.5915	1.09	0.8654
TNS	Call	-0.3771	-0.415	0.66	-1.26	0.481	0.4602	0.0748
	Put	-	-	-	-	-	-	-
KTZ	Call	-0.273	-0.375	1.14	-0.87	0.4928	1.4861	2.6207
	Put	-	-	-	-	-	-	-
SCBS	Call	-0.2389	-0.3	5.34	-0.93	0.5908	7.1482	65.7859
	Put	-0.3403	-0.5	2.22	-1.7	0.8213	1.9198	4.23
FSS	Call	-0.2867	-0.38	3.09	-0.91	0.5714	3.6125	16.1806
	Put	-	-	-	-	-	-	-
RHBS	Call	-0.1312	-0.33	3.53	-1.15	0.7081	2.6431	9.7343
	Put	-0.6957	-0.8	0.18	-1.28	0.3742	0.5064	-0.0402
MACQ	Call	-0.235	-0.28	1.31	-1.07	0.3181	1.0348	2.4698
	Put	-0.4375	-0.48	1.07	-1.28	0.4308	1.5252	5.3555
MBKET	Call	-0.289	-0.36	2.86	-1.48	0.5657	2.5279	10.7491
	Put	-0.6022	-0.655	1.35	-2.04	0.5791	0.8467	1.7726

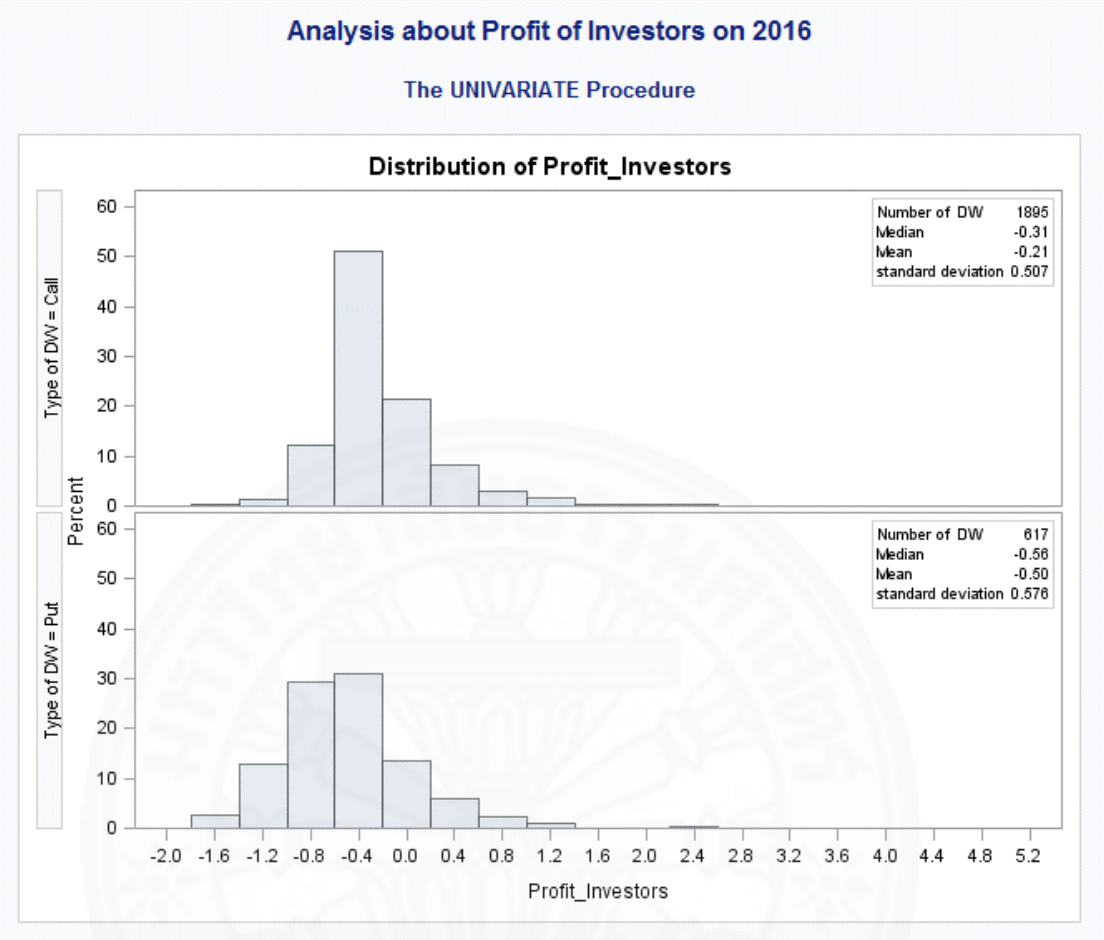

Figure 6.2: Distribution of profit of retail investors

Table 6.5 Descriptive Statistics for the profit of retail investors for holding 3 days

Units: THB per 1 DW

Issuers	Type	Mean	Med	Max	Min	Std. Dev.	Skew.	Kurto.
BLS	Call	-0.0223	-0.02	0.33	-0.21	0.0645	0.2929	3.0897
	Put	0.0078	0.01	0.22	-0.22	0.0614	0.2401	1.8081
PTSEC	Call	-0.0086	-0.02	0.28	-0.19	0.07	0.7363	3.4541
	Put	-0.0077	-0.005	0.13	-0.18	0.0707	-0.5724	1.3462
ASPS	Call	-0.017	-0.01	0.37	-0.53	0.0806	-1.4918	14.7991
	Put	-0.0254	-0.02	0.18	-0.22	0.0819	0.1229	0.4916
KS	Call	-0.0141	-0.02	0.41	-0.3	0.0742	0.8647	7.0084
	Put	-0.0164	-0.02	0.34	-0.35	0.0888	0.6898	7.1563
KGI	Call	-0.0173	-0.02	0.16	-0.36	0.0615	-0.8183	5.0226
	Put	-0.022	-0.02	0.22	-0.22	0.0845	0.2437	0.8562
TNS	Call	-0.0004	-0.005	0.14	-0.1	0.0567	0.591	0.1571
	Put	-	-	-	-	-	-	-
KTZ	Call	-0.0045	-0.035	0.27	-0.16	0.1042	1.2774	1.6693
	Put	-	-	-	-	-	-	-
SCBS	Call	-0.0152	-0.01	0.14	-0.17	0.0469	0.0328	2.2133
	Put	-0.0258	-0.01	0.13	-0.48	0.1081	-2.8396	10.3537
FSS	Call	0.0015	-0.01	0.23	-0.31	0.0671	-0.2765	5.123
	Put	-	-	-	-	-	-	-
RHBS	Call	-0.0142	-0.01	0.2	-0.24	0.0686	-0.5446	2.0371
	Put	-0.0326	-0.03	0.04	-0.24	0.061	-1.9538	5.4628
MACQ	Call	-0.0033	-0.01	0.31	-0.26	0.0576	0.6954	6.1253
	Put	-0.0139	-0.01	0.07	-0.16	0.0517	-0.8012	1.1664
MBKET	Call	-0.0026	-0.01	0.47	-0.16	0.0697	2.4799	12.25
	Put	-0.0107	0	0.15	-0.18	0.0577	-0.3647	1.9989

Table 6.6 Descriptive Statistics for the profit of retail investors for holding 5 days

Units: THB per 1 DW

Issuers	Type	Mean	Med	Max	Min	Std. Dev.	Skew.	Kurto.
BLS	Call	-0.0341	-0.03	0.28	-0.51	0.0855	-0.9601	5.436
	Put	0.0206	0.01	0.77	-0.25	0.1055	2.7661	15.4867
PTSEC	Call	-0.0025	-0.01	0.26	-0.21	0.089	0.6114	0.7606
	Put	-0.0562	-0.04	0.11	-0.28	0.1029	-0.3403	-0.4962
ASPS	Call	-0.0215	-0.03	0.32	-0.58	0.0926	-0.6762	8.905
	Put	-0.0423	-0.03	0.12	-0.26	0.0838	-0.6452	0.323
KS	Call	-0.0137	-0.02	0.38	-0.43	0.0951	0.2636	5.499
	Put	-0.0163	-0.025	0.48	-0.33	0.1274	1.5083	5.3725
KGI	Call	-0.0158	-0.02	0.21	-0.34	0.0788	-0.3487	2.2498
	Put	-0.0174	-0.01	0.41	-0.24	0.1095	0.9792	4.1329
TNS	Call	-0.0018	-0.025	0.18	-0.12	0.0713	0.8995	0.4378
	Put	-	-	-	-	-	-	-
KTZ	Call	-0.008	-0.02	0.26	-0.32	0.1417	-0.1295	0.1387
	Put	-	-	-	-	-	-	-
SCBS	Call	-0.0032	-0.01	0.31	-0.24	0.0701	0.7057	3.8568
	Put	-0.0282	-0.01	0.16	-0.52	0.1248	-2.2991	7.4495
FSS	Call	-0.0013	-0.01	0.27	-0.3	0.0802	0.1869	3.2964
	Put	-	-	-	-	-	-	-
RHBS	Call	-0.0185	-0.01	0.24	-0.21	0.0727	-0.0781	1.8496
	Put	-0.0204	-0.02	0.1	-0.2	0.0679	-0.6292	0.8846
MACQ	Call	-0.0034	-0.01	0.28	-0.18	0.0699	1.0002	2.7731
	Put	-0.0125	-0.015	0.13	-0.12	0.052	0.486	1.4513
MBKET	Call	-0.0046	-0.01	0.44	-0.14	0.0757	2.2348	9.9117
	Put	-0.0241	-0.02	0.21	-0.32	0.0764	-0.1288	3.4337

Table 6.7 Descriptive Statistics for the profit of retail investors for holding 7 days

Units: THB per 1 DW

Issuers	Type	Mean	Med	Max	Min	Std. Dev.	Skew.	Kurto.
BLS	Call	-0.0312	-0.03	0.34	-0.59	0.1	-0.7114	5.3749
	Put	0.0081	0	0.7	-0.29	0.1113	1.7386	9.27
PTSEC	Call	-0.0196	-0.01	0.25	-0.4	0.1032	-0.1374	1.6821
	Put	-0.0562	-0.045	0.09	-0.25	0.1033	-0.4157	-1.0141
ASPS	Call	-0.0243	-0.02	0.51	-0.59	0.1083	0.0577	7.2948
	Put	-0.0594	-0.04	0.12	-0.3	0.0943	-0.9169	0.3546
KS	Call	-0.0159	-0.03	0.59	-0.5	0.1101	0.6027	7.3453
	Put	-0.008	-0.01	0.59	-0.34	0.1303	1.7588	7.8352
KGI	Call	-0.0173	-0.02	0.31	-0.51	0.0924	-0.5046	4.7183
	Put	-0.039	-0.02	0.29	-0.32	0.1025	0.1052	1.8851
TNS	Call	-0.0221	-0.02	0.1	-0.22	0.073	-0.8157	1.6047
	Put	-	-	-	-	-	-	-
KTZ	Call	0.0015	-0.025	0.35	-0.25	0.1596	0.3751	-0.3816
	Put	-	-	-	-	-	-	-
SCBS	Call	0.0029	-0.01	0.44	-0.16	0.0887	2.2059	7.4779
	Put	-0.053	0	0.2	-0.8	0.1902	-2.278	7.0865
FSS	Call	-0.0006	-0.01	0.37	-0.28	0.0907	0.7972	3.7034
	Put	-	-	-	-	-	-	-
RHBS	Call	-0.0333	-0.03	0.13	-0.29	0.0829	-0.7561	0.9783
	Put	-0.0148	0.01	0.15	-0.15	0.0746	-0.1295	-0.0328
MACQ	Call	-0.0146	-0.01	0.36	-0.32	0.0816	0.0831	3.1631
	Put	-0.0221	-0.045	0.13	-0.12	0.0656	0.4919	-0.6973
MBKET	Call	-0.0106	-0.01	0.43	-0.95	0.1088	-2.1819	26.1558
	Put	-0.0366	-0.03	0.17	-0.26	0.0793	0.1116	1.3165

Table 6.8 Descriptive Statistics for the profit of retail investors for holding 15 days

Units: THB per 1 DW

Issuers	Type	Mean	Med	Max	Min	Std. Dev.	Skew.	Kurto.
BLS	Call	-0.0355	-0.03	0.63	-0.68	0.1479	-0.0285	3.1171
	Put	-0.0045	-0.02	0.93	-0.43	0.1703	1.7615	7.9931
PTSEC	Call	-0.0172	-0.02	0.66	-0.33	0.1468	1.0909	4.0672
	Put	-0.0677	-0.065	0.21	-0.31	0.1166	0.4403	0.3921
ASPS	Call	-0.0431	-0.05	0.6	-0.72	0.1563	0.2468	4.7135
	Put	-0.035	-0.06	1.26	-0.49	0.2692	2.6413	10.7643
KS	Call	-0.0027	-0.02	1.1	-0.48	0.1739	1.945	9.8291
	Put	-0.0453	-0.04	0.53	-0.51	0.1611	0.5606	2.3829
KGI	Call	-0.0359	-0.04	0.44	-0.5	0.1515	-0.0008	1.9839
	Put	-0.0782	-0.085	0.45	-0.38	0.1819	0.9689	1.542
TNS	Call	-0.0157	-0.02	0.19	-0.19	0.09	-0.0299	-0.07
	Put	-	-	-	-	-	-	-
KTZ	Call	0.0175	0.005	0.44	-0.32	0.1581	0.5292	2.0595
	Put	-	-	-	-	-	-	-
SCBS	Call	-0.0034	-0.02	0.68	-0.31	0.1301	1.9748	9.5834
	Put	-0.0594	-0.02	0.35	-0.92	0.2119	-2.2561	8.4156
FSS	Call	-0.0085	-0.02	0.82	-0.34	0.1546	1.7264	8.1873
	Put	-	-	-	-	-	-	-
RHBS	Call	-0.0396	-0.04	0.2	-0.43	0.0994	-0.7409	2.4476
	Put	-0.0174	-0.04	0.34	-0.31	0.1535	0.505	0.7568
MACQ	Call	-0.0331	-0.03	0.49	-0.72	0.1331	-0.4947	3.972
	Put	-0.0254	-0.03	0.21	-0.16	0.0792	0.9595	1.5147
MBKET	Call	-0.017	-0.025	0.45	-0.47	0.1395	0.1082	1.2794
	Put	-0.0545	-0.06	0.48	-0.42	0.136	0.6658	3.508

Table 6.9 Descriptive Statistics for the profit of retail investors for holding 30 days

Units: THB per 1 DW

Issuers	Type	Mean	Med	Max	Min	Std. Dev.	Skew.	Kurto.
BLS	Call	-0.0394	-0.05	1.1	-0.81	0.1969	0.8646	6.2322
	Put	-0.0545	-0.05	0.71	-0.63	0.1909	0.6312	2.3085
PTSEC	Call	-0.0455	-0.06	1.15	-0.71	0.226	1.5323	7.857
	Put	-0.0319	-0.045	0.33	-0.27	0.1678	0.6089	-0.0767
ASPS	Call	-0.065	-0.08	0.79	-0.7	0.203	0.6747	2.796
	Put	-0.1387	-0.14	0.97	-0.71	0.2625	1.1371	5.677
KS	Call	-0.031	-0.05	1	-0.75	0.2284	0.9347	4.2625
	Put	-0.0781	-0.09	0.73	-0.54	0.2049	1.007	3.3289
KGI	Call	-0.0533	-0.06	0.69	-0.62	0.1962	0.0755	1.6105
	Put	-0.1308	-0.17	0.94	-0.58	0.2612	1.5242	4.9339
TNS	Call	-0.07	-0.07	0.11	-0.32	0.1211	-0.2641	-0.6956
	Put	-	-	-	-	-	-	-
KTZ	Call	-0.0785	-0.05	0.27	-0.51	0.1685	-0.4549	1.5372
	Put	-	-	-	-	-	-	-
SCBS	Call	-0.0028	-0.03	1.19	-0.36	0.1972	2.3392	10.8774
	Put	-0.133	-0.11	0.85	-1.39	0.3775	-0.7749	4.1931
FSS	Call	-0.0216	-0.05	1.36	-0.47	0.2334	2.4921	12.3056
	Put	-	-	-	-	-	-	-
RHBS	Call	-0.0348	-0.04	0.45	-0.49	0.1598	0.3688	0.843
	Put	0.0026	-0.02	0.73	-0.38	0.2611	0.9678	1.4534
MACQ	Call	-0.0417	-0.05	0.8	-0.78	0.1728	0.3165	3.5938
	Put	-0.1043	-0.115	0.38	-0.44	0.1754	0.9357	1.6353
MBKET	Call	-0.0489	-0.05	0.56	-0.62	0.177	0.2092	1.4864
	Put	-0.0771	-0.07	0.62	-0.62	0.1841	0.6008	2.9745

6.2 Risk factors evaluation

The result from the regression model for both of derivative warrants is presented in table 6.10 and table 6.11 as respectively. Consistent with the result of Huang and Chen (2011), we find that some risk factors such as Gamma risk and Rho risk are statistically significantly correlated with the profit of issuers for call derivative warrants and some risk factors such as Delta risk, Rho risk and Theta risk are statistically significantly with the profit of issuers for put derivative warrants. However, credit rating of issuers are not statistically significantly correlated with the profit of issuers both of derivative warrants. This result can imply that the profit of issuers come from taking risk factors into account. For example, the profit of call derivative warrants for Maybank Kim Eng (MBKET) come from exposing gamma risk and rho risk because the average of gamma and the average of rho are greater than the average of rho and the average of gamma for all issuers. This result isn't consistent with the previous study (Wongsirikul (2013)) that the pricing of derivative warrants is affected from branding effect. So, this point can be more study in the further study that what factors of issuer effect are impacted with the pricing of derivative warrants.

The result in table 6.10 and table 6.11 shows that the profit of issuers come from normal return because the intercept values (alpha variable) for call derivative warrants and put derivative warrants are negative value. This result implied that issuers have no abnormal return from the market. So, the profit of some issuers such as SCB Securities (SCBS), Finansia Syrus (FSS) and Maybank Kim Eng (MBKET) come from exposing gamma risk and rho risk for call derivative warrants and exposing delta risk, rho risk and theta risk for put derivative warrants. In addition, rho risk is a risk factor that the market provide the highest premium for call derivative warrants (0.1574724) and put derivative warrants (17.64713) because issuers are bearing the sensitivity of derivative warrants to a change in interest rate. For delta risk in the model of call derivative warrants, it is insignificant because we already hedge delta risk. So, delta risk is supposed to be zero. In this case, if we compare delta risk in the model of put derivative warrants, we may say that it more difficult in order to always hedge all delta risk from put option because we can't continuously hedge the delta risk. Additionally, put derivative warrants have higher R^2 than call derivative warrants because a number of issuers who issue put derivative warrant are less than a number of issuers who issue

call derivative warrant. So, this point makes that the data of put derivative warrants has less variability than call derivative warrants.

Table 6.10 Regression results: profit of issuers, risk factors and credit rating of issuers for call derivative warrants

* Significant at 95% confidence level

Call Derivative Warrants			
Dependent Variable	**Profit of issuers**		
Explanatory Variables	**Coef.**	**t Value**	**Pr > |t|**
Intercept	-0.7442945	-1.55	0.12
delta	2.67E-11	0.82	0.414
gamma	0.10129	4.79	0*
vega	0.0486123	0.77	0.441
rho	0.1574724	2.58	0.01*
theta	0.0363719	-0.47	0.24
issuer	-0.027006	-1.56	0.637
No. of obs	1895		
R-Square	0.027		
Adj R-Sq	0.0239		

Table 6.11 Regression results: profit of issuers, risk factors and credit rating of issuers for put derivative warrants

* Significant at 95% confidence level

Put Derivative Warrants			
Dependent Variable	**Profit of issuers**		
Explanatory Variables	**Coef.**	**t Value**	**Pr > |t|**
Intercept	-1.362139	-0.86	0.409
delta	-0.0003924	-3.1	0.002*
gamma	0.0362976	0.48	0.632
vega	0.3337679	1.7	0.089
rho	17.64713	3.86	0*
theta	-0.8496149	-2.75	0.006*
issuer	0.157857	0.79	0.43
No. of obs	617		
R-Square	0.1554		
Adj R-Sq	0.1471		

CHAPTER 7
CONCLUSION

This empirical study is to examine the profit of issuers compensated with the risk of issuing in Thai DW market and study risk factors determining the profit of issuers in Thai DW markets by using daily transactions on 2016. We study about the profit of retail investor by using the assumption. The assumption is the retail investor will buy DW at the first day of DW and then holds them until maturity of DW. Moreover, we analyze how to make the profit for retail investors. For example, retail investors need to trade with brokerage firms and how many day retail investors should hold derivative warrants. The results are as follows.

First, the empirical result show that most of issuers can make profit from issuing derivative warrants for call derivative warrants and put derivative warrants, especially KGI Securities, Asia Plus Securities and Maybank Kim Eng. These 3 issuers can make profit more than other issuers. For the profit of retail investors, we study them by using assumption that retail investors buy derivative warrants and hold them until the maturity. For the result, we found that all retail investor make loss from trading with any brokerage firms, especially KGI Securities, Maybank Kim Eng and Asia Plus Securities. Retail investors make loss from trading with these 3 issuers more than other issuers. Moreover, we more study about how to make profit for retail investors. For the result, it is divided into 5 cases. The first cases is holding derivative warrants 3 days. Retail investors can make profit from trading put derivative warrants with Bualuang Securities (BLS) and make profit from trading call derivative warrants with Finansia Syrus (FSS). The second cases is holding derivative warrants 5 days. Retail investors can make profit from trading put derivative warrants with Bualuang Securities (BLS). The third cases is holding derivative warrants 7 days. Retail investors can make profit from trading put derivative warrants with Bualuang Securities (BLS) and make profit from trading call derivative warrants with KT ZMICO Securities (KTZ) and make profit from trading call derivative warrants with SCB Securities (SCBS). The fourth cases is holding derivative warrants 15 days. Retail investors can make profit from trading call derivative warrants with KT ZMICO Securities (KTZ). The last cases is

holding derivative warrants 30 days. Retail investors can make profit from trading put derivative warrants with RHB OSK Securities (RHBS). If retail investors are holding derivative warrants greater than 30 days, they will make loss from trading both call derivative warrants and put derivative warrants with any brokerage firms.

Second, the empirical result show that some risk factors such as Gamma risk and Rho risk are statistically significantly correlated with the profit of issuers for call derivative warrants and some risk factors such as Delta risk, Rho risk and Theta risk are statistically significantly with the profit of issuers for put derivative warrants. So, if issuers would like to issue derivative warrants, they should issue call derivative warrants because call derivative warrants have less bearing risk. If issuers would like to take more risk to make more return, they should issue put derivative warrants because main profit of issuers come from put derivative warrants. Moreover, the regression analysis shows that the profit of some issuers such as SCB Securities (SCBS), Finansia Syrus (FSS) and Maybank Kim Eng (MBKET) come from exposing gamma risk and rho risk for call derivative warrants and exposing delta risk, rho risk and theta risk for put derivative warrants. Rho risk is a risk factor that the market provide the highest premium for call derivative warrants and put derivative warrants because issuers are bearing the sensitivity of derivative warrants to a change in interest rate. When monetary policy of interest rates are announced to increase or decrease, most people concern about changing in interest rate.

Final, it is interesting for the further developments. There are three major points worth to be considered. The first points is to study more about what factors of issuer effect are impacted with the pricing of derivative warrants. This point is very interesting since each issuers can make different profit. It may come from building customer loyalty of issuers that are different. The second points for the development is concentrated on gap premium of put derivative warrants. This point is like puzzle because main profit of issuers come from issuing put derivative warrants. It may occur from imperfect competitive market for issuing put derivative warrants. Issuers need to have that underlying stock before they issue put derivative warrants. Large issuers have higher opportunity than small issuers to issue put derivative warrants because they hold the underlying stocks in SET50. If small issuers don’t have the underlying stock, they need to borrow them before they issue put derivative warrants. Thus, this is a reason

why some issuers only issue call derivative warrants. The last points study about methodology to capture cost of hedging for gamma risk and rho risk and compare them with the profit of issuers to find the benefit from hedging them.

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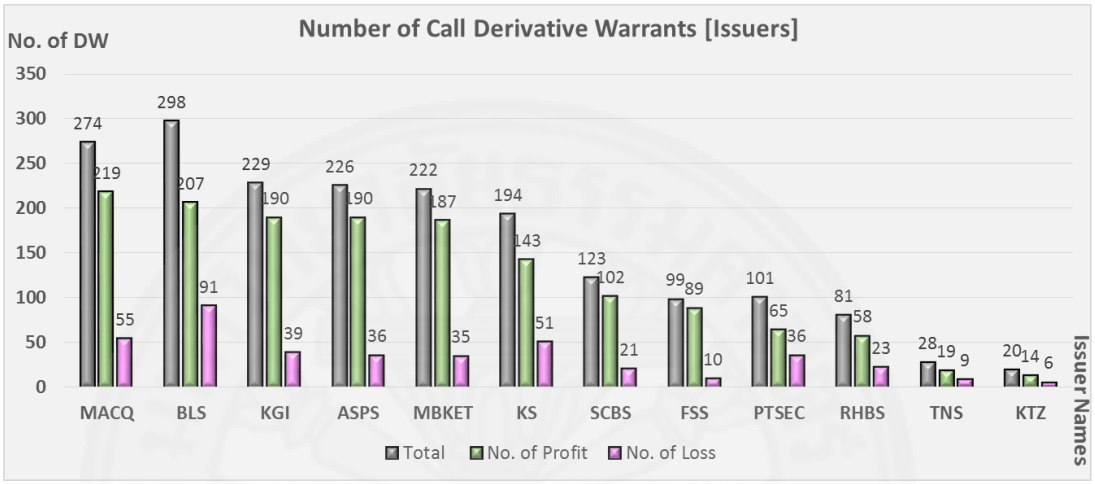
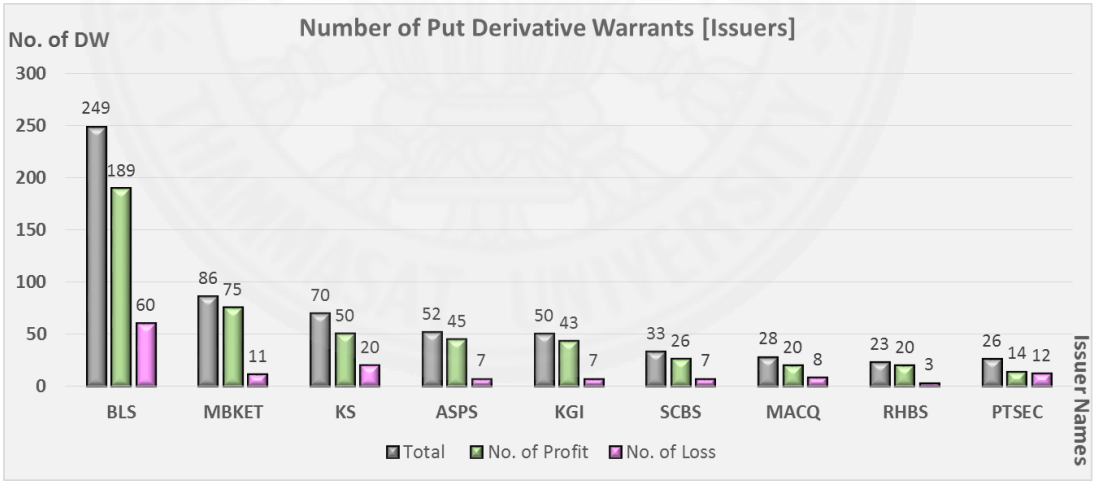
APPENDICES

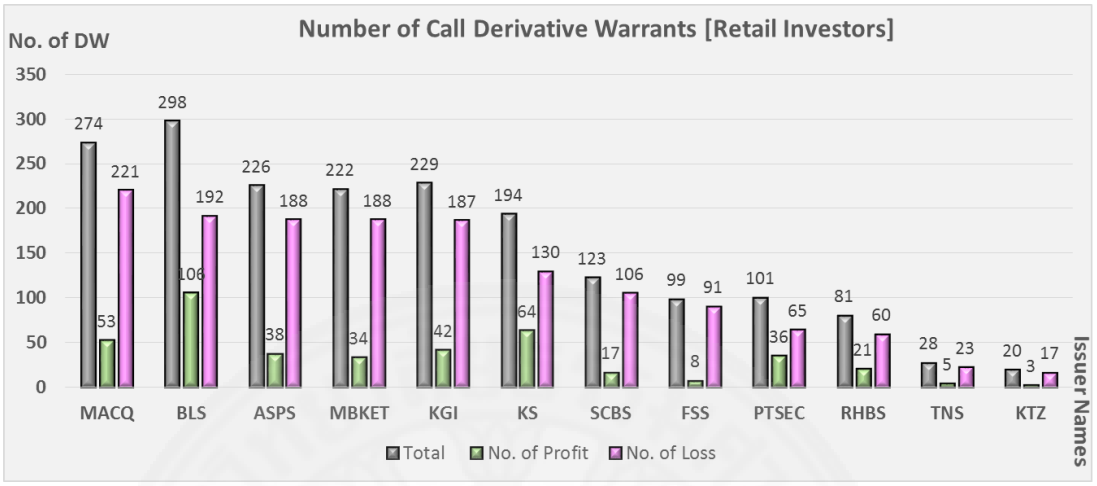
APPENDIX A
FIGURE

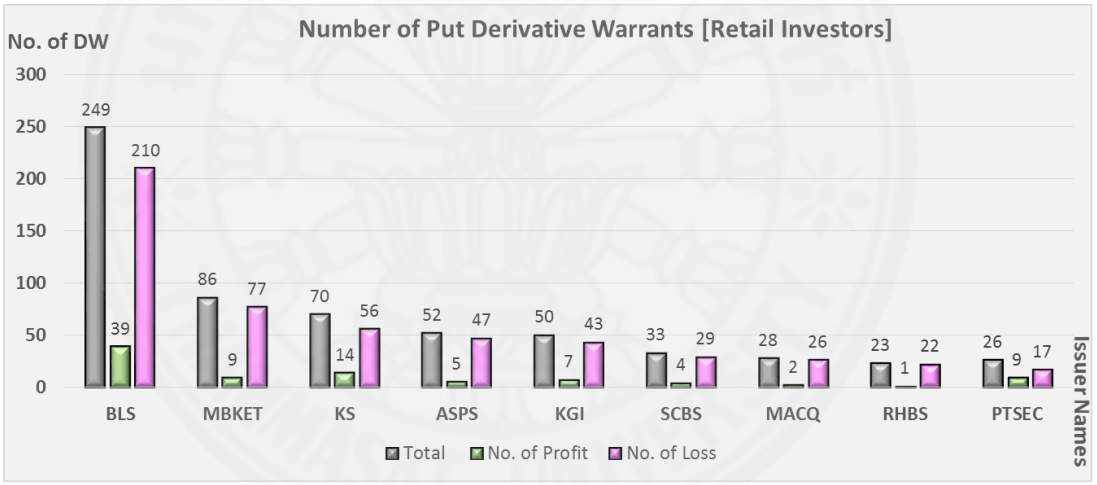
The number of profit/loss of derivative for issuers [call derivative warrants and put derivative warrants]



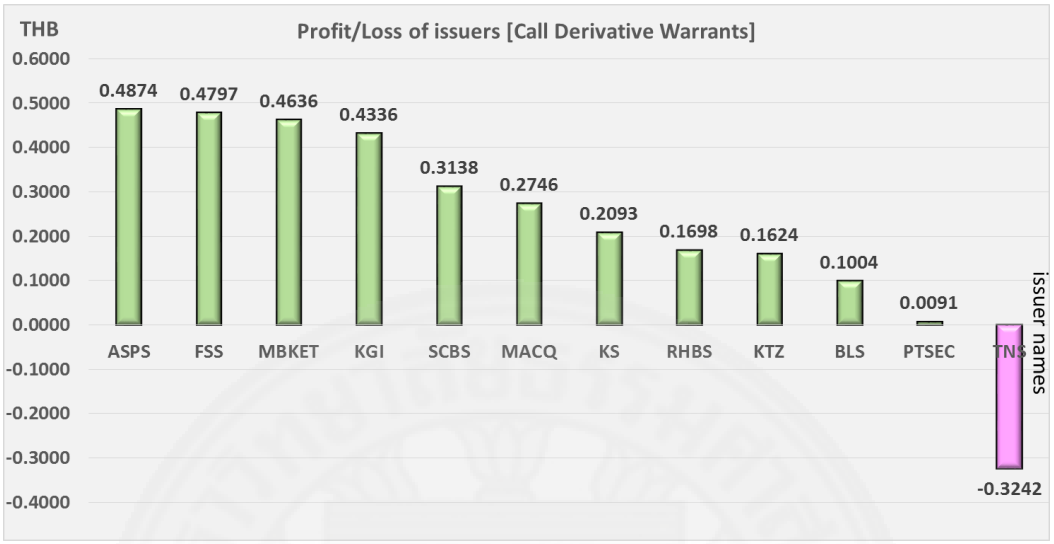


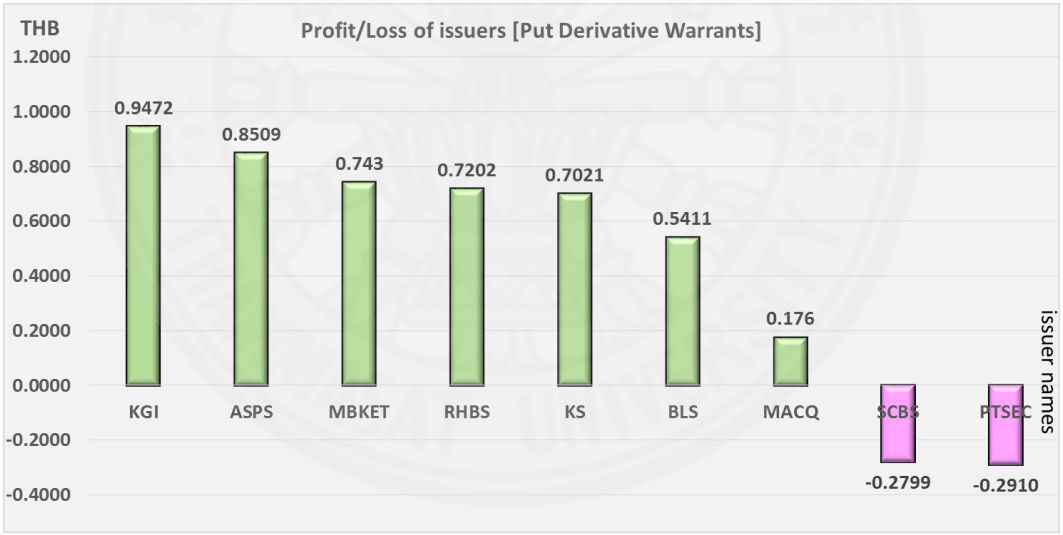
The number of profit/loss of derivative for retail investors [call derivative warrants and put derivative warrants]



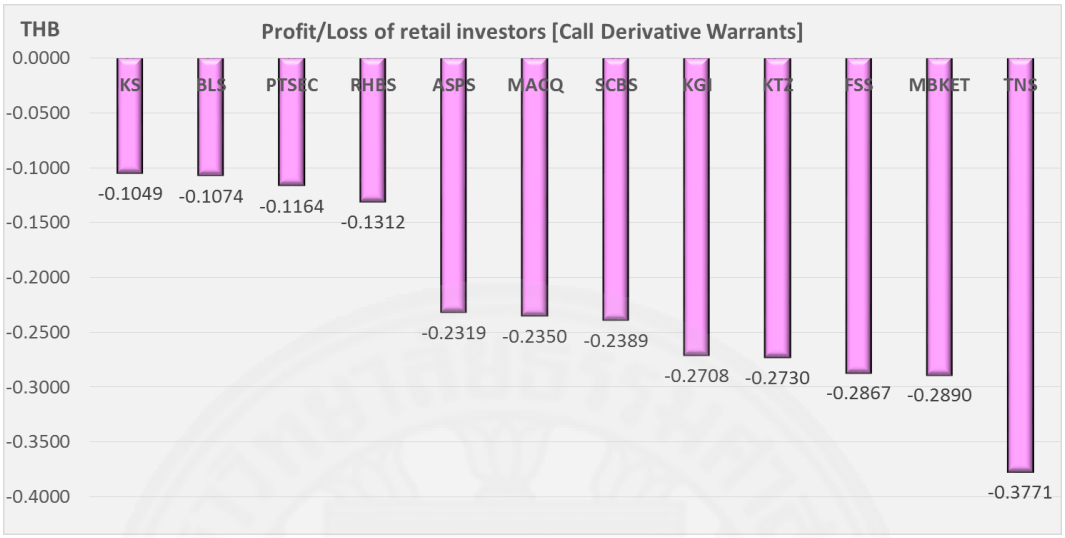


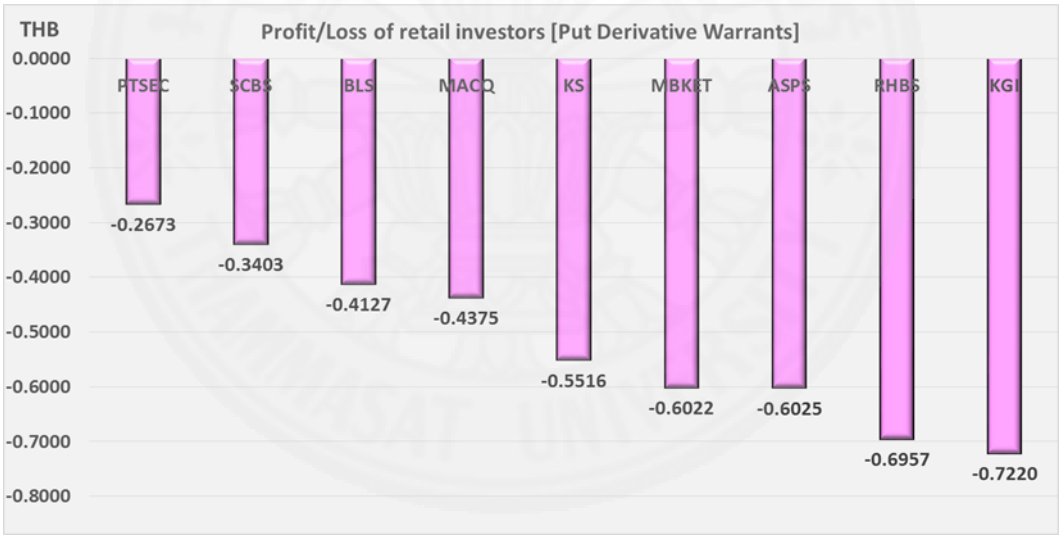
The profit/loss of issuers at maturity [call derivative warrants and put derivative warrants]



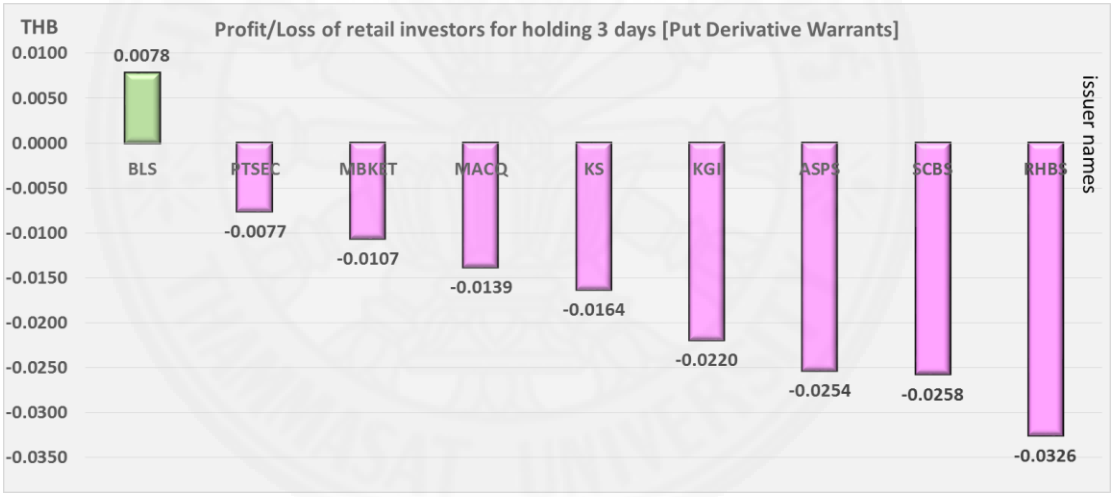


The profit/loss of retail investors at maturity [call derivative warrants and put derivative warrants]

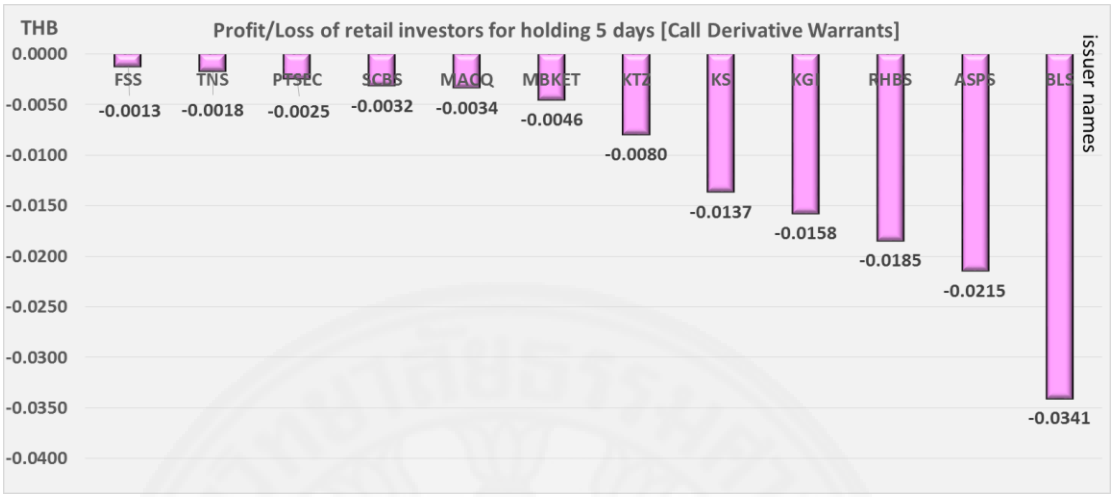




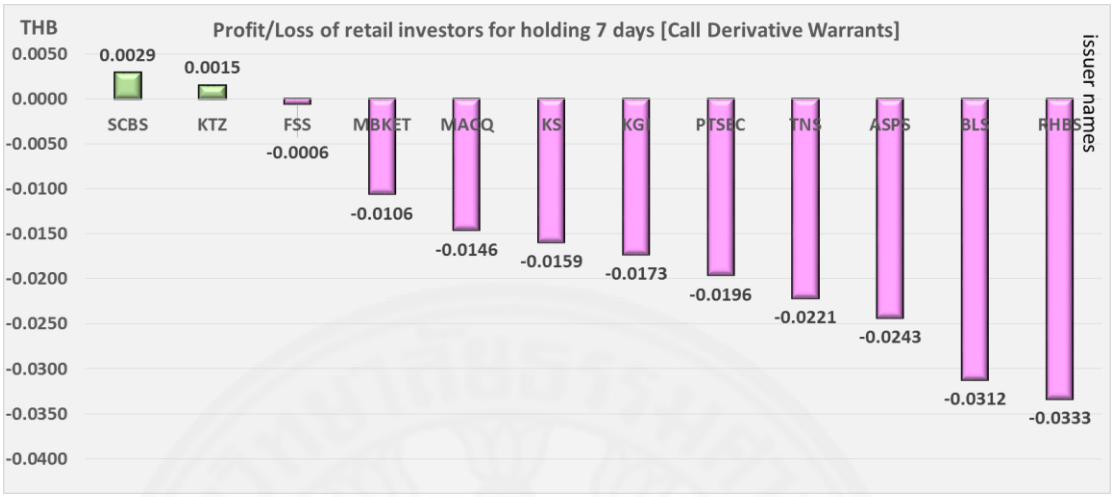
The profit/loss of retail investors for holding 3 days [call derivative warrants and put derivative warrants]

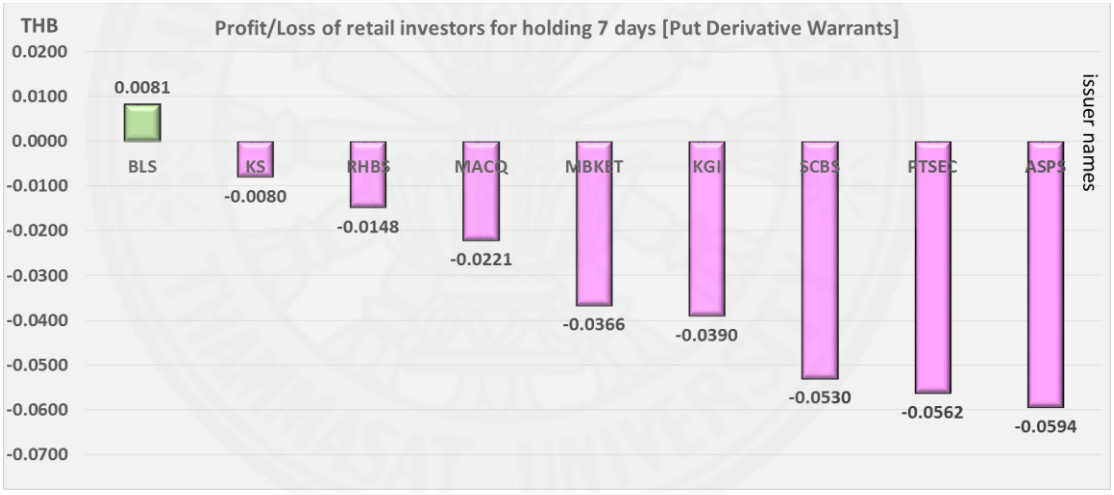


The profit/loss of retail investors for holding 5 days [call derivative warrants and put derivative warrants]

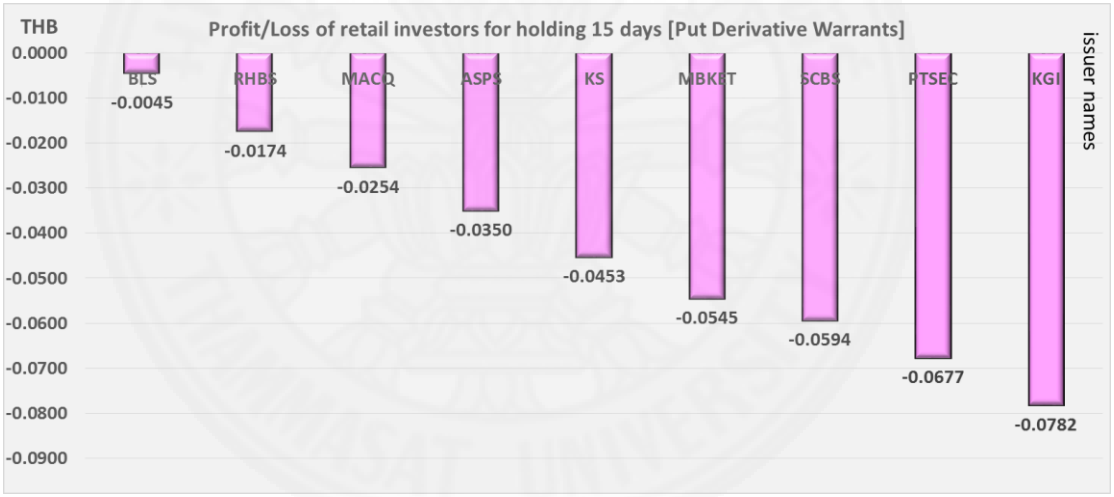


The profit/loss of retail investors for holding 7 days [call derivative warrants and put derivative warrants]

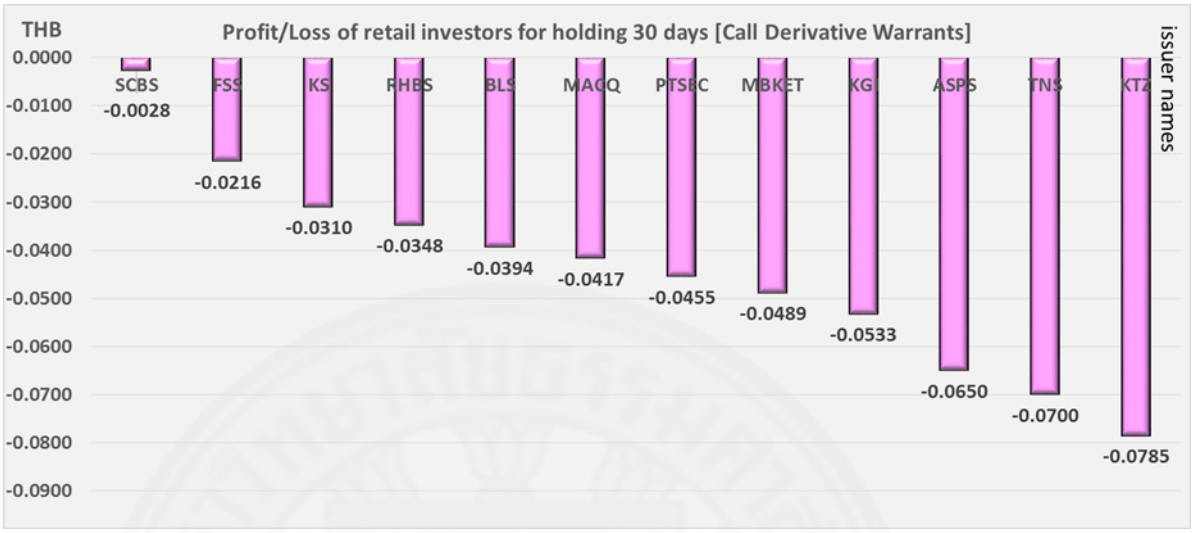


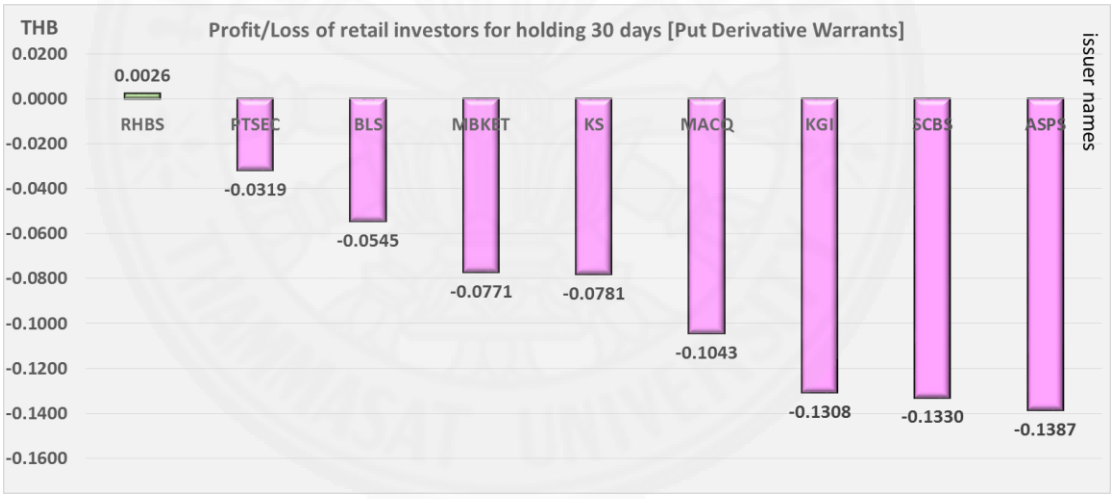


The profit/loss of retail investors for holding 15 days [call derivative warrants and put derivative warrants]



The profit/loss of retail investors for holding 30 days [call derivative warrants and put derivative warrants]





APPENDIX B

Z-SCORE AND EQUIVALENT BOND RATING

Z-Score		Bond Rating
8.15	>8.15	AAA
7.6	8.15	AA+
7.3	7.6	AA
7	7.3	AA-
6.85	7	A+
6.65	6.85	A
6.4	6.65	A-
6.25	6.4	BBB+
5.85	6.25	BBB
5.65	5.85	BBB-
5.25	5.65	BB+
4.95	5.25	BB
4.75	4.95	BB-
4.5	4.75	B+
4.15	4.5	B
3.75	4.15	B-
3.2	3.75	CCC+
2.5	3.2	CCC
1.75	2.5	CCC-
<1.75	1.75	D

BIOGRAPHY

Name	Mr. Mathee Prasertkijaphan
Date of birth	September 28, 1988
Educational attainment	2017: Master in Finance(M.Sc.)
	2011: Bachelor of Engineering, Computer Engineering (B.Eng.)
Work Experiences	June 2017 – Present
	Position: Capital risk analyst
	Company: Muang Thai Life Assurance
	February 2015 – June 2017
	Position: SAP consultant
	Company: PTT Digital Solutions Company Limited