# Transition Method into Alternate Symbols of Korean Option Market by Expiration Date

Young-Hoon Ko

*Department of Computer Engineering, Hyupsung University, Suwon, Korea*
*tigerko@uhs.ac.kr*

***Abstract***

*This paper proposes a method for effectively implementing the pyramid strategy. The pyramid strategy is based on the short strangle strategy and adopts the multiple-entry approach. Risk management is an essential element of derivatives trading, and the pyramid strategy is very efficient because it combines mutual and dynamic hedging. However, in operating the pyramid strategy, choosing a specific exercise price results in significant differences in terms of profitability and stability. This paper analyzes theta—measurement of decreasing time-value of an option—to propose a method for achieving profitability and stability simultaneously. The proposed approach involves adding stability by selecting deep out-of-the-money (OTM) options in early monthly contracts, and moving to near OTM options with high theta values in late monthly contracts to pursue profitability. To verify the validity of the proposed method, automatic strangle trades was simulated based on real data of Korean option information system. The simulation was performed using the multi-chart automatic trading analysis tool. The results of simulation using April 2012 contracts confirmed that the proposed method produces higher returns and offers greater stability than conventional methods.*

***Keywords:*** *Pyramid strategy, Theta*

## 1. Introduction

KOSPI index futures and options provide various opportunities for equity investors as well as for speculative traders. Strangle trading is one of the representative strategies for trading derivatives. Strangle trading is divided into short strangle, which is more profitable during low volatility, and long strangle, which yields higher returns during high volatility. The pyramid strategy is a multiple-entry approach based on short strangle. Risk management is an essential element of derivatives trading, and the pyramid strategy manages risk using two types of hedging: mutual hedging and dynamic hedging. A good investment strategy must achieve both profitability and stability. Stability can be generally measured with maximum drawdown (MDD), which is equal to the maximum loss that an investor can take. For a given profit, a strategy that minimizes the amount of maximum loss is a satisfying strategy for investors. Since a higher return calls for a higher risk, it is not easy to achieve profitability and stability at the same time. In this regard, the pyramid strategy is a highly advisable approach.The pyramid strategy begins with choosing an exercise price of an option. Since options are listed with exercise prices in 2.5 point intervals of the stock market index, there are many types of OTM options. Near OTM yields higher return and lower stability, whereas deep OTM is the reverse. This paper proposes a method for effectively implementing the pyramid strategy. In order to pursue profitability and stability simultaneously, the proposed method analyzes theta, which measures the time-value of an option, and informs when and how much exercise price should be selected. The proposed approach involves adding stability by selecting deep OTM options in early monthly contracts, and from the middle of the month when the theta value begins to decrease, converting to a near OTM options strategy to secure high profitability and stability simultaneously. To verify the validity of the proposed method, profitability and stability are analyzed by performing simulation using the multi-chart automatic trading analysis tool.

## 2. Theta

Theta is one of numerous quantities that represent the characteristics of options. Theta is a numerical representation of option's decrease in time-value and indicates the amount of loss in time-value in one day if the index remains static.

The theoretical values of call and put options are defined as Equation (1)

$$\begin{aligned} \mathrm{C} &= \mathrm{SN}(d_1) - {X_e}^{-n} N(d_2) \\ \mathrm{P} &= -\mathrm{SN}(d_1) + {X_e}^{-n} N(-d_2) \end{aligned} \tag{1}$$

where S is the underlying asset price, X is the exercise price, T is days left to expiration, r is the interest rate, and v is volatility.the manuscript should be directed.

Since theta is time variation of an option, it is written as Equation (2) for a call option.

$$\theta = \frac{\partial C}{\partial T} \tag{2}$$

If we draw a graph of theta against the underlying asset price, it becomes a parabola. In other words, the maximum value of theta occurs where the slope of theta against the underlying asset price is 0. In terms of profit, it can be written as Equation (3).

$$\frac{\partial \theta}{\partial S} = \frac{\partial}{\partial S}\left(\frac{\partial C}{\partial T}\right) = \frac{\partial}{\partial T}\left(\frac{\partial C}{\partial S}\right) = \frac{\partial N(d_1)}{\partial T} = \frac{-\ln\left(\frac{S}{X}\right) - \left(r + \frac{\sigma^2}{2}\right)T}{2\sigma T\sqrt{T}} N(d_1) \tag{3}$$

To find a point where the slope is 0, we let the numerator equal to 0 and rearrange the profit to obtain Equation (4).

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

Solving Equation (4) for S, we obtain Equation (5).

$$\mathrm{S} = {X_e}^{r+\frac{\sigma^2}{2}} T \cong X \tag{5}$$

We can now see that theta has the maximum value when the underlying asset price is near the ATM level. For example, in the case of Call 280, theta reaches its maximum when the index is 280. Since theta is a decreasing parameter, it has a negative value; however, the sign is reversed to positive for shorting the option. Figure 1 displays the graph of theta against underlying asset price for various exercise prices. For a call option with an exercise price of 100, the absolute value of theta becomes maximum when the underlying asset price is 100. After reaching the peak, theta gradually decreases and converges to 0.

The time-value of an OTM option converges to 0 toward the date of expiration. Accordingly, variation of theta according to the number of days left to expiration is very important. Figure 2 displays the relationship between theta and the number of days left to expiration. Theta of the ATM option decreases rapidly, whereas those of OTM options converge to 0. Time-values of OTM options decrease and movement becomes significantly sluggish. In the case of the ATM option, the time-value drastically declines and the expiration date approaches.

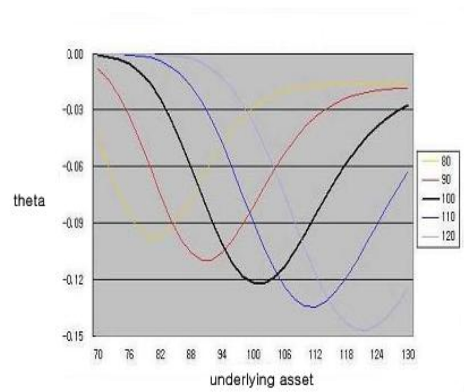



**Figure 1. Theta for each Exercise Price of Call Options for Underlying Asset**

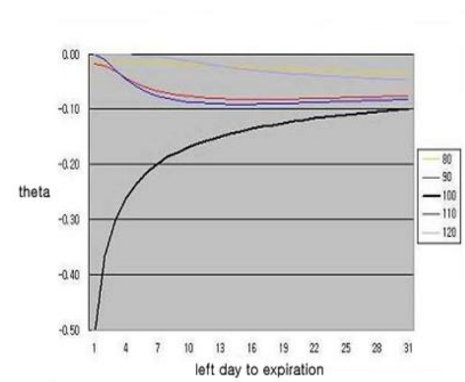



**Figure 2. Variation of Theta According to the Number of Days to Expiration for Various Exercise Prices**

## 3. Experiment and Results

Options expire each month on the second Thursday. Figure 3 displays the index futures chart for the duration of April option contracts. The expiration date of March contracts was March 8, and the April contracts became current month contracts starting on March 9, when the maximum level of liquidity was provided. Since the ATM exercise price of the opening price on March 9—the initial price of the current month contract—was 267.5, prices of April contracts are formed around 267.5. In pyramid strategy, Call OTM10 and Put OTM10 were selected which were based on opening price of April contracts. Call OTM10 exercise price was 277.5 and Put OTM10 exercise price was 257.5. Especially in April contracts, the index has showed above 257.5 all the time since March 9. So the theta of Put OTM10 has decreased to very small amount. In this case, Put ATM was selected for profitability after mid-time of April contract period. But Call option does not need to change exercise price into near OTM because it takes high risk. Multiple-entry shorting strategy was simulated for ten exercise process from ATM to OTM10 in both call and put options. The entry price was [opening price * 0.8] and delta was set at 20%. It can be seen that as we move away from ATM, profit decreases but the odds of making profit increases, which is typical of the high-risk, high-return scenario.


**Figure 3. Daily Candlestick Chart of Index Futures During the Current Month Contract Period (April option contracts)**

**Table 1. Profits and MDD of each Exercise Price**

| Symbols | | | Profit | MDD | Trades | Odds of making profit |
|---|---|---|---|---|---|---|
| Call | OTM10 | Call 277.5 | 595,000 | -94.94% | 21 | 38.1% |
| | OTM7.5 | Call 275 | 745,000 | -116.94% | 10 | 40% |
| | OTM5 | Call 272.5 | -5,000 | -143.22% | 4 | 25% |
| | OTM2.5 | Call 270 | 20,000 | -165.98% | 4 | 25% |
| | ATM | Call 267.5 | -15,000 | 194.21% | 4 | 0 % |
| Put | ATM | Put 267.5 | 10,000 | 40.82% | 4 | 75 % |
| | OTM2.5 | Put 265 | 15,000 | 36.19% | 4 | 25 % |
| | OTM5 | Put 262.5 | 20,000 | 34.38% | 4 | 50 % |
| | OTM7.5 | Put 260 | 1,998,000 | 28.23% | 23 | 60.87 % |
| | OTM10 | Put 257.5 | 1,599,000 | 25.08% | 20 | 50 % |

Analyzing the equity curve, it can be seen that Put 257.5 is an OTM10 option, which generates profit in the early phase but the profit remains static from mid-phase onward. Analyzing the equity curve of the ATM exercise price with Put 267.5, it can be seen that the profit displays a zigzag curve in the initial stage and increases from mid-point onward.

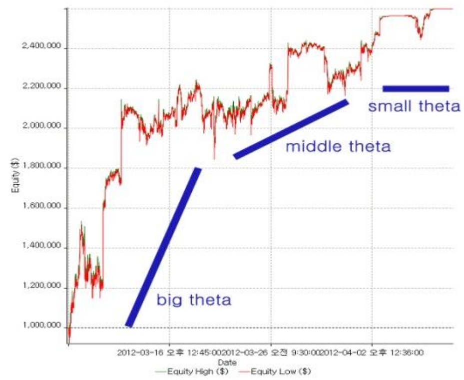



**Figure 4. Put 257.5 Equity Curve**

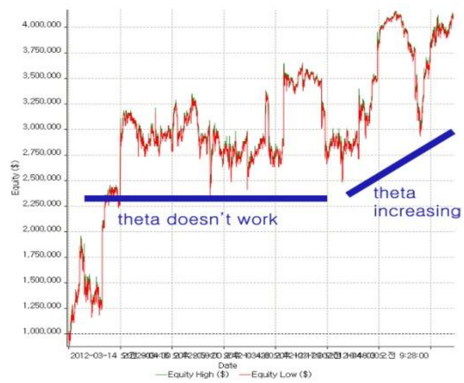



**Figure 5. Put 267.5 Equity Curve**

Therefore, maximum return can be achieved by selecting Put 257.5 in early current month contracts and Put 267.5 in contracts in the latter half of the contract period. Since return is the profit earned relative to the amount of money invested, carefully choosing the exercise price is very important in trading options, a single contract of which usually has a margin requirement of 3 to 4 million won. Next we examined the daily profits of Put 257.5 and Put 267.5. In early stage of the contract—from March 9 to 30 approximately 150% more profits were realized. In the latter part of the contract period—from April 2 to April 12—Put 257.5's profit was nearly 0, whereas Put 267.5 is expected to yield more profit by bigger theta. Therefore, trading Put 257.5 in the first half of the contract period and Put 267.5 in the second half is the optimum choice in terms of profitability and stability.

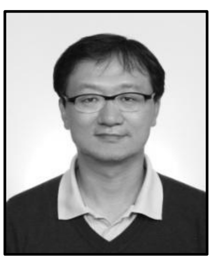
## 4. Conclusions

This paper proposed an efficient method to implement the pyramid strategy. The proposed method achieves profitability and stability simultaneously by analyzing theta, which quantifies the decrease in option's time-value. (Select deep OTM in the first half of monthly contract period for stability and move to near OTM with high theta in the second half to pursue profit.) Simulation tests were performed using the multi-chart automated trading analytical tool in order to verify the validity of the proposed method. Test results were compared between deep OTM Put 257.5 and near OTM Put 267.5. In the first half, Put 257.5 and Put 267.5 yielded profits of 1,599,000 and 10,000 won, respectively with MDD of -25.08% and -40.82%, respectively. In the second half, Put 257.5 is expected bigger profitability, while Put 267.5 has about zero theta. Using the proposed method, we were able to achieve stability in the first half of the monthly contract period by selecting Put 257.5 and earn high profit in the second half by trading Put 267.5. From the results of simulation performed using April 2012 contracts (real data of Korean option information system), we were able to confirm that the proposed method is superior to conventional methods in terms of profitability and stability.

## References

[1] Y. H. Ko, “Exchange Method of the Signal in a Multi-Entry Strategy for MultiChartsPortpolio”, Journal of software society, vol. 22, no. 1, **(2009)**.
[2] Y. H. Ko and Y. S. Kim, “An analysis of Performance on the strategy of ladder trades in a symbol pool by Multicharts”, Journal of the Korea Society of Digital Industry and Information Management, vol. 6, no. 2, **(2010)**.
[3] Y. H. Ko and Y. S. Kim, “The Profit Analysis of Straddle Sell by Entry-Time and Delta at System Trading”, Journal of Journal of the Korea Society of Digital Industry and Information Management, vol. 6, no. 1, **(2010)**.
[4] Y. H. Ko, “Analysis of Straddle trades using open interest of stock index futures in Korea option market”, Proceedings of the international Conference of PPBRI 2010, **(2010)** July.
[5] Y. H. Ko and Y. S. Kim, “A design of automatic trading system by dynamic symbol using global variables”, Journal of Journal of the Korea Society of Digital Industry and Information Management, vol. 6, no. 3, **(2010)**.

## Authors



**Young-Hoon Ko**

He received the B.S., M.S., and Ph.D. degrees in electronics engineering from Yonsei University, Seoul, Korea, in 1991, 1993, and 1997, respectively. He was a professor of Chungbuk University in 1997. He has been a professor of Hyupsung University since 1999. His interest is database and computer network. Since 2009 He has focused on the automatic trading system of Korean option market.