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The Best Stock Hedging Among Option Strategies

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Abstract: Not much research copes derivatives issues, especially option trading. Meanwhile, practitioners need the empirical result of the robustness of derivatives to optimize the portfolio. There are three stock hedge strategy that commonly used by fund manager in their option portfolio. However, none research has discussed about which stock hedge is the best option strategy. This study aims to examine the best stock hedging strategy among option trading strategy. We employed ANOVA and independent samples t-test to test the stock option portfolio in Dow Jones Industrial Average during 2004 up to 2008. We found that covered call strategy as the best strategy as it can gain highest returns among the option strategy with mediocre risk level. Meanwhile, for passive investing, Collar strategy will be suitable.

Key words: Stock hedging, covered call, protective put, collar, Dow Jones industrial average, Indonesia

INTRODUCTION

During late 1980s up to 2007, derivatives are the most interesting investment. One reason for the success was that derivatives greatly extended the range of investment strategy. Fund manager uses the stock hedging to reduce risk over a long time horizon. Hedging a position in stock will expose it basis risk. Each basis risk of each option strategy creates different level of risk. It means each strategy of stock hedge will show different result.

Practitioner and Academician argue that the trigger of recent global financial crisis is caused by derivative instrument trading. This is a big hook for hedge strategist as derivatives theoretically should be the smoother of the risk level. This issue reminds us to the long term capital management failure where best finance scholars failed to gain excess returns in certain level of risk; eventually created big financial losses. However, none of empirical shows the certain derivatives strategy that caused the crisis. Literature shows the basic purpose of derivatives is for hedging. However, as it can be used for speculation, scholars put derivatives as the riskiest investment in the risk ladder. In early 1980s, the derivative trading is begun in commodity exchange based on stock index (Figlewski, 1984).

Oomen and Jiang (2001) addressed that option strategy is effective to hedge investment. Further, they surmised there is difference between option and futures in term of risk level. There are three major stocks hedging in option trading. There are covered call, protective put and collar. Not much research has investigated the best among these three strategies in term of low risk and high return. Therefore, it is needed to investigate this issue.

The objectives of the research are to investigate the stock hedging level of risk of option trading strategy, to investigate the stock hedging level of return of option trading strategy. By finding the level of the risk and level of returns, we examined the differences to find the best stock hedging among option trading. This research is different in 3 ways. Firstly, we investigated all the major strategies in option stock hedging strategy which are: covered call, protective put and collar. Second, we compared the level of risk and level of return not only descriptively, but also statistically. Lastly, we covered all the best option stock in the world which is listed in Dow Jones Industrial Average (DJIA) Index.

LITERATURE REVIEW

Literally, hedging objective is to lock in a fixed future price in order to eliminate their risk of exposure to interim price fluctuations (Bernstein, 2003). This is in line with the definition of hedging. Hull (2002) confirmed this objective as he addressed that hedgers use futures, forwards and options to reduce the risk that they face from potential future Movements in market variable. Speculators use them to bet on the future movements in a market variable.

One of the stock hedge instruments is option trading. Option is an agreement that gives the owner the right but not the obligation to buy or sell (depending on the

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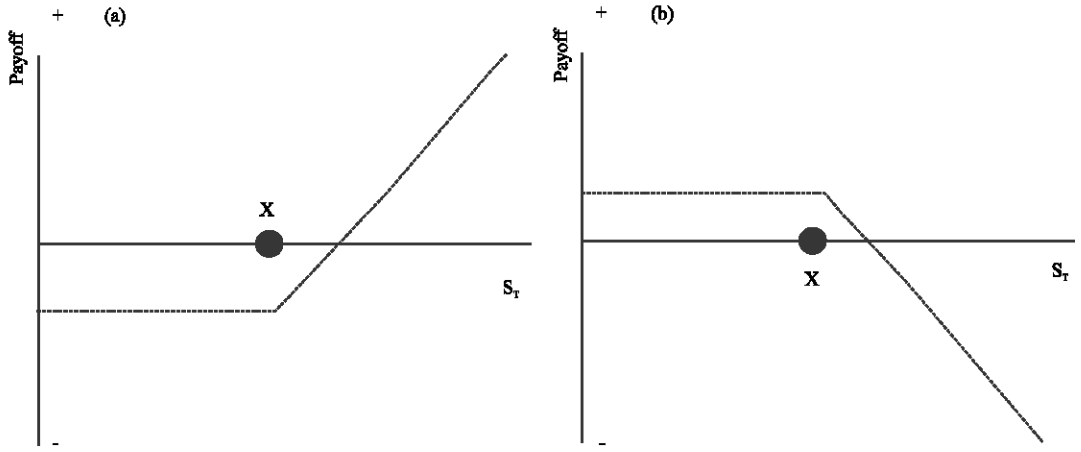

Fig. 1: Call option, Hull (2002); (a) Long call position; (b) Short call position

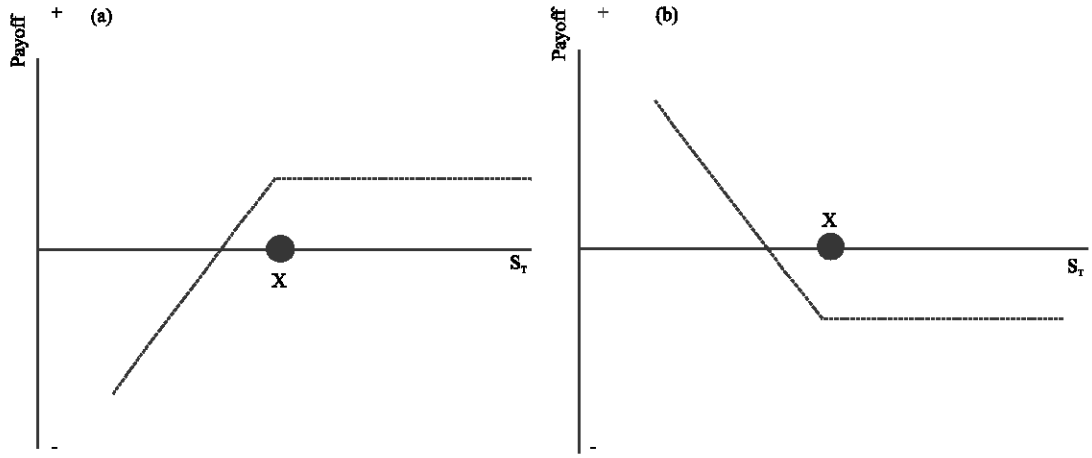

Fig. 2: Put option, Hull (2002) (a) Long put position (b) Short call position, S_T = Price of assset at maturity, X = Strike price

option type) some asset at a specified price for a specified time (Ross *et al*., 2003). The benefit in option is the limited risk with unlimited returns or unlimited risk with limited return. The benefits can be shown in Fig. 1 and 2. There are three major option strategies in stock hedging which are: covered call, protective put and collar. The details will be described below:

Covered call: Hull (2002) defines covered call as write the call option, while in the same time takes position the underlying stock. In this strategy, investor has two roles: holding the underlying asset and call option writer. In other words, investor wants to hedge his/her stock position from volatility by writing the call option. If in the future the underlying stock price is declining, the premium of option covered the loss. Covered call usually employs if the underlying stock has low volatility (Hull, 2002). The detail can be shown in Fig. 3.

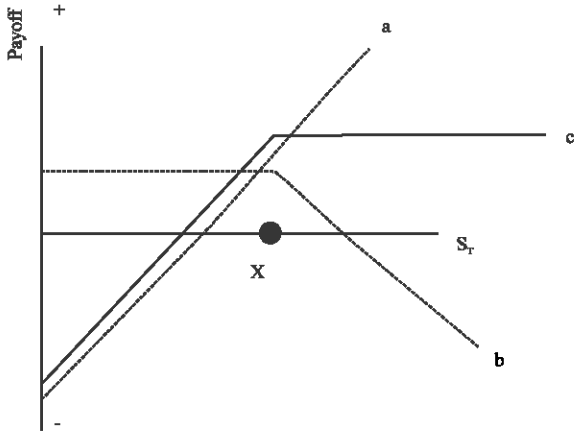

Fig. 3: Covered call option strategy, S_T = Price of assset at maturity, X = Strike price, a = Long position in stock, b = Short position in call, c = Profit combination

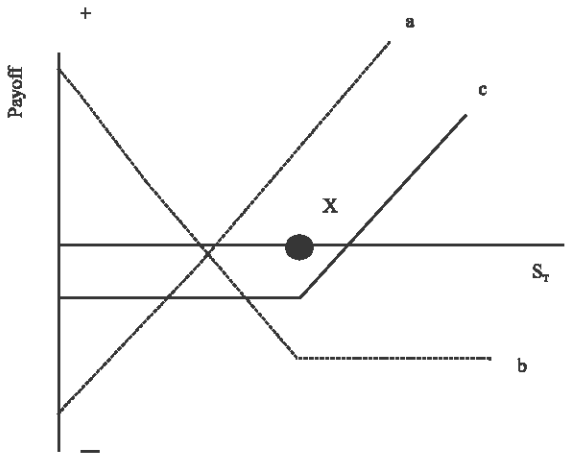

Fig. 4: Protective put option strategy, S_T = Price of assset at maturity, X = Strike price, a = Long position in stock, b = Short position in put, c = Profit combination

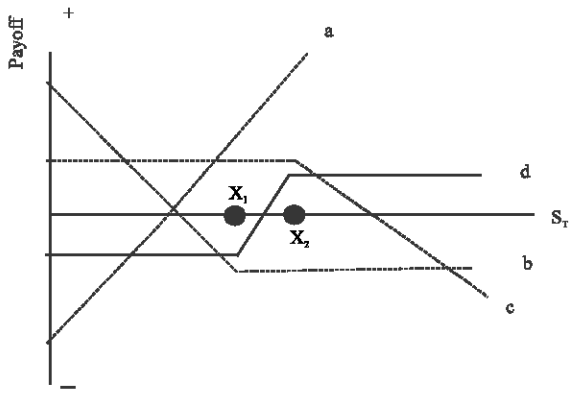

Fig. 5: Collar option strategy, S_T = Price of assset at maturity, X_1 = Strike price of put option, X_2 = Strike price of call option a = Long position in stock, b = Long position input, c = Short position in call, d = Profit combination

Protective put: Protective put is a put option that combined with a long position in underlying asset (Hull, 2002). The protective put strategy combines the long position of underlying stock with the long of put option. The performance of this strategy is almost similar to insurance (Hull, 2002) where investor gains compensation if the underlying stock price is declining.

In this strategy, investor exercises the option if the price of underlying stock is below the strike price. Therefore, investor will gain compensation from the declining of underlying stock. Hull (2002) addresses that investor will employ this strategy if he/she predicts that the future price will be declining. It can be shown from Fig. 4.

Collar: Collar strategy is the combination of call option, put option and the underlying stock. The collar option strategy is a combination of the covered call option strategy and the protective put option strategy (Hull, 2002). This strategy uses long put position, short call position along with long stock position. This strategy purpose is making the protective put where the money get from short of call option. This strategy is risky and set up for out of money option (Hull, 2002) (Fig. 5).

PREVIOUS EMPIRICAL RESULT

One of early studies that investigated the option strategy is Hausman and White (1968). They investigated the optimal strategy in option in case of aversing the risk. By using Pratt's proportional risk aversion model, they found the sufficient risk aversion model to create a series of finite critical prices. In other words, they found that if once an option is exercised, the option holder continually faces a tactical decision to hold the stock and wait for capital gains in order to avoid further risk.

Another early study in option strategy is Bookstaber and Clarke (1984). They investigate the effect of option strategies on portfolio by using an approximation logarithm. They found that the return characteristics of optioned portfolios are not very sensitive to the pricing of the option used. They also found that the distortion in applying mean-variance measures to the evaluation of option portfolio strategies. In the end, their paper surmised that generally the use of capital market line, security market line, Sharpe ratio or Treynor ratio will lead to significant biases in measuring the performance of option portfolio.

Jackwerth (2000) investigated the relationship between aggregate risk-neutral and risk aversion function during 1987 crash by option process. He found that Pre 1987 crash, they are positive and decreasing in wealth; and during post 1987 crash they are partially negative and partially increasing. It implies there is mispricing in option strategies.

Theoretically, there are many hedging strategy in stock option. However, the level of risk and return of each strategy is varying. Dash *et al.* (2007) address that each option strategy will give different result in regards of hedging portfolio. By using covered call and protective put, they concluded that the standard deviation, skewness and kurtosis of the return underlying asset distribution are varying. Further, they found that the risk

of these two strategy influences the optimization of stock hedging. Isakov and Morard (2001) also conducted the similar research. They investigated the portfolio performance of covered call in Zurich stock exchange. They concluded that covered call can induce the hedging optimization of the portfolio. Another research regarding stock hedging of option trading is conducted by Szado and Kazemi (2008). By using collar option strategy, they investigated the portfolio performance of QQQ ETF. They found that collar option strategy succeeded minimizing the risk of the portfolio. However, not much research investigating the best stock hedge strategy of option trading among covered call, protective put and collar.

RESEARCH DESIGN

This research used three variables which are: stock hedging risk of covered call option portfolio, stock hedging risk of protective put portfolio and stock hedging risk of collar option portfolio.

This research used the secondary data. The sample of this research is New York Stock Exchange. We retrieved the secondary data from Thomson data stream. Specifically, we chose Dow Jones Industrial Average (DJIA) Index as it consists of large cap companies, high liquidity and fundamentally good. Moreover, the most important is DJIA consists of all the stock doing option trading. We chose American Treasury Bill as the proxy of risk free asset. The period of the research is from January 2004 up to December 2008. To avoid the calendar anomalies, we picked the Wednesday daily price.

The procedures in analysis are: First, we collected all the listed companies of DJIA for portfolio purpose. We just used the listed companies that consistently in the DJIA during 2004 up to 2008.

These consistent listed companies are set up in equally qeighted portfolio. Second procedure is calculating the risk of the option by using the qually weighted portfolio. Then the next procedure is to determine the strike price. It is important to determine the strike price as it will influence the option premium. This research used 2% OTM strike price as this method can produce cheaper premium contract and good in term of hedging (Brodie and Detemple, 2004) (Table 1).

Next procedure is calculating the implied volatility. It is measured by using GARCH (1,1) model. The parameters of GARCH (1,1) which are: Omega (ω), Alpha (α) and Beta (β) by regressing the daily return of the option without using dependent variable. The latter, these parameters are run to find out the three-month volatility. This model is good as the GARCH (1,1) can retrieve smoother persistent volatility. The conditional variance can be calculated by Lehnert and de Jong (2001):

Table 1: Stock option companies

Symbol	Company	Symbol	Company
MMM	3M Company	HPQ	Hewlett-Packard Company
AA	Alcoa Incorporated	INTC	Intel Corporation
AXP	American Express Company	IBM	International Business Machines
BA	Boeing Company	JNJ	Johnson and Johnson
CAT	Caterpillar Corporation	MCD	McDOnald's Company
C	Citigroup Incorporated	MRK	Merck and Company, Inc
KO	Coca-Cola Company	MSFT	Microsoft
DD	Du Pont	UTX	United Technologies corporation
XOM	Exxon Mobile Company	WMT	Wal-Mart Stores Incorporated
GE	General Electric Company	DIS	Walt Disney Company
GM	General Motors Corporation		

$$\sigma^2_t = \omega + \alpha\varepsilon^2_{t-1} + \beta\sigma^2_{t-1} \quad (1)$$

Where:

$$\omega = \gamma x V_L$$

$$\alpha+\beta+\gamma = 1 \rightarrow \alpha, \beta, \gamma > 0$$

Therefore:

$$\sigma^2_{t+n} = V_L + (\alpha+\beta)^n \times (\sigma^2_t - V_L) \quad (2)$$

Where:

σ^2_t = Variance in period of t
σ^2_{t+n} = Variance in the period of t+n
ω = Average
V_L = Long run variance
ε^2_{t-1} = Square of average return in the period of t-1 (ARCH)
σ^2_{t-1} = Variance in the period of t-1 (GARCH)

Then the 3 month implied volatility is retrieved by using this formula:

$$\sigma_t = \sqrt{\sigma^2_t \times 90 \text{ days}} \quad (3)$$

Where:

σ_t = Volatility in period of t
σ^2_t = Variance in period of t

Then, by conducting Black-Scholes approach we can determine the premium of option. We run the valuation by using OptionScope softwate that intergrated in Metastock Professional Software. One of Other important procedures is to find the returns of the option strategy. The formula is:

If $X_0 < P_t$, then:

$$R_{option} = \frac{P_t - P_{t-1} + C(X_0 - P_t)}{P_{t-1}} \quad (4)$$

And if $Xo > P_t$ then:

Table 2: The Variable Measurement

Variables	Concept	Formula
Covered call option risk	Standard deviation of the covered call option portfolio average return	$\sigma_{cc} = \left[\sum_{i=1}^{n} W^2_t \sigma^2_t + \sum_{i=1}^{n}\sum_{i=1}^{n} W_i W_j \sigma_{kj}\right]^{\frac{1}{2}}$
Protective put option risk	Standard deviation of the protective put option portfolio average return	$\sigma_{pp} = \left[\sum_{i=1}^{n} W^2_i \sigma^2_i + \sum_{i=1}^{n}\sum_{i=1}^{n} W_i W_j \sigma_{kj}\right]^{\frac{1}{2}}$
Call option risk	Standard deviation of the call option portfolio a average return	$\sigma_{co} = \left[\sum_{i=1}^{n} W^2_i \sigma^2_i + \sum_{i=1}^{n}\sum_{i=1}^{n} W_i W_j \sigma_{kj}\right]^{\frac{1}{2}}$

$$R_{option} = \frac{P_t - P_{t-1} + C}{P_{t-1}} \quad (5)$$

Where:

R_{option} = Returns of option strategy
P_t = Stock price at period t
P_{t-1} = Stock price at period t-1
C = Call option premium
X_0 = Strike price

As we have three type of portfolio (covered call, protective put, collar), we have to measure the standard deviation of the portfolio. Therefore, the first step is to calculate the average return of the portfolio by using Edwin *et al.* (2003) formula:

$$R_p = \sum_{t=1}^{n} R_n \times W_n \quad (6)$$

Where:

R_p = The portfolio return
R_n = The average return of single stock
W_n = The portfolio weight

After we have the return of portfolio, we can find the risk by using variance approach. We replicate Edwin *et al.* (2003) calculation which is:

$$\sigma^2_n = \frac{\sum[R_n - E(R_n)]^2}{n} \quad (7)$$

Where:

$\sigma 2n$ = Variance of the portfolio
Rn = The return of stocks

Then, the last procedure is calculation of the risk of stock hedging. Again, we replicated Edwin *et al.* (2003) model:

$$\sigma_{option} = \left[\sum_{i=1}^{n} W^2_i \sigma^2_i + \sum_{i=1}^{n}\sum_{i=1}^{n} W_i W_j \sigma_{kj}\right]^{\frac{1}{2}} \quad (8)$$

Where:

σ_p = The risk of the portfolio
W_i = The weighted of stock i
W_j = The weighted of stock j
σ_{ij} = The covariance between i and j. The details are shown in Table 2

DISCUSSION

It will describe the returns and the risk of option trading strategy. It also will compare the stock hedging strategy of option trading strategy.

Annual returns of option trading strategy: Based on Table 1, it can be seen that the return of covered call option is relatively higher compare to other two strategies. If we relate this finding to DJIA movement in 2004-2008, the sideways of DJIA established higher return in covered call.

As earlier stated in literature section, covered call is much better to be employed in sideways market movement. This also confirms the literature that in sideways condition, covered call is the best strategy of stock hedge to gain higher returns (Table 3).

Risk level of option trading strategy: After we conduct the calculation of the risk, we retrieve the standard deviation. The calculation process can be seen in section methodology. The standard deviation is taken from the covariance matrix.

In term of risk level, Table 4 shows covered call has higher standard deviation. It is in line with the theory where the more is the risk, the more is the returns. It indicates that covered call has higher risk level compare to other two strategies. However, to capture the true risk level, we conducted further analysis by using ANOVA.

Table 3: Option Trading Strategies Annual Returns

Period	Covered call (%)	Protective put (%)	Collar (%)
2004	4.66	-1.05	1.37
2005	3.64	-1.30	1.00
2006	5.30	-0.78	1.68
2007	3.81	-1.97	1.42
2008	-2.97	-3.50	0.38

Table 4: Option Trading Strategy Risk Level

Period	Covered call (%)	Protective put (%)	Collar (%)
2004	2.04	2.72	0.74
2005	1.11	1.26	0.64
2006	0.99	1.79	0.81
2007	3.25	2.98	0.97
2008	3.36	1.94	1.22

Table 5: Covered Call and protactive put

Two-sample	N	Mean±SD	SE±Mean
X1	5	0.0215±0.0113	0.0051
X2	5	0.02137±0.00706	0.0032

Difference = mu (X1) -mu (X2), estimate for difference: 0.00012, 95% upper bound for difference: 0.01121, t-test of difference = 0 (vs<): t-value = 0.02 p value = 0.508, DF = 8, both use pooled SD = 0.0094

Risk comparison between covered call and protective put: According to Table 2, we hypothesize that hedging portfolio risk using covered call is higher than using protective put. This hypothesis was tested by using independent samples t-test. It was tested in Minitab 15. The result is shown in Table 5. The t-value is 0.02. Meanwhile, the t-table is 1.8595. It means that the hypothesis is rejected. It means the risk level of stock hedging of covered call is smaller than protective put. It means the covered call is better in term of low risk but high return. Therefore, we propose covered call strategy to be used by Fund Manager rather than protective put.

Risk comparison between covered call and collar: Based on Table 2, we propose the null hypothesis as: the risk level of covered call hedging portfolio is higher than collar hedging portfolio. We tested the hypothesis also by using independent variable t-test in Matlab 15. Table 6 depicts the statistical result. Based on the result, the t-value is 2.47. It is higher than t-table of 1.8595. If the t-value is higher than t-table, the null hypothesis cannot be rejected. It means the risk level of covered call in stock hedging portfolio is significantly higher than the collar option strategy. This is in line with the theory, as the higher the risk, the higher the returns.

Risk comparison between covered call and protective put: We hypothesize the null hypothesis based on Table 2. It states that the risk level of protective put is higher than risk level of collar option. Again, we tested this hypothesis under independent samples t-test in Minitab 15. Table 7 shows the result. Based on the panel, the t-value is 3.81. Meanwhile, the t-table is 1.8595. It means the t-value is higher than t-table. If the t-value is higher than t-table, the null hypothesis cannot be rejected. Therefore, we concluded that protective put strategy risk level is significantly higher than collar strategy.

Table 6: Covered call and protactive put

Two-sample	N	Mean±SD	SE±Mean
X1	5	0.0215±0.0113	0.0051
X3	5	0.00875±0.0227	0.0010

Difference = mu (X1) -mu (X3), estimate for difference: 0.01274, 95% upper bound for difference: 0.02233, t-test of difference = 0 (vs<): t-value = 2.47 p value = 0.981, DF = 8, both use pooled SD = 0.0082

Table 7: Covered Call and protactive put

Two-sample	N	Mean±SD	SE±Mean
X2	5	0.02137±0.00706	0.0032
X3	5	0.00875±0.0227	0.0010

Difference = mu (X2)-mu (X3), estimate for difference: 0.01262, 95% upper bound for difference: 0.01878, t-test of difference = 0 (vs<): t-value = 3.81 p value = 0.997, DF = 8

Table 8: Risk difference

Risk	Sum of squares	df	Mean square	F	Sig.
Between groups	0.001	2	0.000	4.395	0.037
Within groups	0.001	12	0.000		
Total	0.001	14			

The risk differences among option trading strategy: We hypothesize our null hypothesis as: there is no significant risk level difference among the stock hedge strategy of option trading. Then, this hypothesis was tested by one-way ANOVA in SPSS 15. Table 8 shows the result.

According to the Table 8, the result of significance probability is 0.037. In α value of the significance level of 5%, then we can reject null hypothesis. As it is rejected, we address that there is difference risk level among the stock hedge strategy. The risk level of covered call option is different with protective put and also collar option. It also indicates that statistically the portfolio strategy risk using option trading strategy is vary. This is confirmed the previous results.

CONCLUSION

As only God knows the future, the volatility in the market cannot be predicted. The risk coming up from the dynamic market cannot be avoided. However, in finance, this dynamic movement of prices can be hedged by using derivatives. By using derivatives, investor can manage their fund from the occurred loss of the dynamic movement.

There are 4 types of derivatives which are: forwards, futures, swaps and option. This research discussed only Option trading. Option trading is employed to hedge the stock position. The level of risk and returns is rarely discussed.

There are three major type of stock hedge in option trading strategy. There are: covered call, protective put and collar. The investigation of revealing the best strategy is rarely conducted. This research wants to

investigate the best stock hedging among the option strategy. After conducting the analysis, it is found that the risk level of hedging portfolio by using covered call, protective put and collar in DJIA is vary. Descriptively, the protective put strategy is the riskiest strategy. Further, covered call is the most gainer strategy. This result confirms previous results (Szado and Kazemi, 2008) that mentioned the level of risk and returns of stock hedging depending on the option strategy. Then to make it more robust, we tested this descriptive result by ANOVA approach. The paired test of ANOVA confirms the descriptive results. It surmised that stock hedge risk gave the highest level of risk. Then second highest in term of risk level is covered call.

The safest stock hedging is collar strategy. Interestingly, the trade-off rank between risk and returns among the option strategy is odd. Theoretically, the more is the risk, the more is the returns as it is the compensation for the risk. It is found, protective put has the highest risk but also has the highest level of returns. Meanwhile, collar has the lowest level of risk but did not as the highest level of returns. Covered call as the second highest risk, achieved the most gainer strategy.

Therefore, we can propose that covered call strategy as the best stock hedge strategy. Investment manager and mutual fund manager should use covered call instead the other two strategies. Future research should conduct the E-GARCH to compare the persistent volatility. Value-at-Risk (VaR) model can also be conducted to capture the breadth of risk, including the maximum loss. In the end, future research can also establish new model to capture the life cycle of derivative market.

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