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**COMPARISON OF HEDGING STRATEGIES USING FORWARDS,  
OPTIONS AND NO HEDGING STRATEGIES FOR LISTED COAL  
MINING COMPANIES IN INDEX LQ45 2017**

Rifky Rachmansyah<sup>1</sup>, Brady Rikumahu<sup>2</sup>  
Magister of Management Program, Faculty of Economics and business  
Telkom University, Bandung, Indonesia

**Abstract**

Domestic mining companies such as ADRO, BUMI and PTBA and other companies that have the majority of export sales cannot avoid the existence of external risks that affect the company's stock price. From the observations in the same observation period, which was July 16, 2008 to January 31, 2017, information on the phenomenon of price fluctuations occurred on the three stocks, ADRO with daily stock returns - 19% to 19%, BUMI - 36% to 35% and PTBA - 23% up to 43%. These fluctuations identify high volatility which has an impact on the risk of investment losses on the three stocks that are reason from the need for risk management. This research examines the hedging strategy with call options, short forward and no hedging on ADRO, BUMI and PTBA stock in the period January 1, 2012 to January 1, 2012.

In total 61 data points were obtained and it was found that the hedging strategy with short forward provided risk protection and profit for each of ADRO, BUMI and PTBA shares, while call options and no hedging had a negative impact on risk protection and profitability.

**Keywords:** derivative, hedging, call option, short forward, no hedging/

**Introduction**

Domestic mining companies such as ADRO, BUMI and PTBA and other companies that have a majority of export sales cannot avoid external risks such as fluctuations in international coal prices, ups and downs of international coal demand or climate risk, namely the rainy season which significantly disrupts coal production, all of these risks affect the performance of the company, including the company's shares price stock price observations and daily stock returns are carried out on ADRO, BUMI and PTBA to determine the risks exposure in the three shares. The observation period was carried out from July 16, 2008 to January 31, 2017.

ADRO's share price was recorded at the beginning of observation amounting to Rp1,730.00 per share and the stock price at the end of the observation was Rp1,695.00 per share, in the observation period recorded the lowest share price Rp.437.00 on January 20, 2017, then the highest share price of Rp2,875.00 per share at 4 Januari 2011. Meanwhile the daily stock return ranged from -19% to 19%.

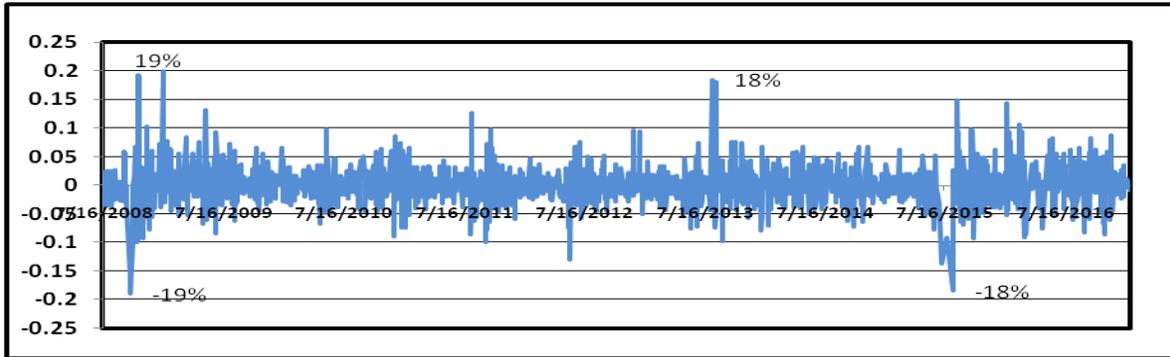


Figure 1. ADRO Daily Stock Return January 2008 – January 2017

BUMI's share price was recorded at the beginning of the issuance of Rp.6,800.00 per share and the share price at the end of the observation was Rp278.00 per share, in the observation period the lowest share price was Rp50.00 on August 12, 2015, then the highest share price of Rp.6,800,00 per share on July 16, 2008. Meanwhile, daily stock returns range from -36% to 35%.

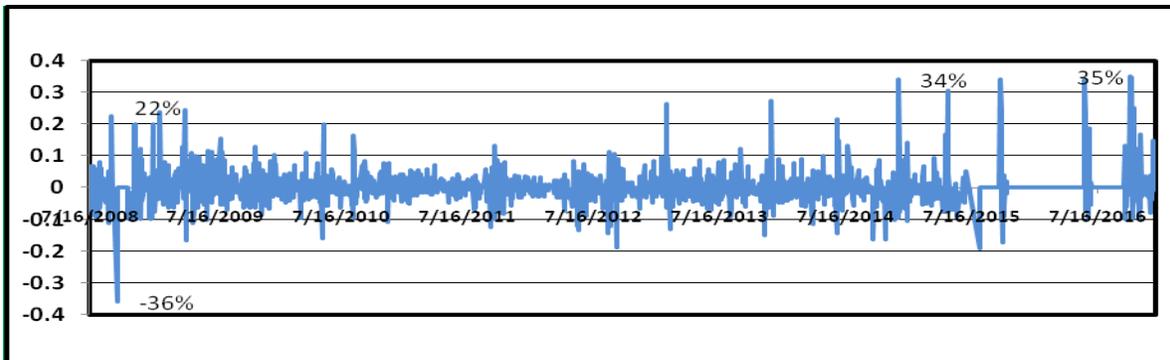


Figure 2. BUMI Daily Stock Return January 2008 – January 2017

PTBA's share price recorded at the beginning of the transaction was Rp. 24,900 per share and the stock price at the end of the observation was Rp. 11,600 per share, in the observation period the lowest share price was Rp. 2011. While the daily stock returns range from -23% to 43%.

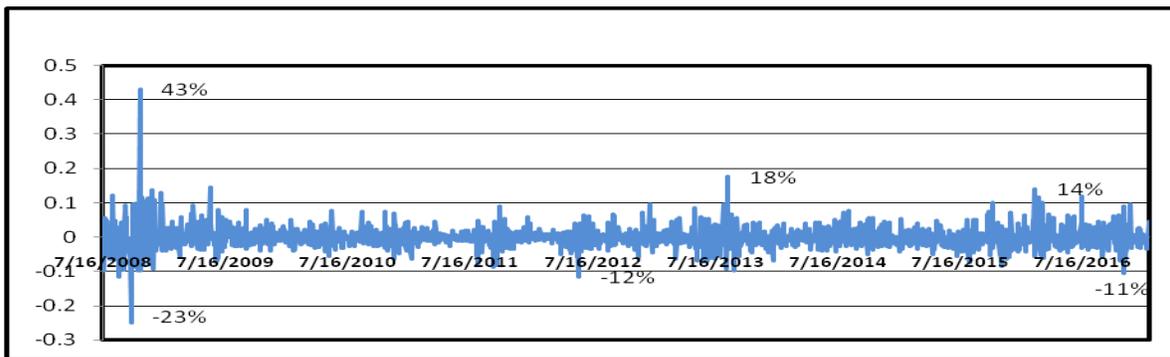


Figure 3. PTBA Daily Stock Return January 2008 – January 2017

From the observations in the same observation period, which was July 16, 2008 to January 31, 2017, information on the phenomenon of price fluctuations occurred on the three stocks, ADRO with daily stock returns - 19% to 19%, BUMI - 36% to 35% and PTBA - 23% up to 43%.

These fluctuations identify high volatility which has an impact on the risk of investment losses in the three stocks. there is a need for risk management to mitigate the occurrence of unexpected stock movements and to maintain the expected return on investments and protect against risks that may arise.

Rutterford (2007:3) stated that in response to the increase in volatility and complexity of the stock exchange since 1970, a financial product has been developed to manage risks arising from stock trading activities and to estimate stock price movements, without directly buying or selling those shares. Marroni and Perdomo (2013:19) mentioned that derivatives can be transacted based on the rights of contract holders and can be used for hedging or hedging or for speculative purposes, where users of derivative instruments can take advantage of what might happen and affect the underlying asset. Stapleton (1991:92-93) mentioned that forwards and options are products that are widely used in risk management or hedging in the financial market. The most extensive research on both forwards and options derivative products or other derivative products has been carried out, and among them have positive results in mitigating risk in the financial market.

Previous research has been conducted to find out and measure the effects of hedging including Zhang and Zhou (2004), namely the analysis of the use of forwards options, Khazed and Winder (2006) conducting options and money market research, Maurer and Valiani (2007) testing forwards and options in currencies, Vargas and Kessakorn (2013) tested the effectiveness of hedging with forwards and options, Lee, Stevenson and Lee (2014) testing trading using futures, Kamau, Inanga, Rwegasira (2015) using swaps, forwards and options to manage exchange rate risk, Hendrawan (2017 ) testing forwards, forwards options and no hedging to manage exchange rate risk.

In addition to derivatives, no hedging transactions are also taken into account in this study as a comparison of the effectiveness of hedging with its spot prices and also measuring the impact of no hedging on stocks that have a high risk of return on an investment.

### **Literature review**

Derivatives are financial instruments whose values are derived based on values other than the reference asset prices, derivatives can depend on almost all variables. Rarely is the derivative worth the same as the price of the reference asset traded.(Hull, 2015).

### **Derivative Function**

Derivatives are mainly to be used for hedging, speculation or arbitrage. These three uses have a role to transfer economic risk from one party to another. Hedgers use derivatives to reduce the risks they face from potential movements in the future that may happen.

### **Forward**

Forwards contract is an agreement to buy or sell an asset at a certain time in the future at a specified price, different from a spot contract which is an agreement to buy or sell an asset on the same day. A forward contract is traded on an over-the-counter market (OTC) usually between two financial institutions or financial institutions with its clients, unlike the options for forwards and futures there is no fee to enter the contract. The party that agrees to buy assets at a certain time in the future at the price agreed to is also called a long position, whereas a short position is a party that agrees to sell assets at a certain time in the future at an agreed price.

Forward contract equation:

$$F_0 = S_0 e^{rT} \quad (1)$$

Where:

$F_0$  = Forward price

$S_0$  = Price of the asset underlying the forward contract today

e = Constants

r = Risk free rate

T = Time until delivery date

### **Hedging with Short Forwards**

Hedging using forward is a mechanism to lock prices in the future that are determined now to avoid unwanted price movements in the future, Short forward is done to protect against the risk of a decline in the price of an asset in the future by protecting it from the potential loss arising from the sale of assets in the future at a price determined now.

### **Options**

Options are traded on the stock exchange and in over-the-counter markets (OTC), there are two types of options, namely call options, namely the rights held by the contract holder to buy an asset at a certain price and time. This is what distinguishes an option whose holder has the right to do something; the holder can not to execute this right. The put option gives the contract holder to sell an asset at a certain price and time, the price agreed to in the contract is also called exercise price or strike price, while the time agreed on the contract is also called the expiration date or maturity date.

The Black-Schools model can explain how volatility can be estimated through historical and implied data from option prices using the model.

Call option contract:

$$(C) = SN(d_1) - K e^{-rt} N(d_2) \quad (2)$$

The equation model is divided into two, namely  $SN(d_1)$  he expected profit from the purchase of assets or simply can be called the amount obtained, while  $- K e^{-rt} N(d_2)$  is a delivery price payment on expiration day or can be called the amount paid.

Where:

$$d_1 = \frac{\ln\left(\frac{S}{K}\right) + \left(r + \frac{\sigma^2}{2}\right)t}{\sigma\sqrt{t}} \quad (3)$$

$$d_2 = d_1 - \sigma\sqrt{t} \quad (4)$$

S = Spot price of the underlying asset

K = Delivery price

t = Maturity date

r = Risk free interest rate

$\sigma^2$  = Variance of underlying asset

N = Standard cumulative normal distribution

### Hedging With Call Options

Hedging using options offers protection against risk from the price that will occur and also offers flexibility to choose whether or not the option contract is held. Loss on options is limited to options or premium costs while for unlimited profits this is also the advantage of options, namely leverage from the purchase of call and put option contracts as long as the decrease and increase in asset prices while losses that might occur will be limited to premiums paid at the beginning.

### Volatilities

Hull (2015:325) explaining volatility that has a symbol  $\sigma$  is a measure of uncertainty of the return of a stock. Stocks generally have volatility between 15% and 60%. To calculate the volatility of stock prices empirically, it is necessary to observe stock prices at certain time intervals (days, weeks or months) to determine stock returns:

$$u_i = \ln\left(\frac{S_i}{S_{i-1}}\right) \quad (5)$$

Di mana:

$u_i$  = Stock return at certain day.

$S_i$  = Stock price at certain day.

$S_{i-1}$  = Stock price at previous day.

Then volatility is calculated using historical data to estimate future stock price movements with the following equation:

$$s = \sqrt{\frac{1}{n-1} \sum_{i=1}^n u_i^2 - \frac{1}{n(n-1)} \left( \sum_{i=1}^n u_i \right)^2} \quad (6)$$

Zhang and Zhou (2004) analyze the use of forward options against uncertainties in electricity market risk the results show that forward options are good at reducing and avoiding the risk of market uncertainty, increasing control capabilities, strengthening price stabilization. Khazeh and Winder (2006) Comparing the effectiveness of hedging using money market and options for British pounds, German marks, Japanese yen and Swiss franc. The results are multinational companies benefit from using hedging with the money market for payable. Money market is also better for receive able in British pounds. For some multinational companies, hedging using options can be a choice because of the flexibility that the company has. Maurer and Valiani (2007), test the effectiveness of managing exchange rate risk to diversify international mixed assets through two instruments of hedging: currency forwards and currency options The results of the study found European put-in the money options have the potential to replace portfolios that have used forward contracts optimally. Taking into account the composition of the portfolio in using the money options and forwards shows that using one of the two hedging tools will get a choice from a more diverse stock and debt market, compared to without hedging.

Vargas and Kessakorn (2013) Test the effectiveness of hedging on an International portfolio consisting of capital and state debt securities in the perspective of European investors. The results show that hedging using forwards and put options gives a better performance that is better than a strategy without hedging, there is no clear correlation if forwards and options are better than each other because of differences in the level of strike price prices, forward contracts are more effective than put options at strike price of 1%, 5% and 10% above the spot rate while put options with a strike price of 15% above the spot price are more effective than forwards in hedging exchange rates on international portfolios. Lee, Stevenson and Lee, (2014) Conducted futures trading uses tests on the European stock market. The results showed that the use of hedging instruments in real estate companies listed on European exchanges decreased risk by 64%. Kamau, Inanga, Rwegasira (2015) Conducted empirical research and currency derivatives in multilateral research and speculate in managing exchange rate risk. The results of the study found that multilateral banks use currency derivatives such as: currency swaps, currency forwards, currency options, currency futures to hedges of exchange rate risk. Hendrawan (2017) Conducted test to see the impact of applying forward, forward options and no hedging strategies

in managing the changes in the rupiah against the US Dollar. The results of the study found that forward options did not give positive results in risk management, no hedging strategy gave 36.36% positive results and forward contracts gave 72.73% positive results. This means that forward contracts are better than forward options and no hedging strategies in managing exchange rate pressures.

**Methods**

The study take place in the period January 2012 to January 2017 with the subject of this study is the stock price listed in the LQ45 2017 index, namely ADRO, BUMI and PTBA, The stock price used is the daily closing stock price of the IDX stock exchange obtained from the website (*finance.yahoo.com* dan *duniainvestasi.com*). Suku Bungabebasrisiko yang digunakan adalah Bank Indonesia rate (BI) ([www.bi.go.id](http://www.bi.go.id)) for the period January 2012 to July 2016 and BI 7-day repo rate for the periode Agustus 2016 untill January 2017 which replaced BI rate. While the volatility estimation uses the historicalial volatility approaches. The maturity date for short forward and call options is 1 month, while the no hedging strategy uses data at the beginning and end of the month.

The data analysis step for short forward and call options is done by the following technique: (1) Calculating the historical volatility for call options. (2) Calculate short forward and call option contracts with a 1 month period. (3) Calculate the profit / loss for each short forward and call option with the contract price and premium equal to or below the stock price at maturity. (4) Calculate the price absolute error value. Whereas for no hedging analysis of data data carried out is the difference from the stock price from a point to another point in the following month then can know the profit / loss. The analysis method used is to compare the effectiveness of the strategy on the forward option and the no hedging strategy from the profit / loss obtained

**Results**

**Short Forward Contract Simulation**

The results of short forward simulation overall gave a positive impact on risk protection for ADRO, BUMI and PTBA shares. In addition, the usage of short forward gave profitability, PTBA gets the biggest total profit 9,464.58 while the smallest total profit is obtained by ADRO which is 376.99.

**Tabel 1. Profit/Loss Short Forward Simulation**

No	Year	Company's Profit/Loss		
		<b>ADRO</b>	<b>BUMI</b>	<b>PTBA</b>
1	2012	221.76	1,619.80	2,913.45
2	2013	801.71	397.58	7,096.72

3	2014	(5.14)	221.79	(1,261.07)
4	2015	529.72	54.90	7,521.86
5	2016	(1,171.06)	(417.75)	(6,806.38)
Total Profit/Loss		<b>376.99</b>	<b>1,876.33</b>	<b>9,464.58</b>
Average		<b>6.18</b>	<b>30.76</b>	<b>155.16</b>
Price absolute error		<b>0.52</b>	<b>2.56</b>	<b>12.93</b>

This positive result was obtained because stocks experienced a downward trend in stock prices and were able to sell shares that were better than the spot price price. The loss directly occurred on the contract owner on the other side, namely long position.

**Call Option Contract Simulation**

The results of the simulations during the period of 2012 to 2016 ADRO, BUMI, PTBA shares as a whole suffered losses, PTBA suffered the biggest loss which amounted to 6,401.38 while ADRO suffered the smallest loss compared to the three shares.

**Table 2. Profit/Loss Call Option Simulation**

No	Year	ADRO		BUMI		PTBA	
		P/L	Volatility (%)	L/R	volatility (%)	L/R	Volatility (%)
1	2012	(8.74)	32.6%	(454.87)	50.3%	(592.28)	31.0%
2	2013	(151.88)	44.2%	(266.18)	60.8%	(4,331.01)	43.1%
3	2014	(138.63)	39.2%	(170.22)	70.3%	(1,374.91)	33.0%
4	2015	(339.01)	44.1%	(50.44)	56.8%	(2,294.02)	38.6%
5	2016	259.7	52.5%	195.5	33.9%	2190.8	50.7%
Total P/L		<b>(378.57)</b>		<b>(746.16)</b>		<b>(6,401.38)</b>	
Average		<b>(6.21)</b>		<b>(14.92)</b>		<b>(104.94)</b>	
Price absolute error		<b>(0.52)</b>		<b>(1.24)</b>		<b>(8.75)</b>	

The phenomenon that occurs is that the three shares in general have experienced a decline in share prices starting from the beginning of 2012 until the beginning of 2016, which is one of the loss factors in call options, contrary to the nature of call options, which protect against the risk of price increases so that during the downward trend there was a simulation of call options experiencing losses because they had to pay premiums for protection against the risk of rising stock prices, in 2016 the trend of the three stocks experienced an increase in stock prices which had a positive impact on protection and also profits

**No Hedging Simulation**

The results of the no hedging simulation in general did not have a positive impact on the three stocks; in the simulation period of 2012 to 2016 PTBA's shares suffered the largest losses with a total of 5,650.00 while ADRO suffered the smallest loss of 340.00. Through specific observations in 2016, ADRO, BUMI and PTBA all experienced positive impacts from the simulation of no hedging PTBA experienced the biggest profit compared to previous years, this also happened to ADRO and BUMI shares the biggest advantage was in 2016 compared to the previous year who generally suffer losses.

**Table 3. Profit/Loss No Hedging Simulation**

No	Year	Company's Profit/Loss		
		<b>ADRO</b>	<b>BUMI</b>	<b>PTBA</b>
1	2012	(120.00)	(1,530.00)	(1,850.00)
2	2013	(830.00)	(363.00)	(6,250.00)
3	2014	(60.00)	(207.00)	2,125.00
4	2015	(586.00)	(50.00)	(6,850.00)
5	2016	1,256.00	424.00	7,175.00
Total P/L		<b>(340.00)</b>	<b>(1,726.00)</b>	<b>(5,650.00)</b>
Average		<b>(5.57)</b>	<b>(28.30)</b>	<b>(92.62)</b>
Price absolute error		<b>(0.46)</b>	<b>(2.36)</b>	<b>(7.72)</b>

Explanation of why no hedging in general experiences losses, namely simulations carried out by comparing current stock purchases or spot prices with purchases in the next month when have observed at the performance of these three stocks the downward trend in early 2012 to early 2012 is one reason why unprofitable because the stock price were keep decreasing, another

phenomenon that makes spot price purchases profitable in the 2016 period where the trend of rising stocks occurred in all three shares

### **Discussion**

The results showed that the use of hedging using short forward has a positive impact in reducing and affecting the level of difficulty for 5 years. And also profits. Meanwhile the observation of the use of call options as overall risk protection did not have a positive impact if it is accumulated in 5 years because of the downward trend in stock prices on ADRO, BUMI and PTBA in contrast to the nature of the use of call options, namely to anticipate the risk of price increases resulting in losses on contracts Call options when compared to the no-hedging results of a call options contract have a greater loss on shares due to the premium that must be paid.

When compared with previous studies Zhang and Zhou (2004) where the use of forward options offers potential benefits and has an important role in reducing and avoiding risk uncertainties, Khazeh and Winder (2006) where the use of hedging gave benefits to multinational companies, Maurer and Valiani 2007 where the optimal use of hedging using forward as a whole gives a better performance than other hedging tools, Vargas and Kessakorn (2013) found that the use of forward and options gives better performance than without hedging while there is no clear conclusion if the forward has a better performance or an option that has a better performance. Meanwhile, Hendrawan (2017) shows that hedging using forward gives better results compared to option use and no hedging.

### **Conclusion**

This research was conducted on ADRO, BUMI and PTBA shares in the period January 1, 2012 to January 1, 2017 by testing hedging with short forward, call options and no hedging, based on the results of the research that has been done, it can be concluded as follows, short forward generally has a positive effect both in risk protection and also providing profit to its users, each of ADRO, BUMI and PTBA shares benefit from the use of hedging with short forward. In general, call options gave a negative effect on risk protection and also profitability. Each ADRO, BUMI and PTBA get losses from the use of hedging with call option. No hedging in general, the usage gave a negative effect on risk protection and also profitability. ADRO, BUMI and PTBA each suffer losses from the usage of the no hedging strategy.

It can be concluded that the optimal strategy for ADRO, BUMI and PTBA stocks for the period of January 1, 2012 to January 1, 2017 is hedging by using short forward and conclusions because specific conditions occur in the three stocks, namely the downward trend in stock prices. Further research is highly recommended to do a short forward, put option and no hedging comparison with a short position in the same period to see the performance and effectiveness of each hedging tool so that we can see and know what specific conditions on the use of one hedging tool can outperform one another. Then the comparison of hedging with short forward, call option and no hedging can be done on other industrial stocks to find out whether the same phenomenon will occur or not.

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