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The moderating effect of selling prices and buying prices on the effect of copper hedging on the profitability of the copper division of PT TMS

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ABSTRACT

Profitability is a major factor that determines the survival of a company. There are two general factors to determine the profitability of a company, namely first sales and second direct and indirect costs. However, there are other factors that affect the profitability of the company itself, namely hedging activities. The company in this study is PT. Tembaga Mulia Semanan Tbk. (PT. TMS), a manufacturing company that produces copper wire & rod. This study has three objectives, namely to determine the effect of hedge metal on profitability, and identify whether the selling price or purchase price can moderate this influence on company profitability. This study uses the type of data Secondary data taken directly from PT. Tembaga Mulia Semanan Tbk. In addition, this research is also supported by literature research through literature books and journals. The population data at PT. Tembaga Mulia Semanan Tbk. as much as 700 data. In this study, the authors used simple random sampling, the number of samples to be taken in this study was 240 data (monthly data from 2016 – 2021. This study uses multiple regression analysis with moderation, below is the regression model. Based on the results of the study, empirical facts were obtained in the form of: 1) 1. Hedge Amount has a significantly negative effect on EBIT; 2) The negative effect of the Hedge Amount on EBIT will be more positive when the Selling Price increases; 3) Purchase Price significantly moderates the positive effect of Hedge Amount on EBIT.

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INTRODUCTION

Profitability becomes a parameter for the sustainability of a company. There are two general factors that affect a company's profitability, namely sales and costs, both directly and indirectly PT. Tembaga Mulia Semanan Tbk. as a manufacturing company that produces copper wire and rod, was hedging its selling price risk and purchase price risk. Hedging activity is the company's strategy to reduce the risk of losses caused by the volatility of metal prices, namely copper, using London Metal

Exchange (LME) prices as a basis. LME is the largest metals trading center in the world, and more than 80% of metal products are traded here. So that many metal business players use LME as a reference for the price of their products. Prices that occur in the LME are prices that are purely determined by supply and demand and the movement of money funds.

The selling price affects the amount of profit that will be obtained by the company, in this paper is the sale of copper rod and wire. In addition to the LME price, the company must also take into account the size of the premium selling price composition which must be added to the composition of the selling price of copper rod and wire. So that the selling price can give effect to the profitability of the company.

The selling price of copper rod and wire affects the amount of the company's operating income (EBIT). So that the selling price can give effect to the profitability of the company. In the table below you can see how the composition of the selling price can affect the company's Operating Income (EBIT).

The purchase price, such as premium, shipping costs, interest, and material costs, also can affect the company's operating income (EBIT). In reality hedging activity can pose a risk of loss the short term profitability which called metal loss. Hedging activities sometimes also provide benefits which called metal gains.

Even though the purpose of hedging activity is to reduce the risk of loss caused by the volatility of copper prices, in reality this activity can also pose a risk of loss to profitability in the short term which is commonly called metal loss. However, hedging activities sometimes also provide benefits which are commonly called metal gains.

Hedging transactions do not need to be done by PT. TMS if the purchase and sale transactions both use the monthly average LME price, for the month in which the delivery is made. TMS needs to carry out hedging activities if buying and selling transactions do not use the same LME price. From hedging activities it is also known that there is a possibility of a risk of loss to the company's profitability

Hedging activities will be carried out on what factors influence this risk from sales and purchases, and can take to minimize the risk of loss, so this study aims to analyze whether or not the influence of hedge metal has on the profitability. the moderating effect of the selling price the purchase price on the effect of hedge metal on the profitability.

RESEARCH METHOD

This research was conducted in December 2022 - March 2023 at PT. Tembaga Mulia Semanan Tbk., a manufacturing company that produces copper rod and wire. The independent variable is hedge metal, the data is obtained from hedged copper price data from 2016-2021. Selling prices and buying prices are as moderating variables, and profitability the company's financial statements are the dependent variable. The Selling Price is the selling price of copper based on LME plus the premium Selling Price, where the premium Selling Price includes the premium Purchase Price, production costs, transportation costs, other costs and margin. The data was obtained from copper selling price and copper material purchase prices from 2016-2021. Profitability data obtained by the company's operating income data for 2016-2021. The company also provides spot LME prices for customers who don't want to use the monthly average LME price.

Table 1. Variable operationalization

Variable	Definition	Measurement
Hedge Metal	The price of copper that has been hedged,	Protected Copper Prices from 2016 - 2021
Selling price	The selling price of copper is based on LME plus a premium selling price	The selling price of copper after adding the premium selling price from 2016-2021

Purchase price	copper purchase price at the monthly average LME price when the company purchases raw materials plus a premium purchase price	The purchase price of copper after adding the premium purchase price from 2016-2021
Profitability	Profits / profits earned by the company	PT TMS Operating Income from 2016 - 2021

In this study, the population was 700 data at PT. Tembaga Mulia Semanan Tbk. The number of samples to be taken in this study is 240 data.

Data analysis using the regression model with the full model interaction:

EBIT = β_0 + β_1 selling price + β_2 buying price + β_3 hedging + β_{13} selling price x hedging + β_{23} x hedging + Σ

(Selling Price & Purchase Price as the main variable and moderating variable)

Regression Model with full moderation interaction:

1. EBIT = α_0 + α_1 hedging + α_{12} hedging x Selling price + Σ_1
   (full moderating selling price)
2. EBIT = γ_0 + $\gamma_1$hedging + γ_{13} hedging x Purchase price + Σ_2
   (full moderating purchase price)

To get the results needed in research, the authors used IBM Statistical Package for the Social Science (SPSS) version 26 for Windows. The classical assumption test will be carried out, which consists of a normality test, multicollinearity test, heteroscedasticity test, and autocorrelation test needs to be fulfilled when carrying out multiple regression analysis as a prerequisite before carrying out multiple regression analysis and hypothesis testing.
Moderation analysis assisted by a moderation framework from (Sugiono, 2004), which can be seen in the image belows:

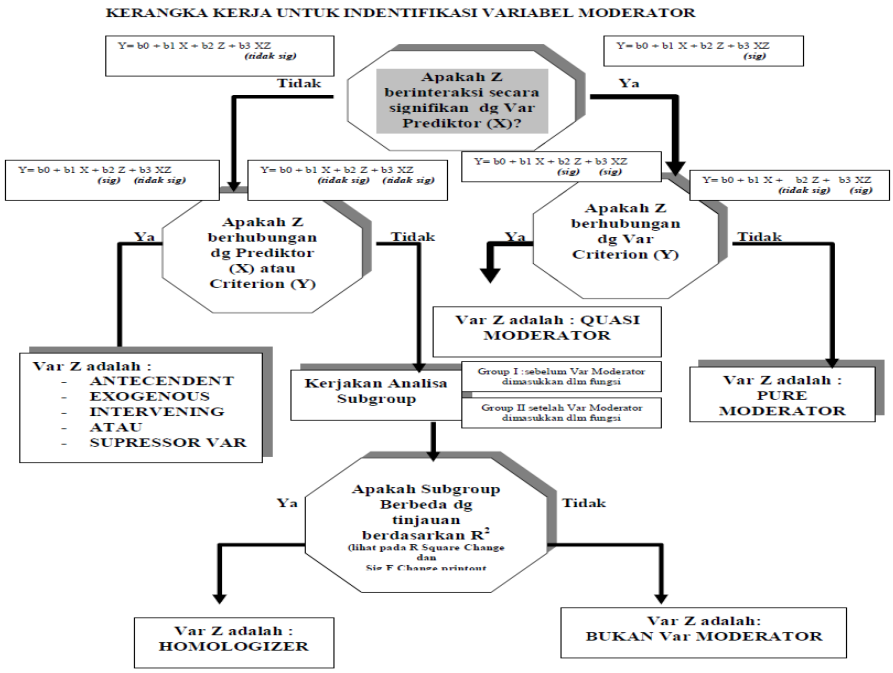

Figure 1. Concept, Identification, Analysis Tools and Problems Using Moderator Variables
Source: Sugiono (2004)

Explanation of the Nature of Moderation, (a) XZ (Interaction Variable) is significant; Significant Z (Moderating Variable) = Quasi Moderator (b) XZ (Interaction Variable) is significant; Z (Moderation Variable) is not significant = Pure Moderator. (c) XZ (Interaction Variable) is not significant; Significant Z (Moderating Variable) = Exogenous, Intervening. (d) XZ (Interaction Variable) is not significant; Z (Moderating Variable) is not significant, see comparison of R-Square before the moderating variable is entered and R-Square after the moderating variable is entered. If there is a change in R-Square: There is a moderating effect, it is a homologizer, If there is no change in R-Square: No moderation effect.

RESULTS AND DISCUSSIONS

Descriptive statistics

The table below presents descriptive statistics for each variable.

Table 1. Research Variable Descriptive Statistics

Descriptive Statistics					
	N	Minimum	Maximum	Means	std. Deviation
Hedge Amounts	72	-1157867	923473	21707.28	318557.254
Selling price	72	4949	10404	6845.13	1413.336
Purchase price	72	4584	10248	6584.36	1431,818
EBIT	72	-691607	2994226	936436.66	537333.476
Valid N (listwise)	72				

The month with the largest or maximum Hedge Amount is June 2021, and the month with the minimum Hedge Amount is March 2021. The month with the highest or maximum selling price is June 2021, and the month with the minimum selling price is January 2016. The month with the highest or maximum Purchase Price is May 2021, and the month with the minimum Purchase Price is January 2016. The month with the highest or maximum EBIT is June 2021, and the month with the minimum EBIT is May 2021. These results illustrate that EBIT at PT. Tembaga Mulia Semanan Tbk. (PT. TMS), is uniform so that it can be concluded that the mean value can represent the overall value of EBIT.

From the data above it can be seen that the Hedge Amount and EBIT are too extreme because the distribution of the data is tens of millions, hundreds of thousands, tens of thousands, and some are even minus millions, or heterogeneous in nature, this data phenomenon makes data are not normal. To fulfill the normality assumption, this study transformed the data of all the variables by Z-Score.

The Z-Score method is used to guarantee data normality and homogeneous residual variance so that the regression equation model meets the best linear and unbias estimator (BLUE) criteria.

$$ZScore = \frac{X - Mean}{Standar\ Deviasi}$$

Below is a table of Descriptive Statistics with Z-Score Data.

Table 2. Descriptive Statistics of Research Variables with Z-Score Data

Descriptive Statistics					
	N	Minimum	Maximum	Means	std. Deviation
Hedge_Amount	72	-2.3094	2.4255	-.045997	.9696932
SELLING PRICE	72	-1.9676	2.7106	-.000001	.9641460
PURCHASE PRICE	72	-2.0096	2.3260	-.000001	.9641460
EBIT	72	-2.1159	2.3216	.000001	.9641460

Valid N (listwise)	72

Source: Processed data (SPSS 26), 2023

Classical Assumption Testing

Normality test

The data normality test was carried out to detect whether the data used in this study were normally distributed or not. A data is said to be normally distributed if the graph is a normal probability plot where the data points spread around the diagonal line and are not too far from the line.

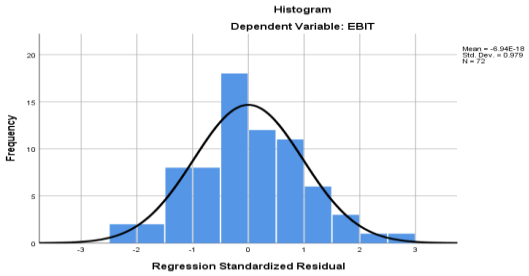

Figure 1.histogram

Source: Processed data (SPSS.26), 2023

The data in this study are normally distributed, because the histogram forms has a mountain and is not too extreme to the left or right.

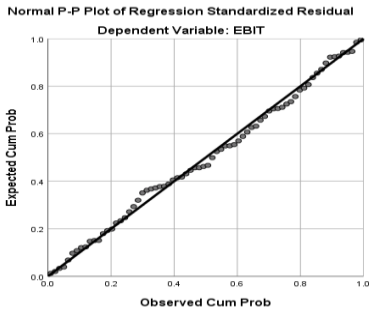

Figure 2. Normal Probability Plots

Source: Processed data (SPSS.26), 2023

The normal probability plot graph shows the data points spread around the diagonal line and not too far from the line. Based on the results of the two tests above, it can be stated that the data in this study are normally distributed, so that further analysis can be carried out.

Multicollinearity Test

The multicollinearity test is carried out to ensure that there is no multicollinearity or the data of the independent variables are correlated with each other in the model.(Ghozali, 2018). The multicollinearity test can be seen from the Variance Inflation Factor (VIF). Below are the requirements for the multicollinearity test: (a) VIF < 10, meaning that there is no multicollinearity. (b) VIF > 10, meaning there is multicollinearity

Table 3. Multicollinearity Test Results

Coefficientsa	
Model	Collinearity Statistics

		tolerance	VIF
1	(Constant)		
	Hedge_Amount	1,000	1,000

a. Dependent Variable: EBIT

Source: Processed data (SPSS.26), 2023

Table 4.3 above shows that there is no multicollinearity, because the VIF value of each of these variables does not violate the rules that VIF is less than 10.

Table 4. Explanation of the VIF and Tolerance values of each variable

Variable	VIF	Conclusion
HEDGE AMOUNT	1,000	No Multicollinearity

Autocorrelation Test

The autocorrelation test is used to test whether in a linear regression model there is a correlation between sample members sorted by time. This test will be carried out using the Durbin-Watson test to see if the regression results are outside the autocorrelation or are they within the autocorrelation.

Decision: Durbin-Watson numbers are in the range 1 < DW < 3→No Autocorrelation)

Table 5. Autocorrelation Test Results (DW – Test)

Summary modelb					
Model	R	R Square	Adjusted R Square	std. Error of the Estimate	Durbin-Watson
1	.182a	.033	.019	.9547957	2.123

a. Predictors: (Constant), Hedge_Amount

b. Dependent Variable: EBIT

Table 4. shows the Durbin Watson value is 2.123 is in the range 1 < DW < 3. This result does not violate the assumption of autocorrelation if it is in range 1 < DW < 3.

Heteroscedasticity Test

The Heteroscedasticity Test aims to test whether the Regression model has an unequal variance from the residuals of one observation to another. A good regression model is homoscedasticity or does not have heteroscedasticity.

The heteroscedasticity test in this study was tested using a Scatterplot. Following are the requirements (a) If there is a certain pattern, such as the dots forming a certain pattern that is regular (wavy, widens, then narrows), then this indicates heteroscedasticity occurs. (b) If there is no clear pattern and the points spread above and below zero on the Y axis, then heteroscedasticity does not occur.

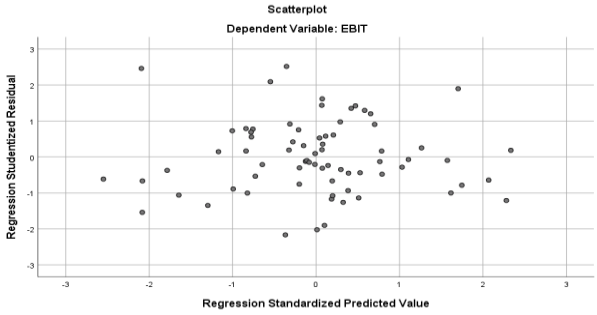

Figure 3. Scatter Plot Heteroscedasticity Test
Source: Processed data (SPSS.26), 2023

Based on Figure 4.3, the scatter plot of the Heteroscedasticity test can be seen that the data points are spread irregularly and do not form a certain pattern, so that it can be stated that there is no heteroscedasticity (fulfilling the assumption of homoscedasticity).

ANOVA Test Results

The F statistical test can be seen in Table 5 and Table 6. as follows:

Table 6. Selling Price ANOVA Test Results

ANOVAa						
Model		Sum of Squares	df	MeanSquare	F	Sig.
1	Regression	10,084	3	3,361	4,088	.010b
	residual	55,916	68	.822		
	Total	66,000	71			

a. Dependent Variable: EBIT
b. Predictors: (Constant), HedgexSales, Sales_Price
Source: Processed data (SPSS.26), 2023

The ANOVA test results shown in Table 5 show thatp-valuesthe significance of Anova (0.010) is smaller than Alpha 5% (0.05) Based on these results it can be concluded that all independent variables (Sales) simultaneously have a significant effect on EBIT.

Table 7. Purchase Price ANOVA Test Results

ANOVAa						
Model		Sum of Squares	df	MeanSquare	F	Sig.
1	Regression	6,321	3	2.107	2,401	.075b
	residual	59,679	68	.878		
	Total	66,000	71			

a. Dependent Variable: EBIT
b. Predictors: (Constant), HedgexPurchase, Purchase_Price
Source: Processed data (SPSS.26), 2023

The results of the ANOVA test are shown in Table 6. It shows thatp-valuesthe significance of Anova (0.075) is smaller than Alpha 10% (0.10) Based on these results it can be concluded that at least one of independent variables in this regression model can predicts the dependent variable (EBIT).

Moderation Analysis

Table 8. Selling Price Moderation in the Effect of Hedge Amount on EBIT

Coefficientsa						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	std. Error	Betas		
1	(Constant)	-.019	.107		-.177	.860
	Hedge_Amount	-.216	.112	-.218	-1,939	057
	SELLING PRICE	.224	.112	.224	1998	.050
	HedgexSelling Price	.231	.103	.252	2,245	.028

Dependent Variable : EBIT Note: significant if sig value less than 0.05

Based on the results of the t test above, it can be seen that the selling price has significantly effect on EBIT, and the interaction variable hedge amount x selling price has significantly effect on EBIT (quasi moderator). It can be concluded that the Selling Price strengthens the influence of the Hedge Amount on EBIT.

$$EBIT = -0.019 - 0.216HEDGE\_AMOUNT + 0.224HARGA\_JUAL + 0.231HEDGExHARGAJUAL$$

$$\frac{\Delta EBIT}{\Delta HARGAJUAL} = 0.224 + 0.231HEDGE$$

$$\frac{\Delta EBIT}{\Delta HARGAJUAL} = 0.224 + 0.231(-0.045997)$$

$$\frac{\Delta EBIT}{\Delta HARGAJUAL} = 0.2134$$

$$\Delta EBIT = 0.2134\ \Delta HARGAJUAL$$

From the calculation above, it can be seen that the magnitude of the change in EBIT on changes in selling prices is positively influenced by the Hedge amount. An increase in the selling price of 1%, EBIT will increase by 0.2134%, and *vice versa*. When the selling price appreciates, the company does not need to do customer hedge or additional hedging of the hedge amount with an average value of US$ 21,707.28, vice-versa.

$$EBIT = -0.019 - 0.216HEDGE\_AMOUNT + 0.224HARGA\_JUAL + 0.231HEDGExHARGAJUAL$$

$$\frac{\Delta EBIT}{\Delta HEDGE\_AMOUNT} = -0.216 + 0.231HARGA\_JUAL$$

$$\frac{\Delta EBIT}{\Delta HEDGE\_AMOUNT} = -0.216 + 0.231(-0.000001)$$

$$\frac{\Delta EBIT}{\Delta HEDGE\_AMOUNT} = -0.216$$

$$\Delta EBIT = -0.216\ \Delta HEDGE\_AMOUNT$$

If the company hedges when the selling price rises from the average hedge amount of US$ 21,707.28, then every 1% increase in the hedge amount will reduce EBIT 0.216%. So when the selling price rises, there is no need to hedge. If the Hedge amount drops 1% it will increase EBIT 0.216%.

Table 9. Purchase Price Moderation in the Effect of Hedge Amount on EBIT

Coefficientsa						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	std. Error	Betas		
1	(Constant)	-.020	.111		-.185	.854
	Hedge_Amount	-.216	.116	-.217	-1,859	.067
	PURCHASE PRICE	-.021	.116	-.021	-.182	.856
	HedgexPurchase Price	.229	.107	.251	2,150	.035

a. Dependent Variable: EBIT Note: significant if sig value less than 0.05

Based on the results of the t test above, it can be seen that the Purchase Price has not significantly effect on EBIT, and the interaction variable (Hedge Amount x Purchase Price) has significantly effect on EBIT, it can be stated that there is a moderating effect of hedge purchase price as pure moderator. It can be concluded that the Purchase Price strengthens the influence of the Hedge Amount on EBIT.

$$EBIT = -0.020 - 0.216HEDGE\_AMOUNT - 0.221HARGA\_BELI + 0.229HEDGExHARGABELI$$

$$\frac{\Delta EBIT}{\Delta HARGA\_BELI} = -0.021 + 0.229HARGA\_BELI$$

$$\frac{\Delta EBIT}{\Delta HARGA\_BELI} = -0.221 + 0.229(-0.045997)$$

$$\frac{\Delta EBIT}{\Delta HARGA\_BELI} = 0.000956$$

$$\Delta EBIT = 0.000956\ \Delta HARGA\_BELI$$

From the calculation above, it can be seen that the magnitude of the change in EBIT to the change in Purchase Price is negatively affected by the Hedge amount. An increase in the Purchase Price of 1%, EBIT will increase by 0.000956%, *vice versa*. If the purchase price appreciates, then the company does not need additional hedging equal to the average value of US$ 21,707.28, vice versa.

$$EBIT = -0.020 - 0.216HEDGE\_AMOUNT - 0.221HARGA\_BELI + 0.229HEDGExHARGABELI$$

$$\frac{\Delta EBIT}{\Delta HEDGE\_AMOUNT} = -0.216 + 0.229(-0.000001)$$

$$\frac{\Delta EBIT}{\Delta HEDGE\_AMOUNT} = 0.013$$

$$\Delta EBIT = 0.013\,\Delta HEDGE\_AMOUNT$$

If Hedge Amount increases by 1%, it will result in EBIT increasing by 0.013%. So it is not significant if the company hedges when the purchase price rises. When the purchase price falls, the company should follow the market price and not need to do an unknown hedge, namely a selling hedge on purchases with delivery in the same month.

Discussion

Table 10. Research Hypothesis Testing Results

	Hypothesis	Sig.	Conclusion	Hypothesis Test Results
H1	*Hedge Amounts*positive effect on EBIT	0.057 (sale) and 0.067 (purchase).	Hedge Amount has a significant negative effect on EBIT	Hypothesis Accepted (for α 0.1)
H2	Selling Price moderates the positive effect of Hedge Amount on EBIT	*Hedge Amounts*x Selling Price: 0.028	Selling Price moderates the positive effect of Hedge Amount on EBIT	Hypothesis Accepted (for α 0.05)
H3	Purchase Price moderates the effect of Hedge Amount on EBIT	*Hedge Amounts*x Purchase Price: 0.035	Purchase Price moderates the positive effect of Hedge Amount on EBIT	Hypothesis Accepted (for α 0.05)

Effect of Hedge Amount on EBIT

Table 4.5 shows that the hypothesis testing results of H1 was rejected, it can be stated that the Hedge Amount does not directly determine PT TMS's EBIT, because a high Hedge Amount value indicates that the company is spending more and more hedging costs. The coefficient, of Hedge Amount has a negative effect on EBIT, which means that the higher the Hedge Amount, th lower the company's EBIT. the value they have to spend due to the uncertainty of copper prices in the market, not to mention the addition of other operational costs, such as direct conversion costs, direct selling expenses and indirect conversion costs.

Selling Price Moderation in the Effect of Hedge Amount on EBIT

Table 4.5 that shows the results of the H2 hypothesis testing was accepted, it can be stated that the selling price significantly moderates the positive effect of Hedge Amount on EBIT. These results indicate that the Selling Price is the most determining factor on EBIT that shows how much a company has to spend on hedging costs to sell copper at the price they want. The selling price itself is the selling price in a market that has high volatility. make PT. TMS is more careful in determining the amount of hedge they will issue when it wants to enter into sales transactions of copper rod and wire. The results of this study are strengthened by previous research were conducted by Narayan et al (2015), Min Wang et al (2021).

Purchase Price Moderation in the Effect of Hedge Amount on EBIT

Based on the results of the H3 hypothesis testing was accepted which shown by Table 4.5, it can be stated that the Purchase Price significantly moderates the positive effect of Hedge Amount on EBIT.

These results indicate that the Purchase Price is the most determining factor on EBIT that shows how much a company has to incur hedging costs to buy copper sheet or copper cathode and copper scrap at the price they want. The Purchase Price in the market which has high volatility, this makes PT. TMS is more careful in determining the amount of hedge they will issue when they want to make transactions to purchase copper raw materials. The purchase price for PT. TMS is the most vital element, because it is directly related to the cost of procuring raw materials, of course PT. TMS wanted to get copper at a purchase price that matched their hedge value and did not want to lose money because of the difference between the purchase price and the hedge. The results of this study confirmed to the previous studies were conducted by Marn and Rosiello (1992), de Roon et al (2000), Joy (2011), and Ischuk et al. (2016) which states that the Purchase Price determines the Hedge Amount and profitability in the company's financial statements (EBIT), and/or the Purchase Price moderates the influence of the Hedge Amount on Profitability (EBIT). The results of this study supported the results of previous studies which were conducted by Marn and Rosiello (1992), de Roon et al (2000), Joy (2011), and Ischuk et al. (2016) which states that the Purchase Price determines the Hedge Amount and profitability in the company's financial statements (EBIT) and/or the Purchase Price moderates the influence of the Hedge Amount on Profitability (EBIT). These results confirmed to the strengthened of previous studies were conducted by Marn and Rosiello (1992), de Roon et al (2000), Joy (2011), and Ischuk et al. (2016) which states that the Purchase Price determines the Hedge Amount and profitability in the company's financial statements (EBIT) and/or moderates the influence of the Hedge Amount on Profitability (EBIT).

CONCLUSION

The conclusions of this research can be drawn are as follows: Hedge Amount has a significantly negative effect on EBIT, The negative effect of the Hedge Amount on EBIT will be more positive when the Selling Price increases, Purchase Price significantly moderates the positive effect of Hedge Amount on EBIT. Companies must reduce the negative effect of hedges on EBIT, so companies need to pay attention to any changes in selling prices. When the selling price appreciates, the company does not need to carry out customer hedging or additional hedging equal to the average value of the hedge, which is US$ 21,707.28, and vice versa. If there is an increase in the selling price, the company should follow the market price. Companies must reduce the negative effect of hedging on EBIT, so companies need to pay attention to any changes in purchase prices. If the Purchase Price appreciates, the company does not need additional hedging in the amount of the hedge value which is an average value of US$ 21,707.28, and vice versa. When the purchase price falls, the company should follow the market price and not need to do an unknown hedge, namely a selling hedge on purchases with delivery in the same month. This research just used hedge amount as independent variable, sales and purchase price as moderation variable to independent variable and profitability (EBIT) amount as dependent variable. For further research has expected to put other moderation variable such as interest and premium.

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