



# THE EFFECTS OF THE OIL PRICES AND USD/VND EXCHANGE RATES ON VIETNAM'S INFLATION RATE DURING THE PERIOD 2021-2022

**Course:** Mathematics in Business and Trade

**Instructor:** Nguyen Tai Vuong

**Student group names:**

Le Phuong Linh 20213069

Tran Thi Thuy Linh 20213070

Nguyen Thi Ninh 20213088

Tran Bui Ha My 20213077

Ha Noi, January 2023

# TABLE OF CONTENTS

<b>EXECUTIVE SUMMARY.....</b>	<b>3</b>
<b>I. POSE THE PROBLEM .....</b>	<b>4</b>
1. The topic.....	4
2. Model Building .....	5
<b>II. ANALYSIS .....</b>	<b>6</b>
1. Descriptive statistics of variables.....	6
<i>1.1 Data Summary.....</i>	<i>6</i>
<i>1.2 Frequency table and graph of data.....</i>	<i>6</i>
2. Analysis according to the questions suggested in Case-Problems .....	10
3. Conclusion based on the above analysis .....	12
4. Multiple Regression Analysis .....	12
<b>III. CONCLUSION .....</b>	<b>13</b>
<b>DATA REFERENCES .....</b>	<b>14</b>

# EXECUTIVE SUMMARY

The following report is the result of our analysis and survey on the impact of world oil prices and USD/VND exchange rates on Vietnam's inflation during the period 2021-2022. It is completed by the members' contributions with the knowledge drawn from studying and researching Math in Business and Trade course.

With this report, we were able to better understand the relevant characteristic analysis and testing, as well as apply the knowledge in school to get useful conclusions about phenomena in different relationships and interactions between variables.

Lastly, we sincerely thank Mr. Nguyen Tai Vuong for accompanying us in researching and studying. Due to limited knowledge and skills, surely this report cannot avoid errors, we are looking forward to receiving your encouragement so that we can improve our knowledge and skills to apply better in the future.

# I. POSE THE PROBLEM

## 1. The topic

During 2021-2022, the world oil price fluctuates in clear up trends. In particular, the increase in oil price volatility is mainly due to tight oil markets and tensions in Russia and Ukraine, causing disruptions in the supply of energy products, while increasing consumption demand. Energy is also an important input, greatly affecting the prices of many other goods and services that make the huge pressure on Vietnam inflation rate to increase.

Another problem, during 2021-2022, after the Covid-19, the USD has a strong upward trend because of the work of the US Federal Reserve (FED) raising interest rates to use the escalation mode in this country put pressure on VND, so the gap of price for USD/VND exchange rate is quite big. When the Exchange Rate increases, the price of imported goods becomes more expensive, thus increasing the Rate of Inflation.

Therefore, this case study will focus on assessing two factors of fluctuations in the world Oil Prices (Brent) and USD/VND Exchange Rate on the Vietnamese economy to provide a clearer analysis of their great impact on inflation.

	Exchange rate (USD/VND)	Oil Price	Inflation Rate (%)
Jan-21	23.048	55.04	-0.97
Feb-21	23.015	54.02	0.7
Mar-21	23.074	62.74	1.16
Apr-21	23.054	66.76	2.7
May-21	23.04	68.95	2.9
Jun-21	23.014	74.62	2.4
Jul-21	22.95	75.41	2.64
Aug-21	22.775	71.63	2.82
Sep-21	22.75	78.31	2.06
Oct-21	22.75	83.72	1.77
Nov-21	22.688	69.23	2.10
Dec-21	22.825	77.35	1.81
Jan-22	22.645	89.26	1.94
Feb-22	22.805	97.97	1.42
Mar-22	22.838	104.71	2.41
Apr-22	22.962	107.14	2.64
May-22	23.185	115.60	2.86
Jun-22	23.255	109.03	3.37
Jul-22	23.335	103.97	3.14
Aug-22	23.45	95.64	2.89
Sep-22	23.885	85.14	3.94
Oct-22	24.84	94.83	4.30
Nov-22	24.63	85.43	4.37
Dec-22	23.61	85.91	4.55

## 2. Model Building

- *Define model format*

To analyze the effects of factors affecting Inflation Rate we have chosen uses regression analysis with linear regression model to make estimates and conclusions about the dependent variable of the model.

The variables used for inclusion in the article are:

	<b>Name</b>	<b>Unit</b>
<b>Dependent variable</b>	Inflation Rate	%
<b>Independent variable</b>	Oil Price	USD
	USD/VND Exchange Rate	USD/VND

The overall regression model describes the relationship between the dependent variable Y and the independent variables of the form:

$$Y = \beta_0 + \beta_1 * \text{Oil Price} + \beta_2 * \text{Exchange Rate} + \varepsilon$$

Where:

- $\beta_0$ : is the intercept coefficient.
- $\beta_1, \beta_2$ : are the coefficients corresponding to the independent variables.
- $\varepsilon$ : is the random error.

- *Expectations about the sign of the independent variables:*

From the topic:

The Oil Price increase, It will put pressure on inflation rate increase (+).

The USD/VND exchange rate increase, leading to increase the rate of inflation (+).

## II. ANALYSIS

### 1. Descriptive statistics of variables

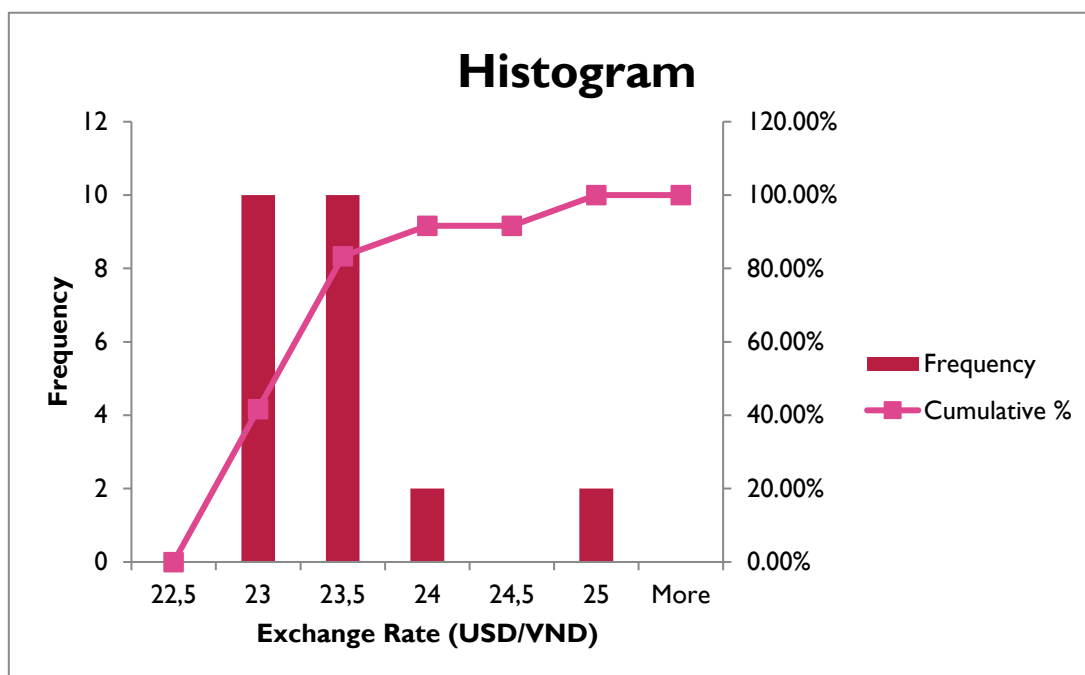
#### 1.1 Data Summary

<i>Inflation Rate (%)</i>		<i>Oil Price</i>		<i>Exchange Rate (USD/VND)</i>	
Mean	2.496666667	Mean	83.85041667	Mean	23.18429167
Standard Error	0.250867095	Standard Error	3.508038671	Standard Error	0.115055335
Median	2.64	Median	84.43	Median	23.0275
Mode	2.64	Mode	#N/A	Mode	22.75
Standard Deviation	1.228992754	Standard Deviation	17.18580948	Standard Deviation	0.563653723
Sample Variance	1.510423188	Sample Variance	295.3520476	Sample Variance	0.31770552
Kurtosis	1.660644985	Kurtosis	-0.821903955	Kurtosis	3.539400682
Skewness	-0.686491651	Skewness	0.082448615	Skewness	1.935523892
Range	5.52	Range	61.58	Range	2.195
Minimum	-0.97	Minimum	54.02	Minimum	22.645
Maximum	4.55	Maximum	115.6	Maximum	24.84
Sum	59.92	Sum	2012.41	Sum	556.423
Count	24	Count	24	Count	24

#### 1.2 Frequency table and graph of data

##### 1.2.1. Exchange Rate (USD/VND):

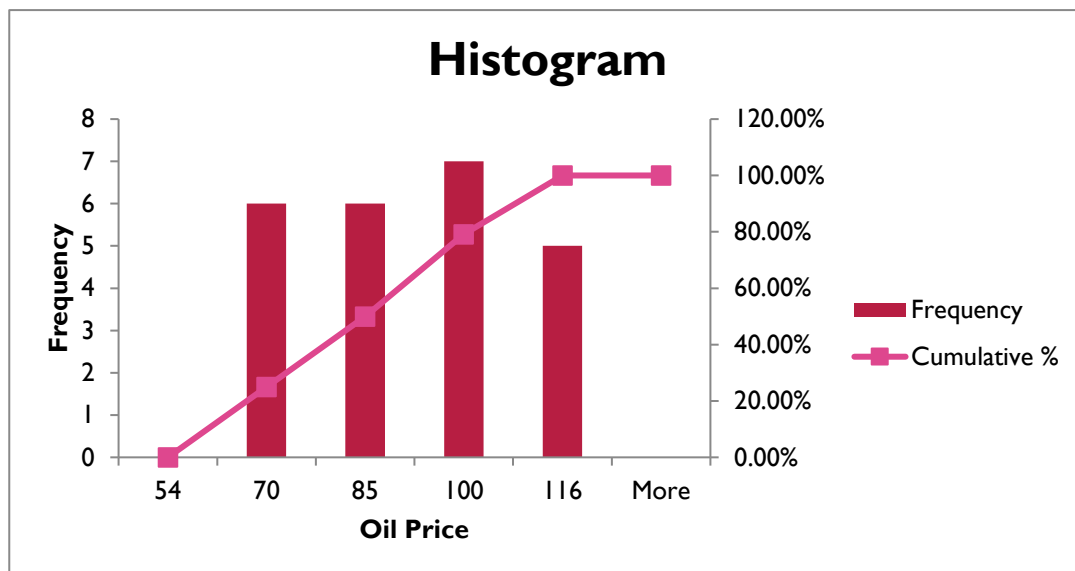
<b>Exchange Rate (USD/VND)</b>	<b>Frequency</b>	<b>Freq (%)</b>	<b>Cumulative frequency (%)</b>
22.5	0	0%	0%
23	10	41.67%	41.67%
23.5	10	41.67%	83.33%
24	2	8.33%	91.67%
24.5	0	0%	91.67%
25	2	8.33%	100%



*Comment:* The USD/VND exchange rate is mainly fluctuated between 22.5 and 23, the big exchange rate is not too much.

#### 1.2.2. Oil Price:

Oil Price	Frequency	Freq(%)	Cumulative frequency (%)
54	0	0%	0%
54 - 70	6	25%	25%
70 - 85	6	25%	50%
85 - 100	7	29,17%	79,17%
100 - 116	5	20,83%	100%

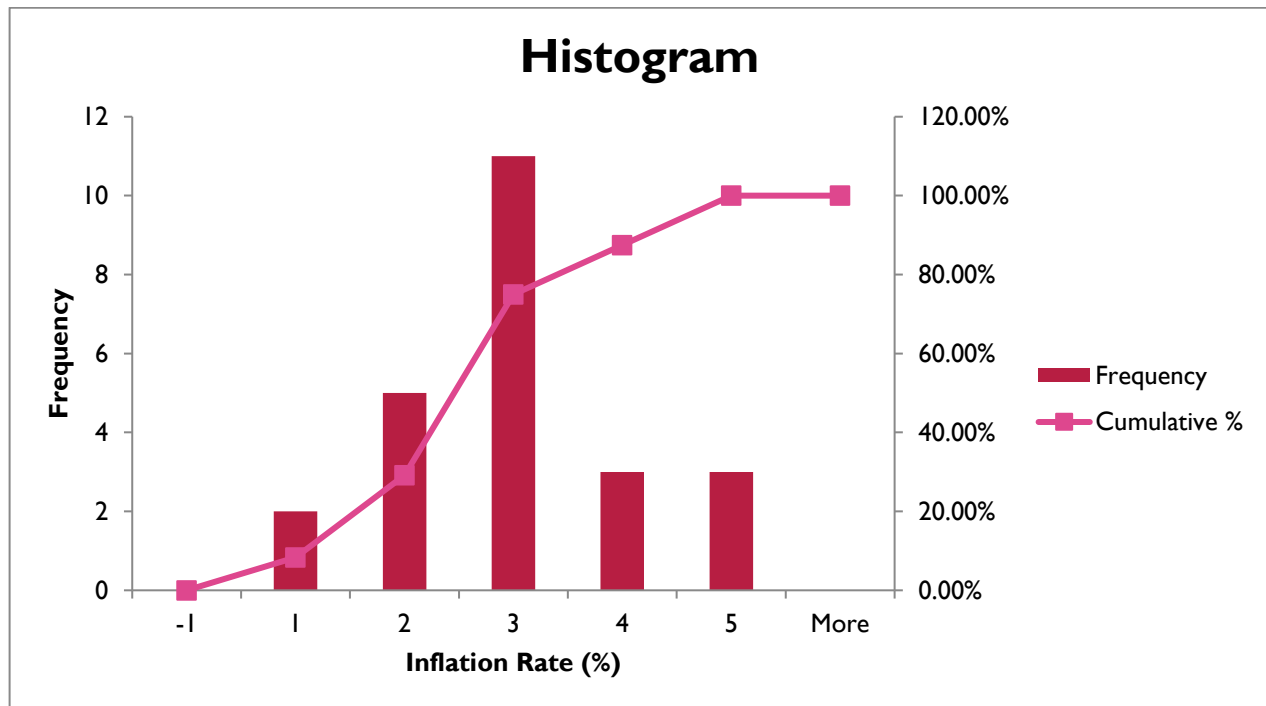


*Comment:* Oil Prices have spiked spikes, up trend slope.

#### 1.2.3. Inflation Rate (%):

Inflation Rate (%)	Frequency	Freq (%)	Cumulative frequency (%)
-1	0	0%	0%
1	2	8.33%	8.33%
2	5	20.83%	29.17%
3	11	45.84%	75%
4	3	12.5%	87.5%
5	3	12.5%	100%





*Comment:* Inflation is usually concentrated in the range of 2% - 4%, inflation rises suddenly, and suddenly decreases, not much.

## 2. Analysis according to the questions suggested in Case-Problems

Using Excel software to estimate the simple linear regression model by OLS method, we have the results of the dependence of the variable Inflation with other variables as follows:

### 2.1 Exchange Rate

SUMMARY OUTPUT								
Regression Statistics								
Multiple R	0.639469744							
R Square	0.408921553							
Adjusted R Square	0.382054351							
Standard Error	0.966105293							
Observations	24							
ANOVA								
	df	SS	MS	F	Significance F			
Regression	1	14,20582572	14,20582572	15,22010187	0,000767031			
Residual	22	20,53390762	0,933359437					
Total	23	34,73973333						
	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95,0%	Upper 95,0%
Intercept	-29,82924446	8,288290434	-3,598962259	0,001595465	-47,01810677	-12,64038215	-47,01810677	-12,64038215
Exchange rate (USD/VND)	1,394302297	0,357394746	3,901294897	0,000767031	0,65311096	2,135493635	0,65311096	2,135493635

Test hypothesis with parameters:

- $H_0 = 0$  (no linear relationship between X and Y).
- $H_1 \neq 0$  (linear relationship exists between X and Y).

At the 5% significance level:

$$P(F > 15.22) = 0.00076 < 0.05$$

=> Reject the  $H_0$  of no linear relationship. There is a linear relationship between Exchange Rate and Inflation Rate.

- Having  $R^2 = 0.408$  that the variable Interest explains 40.8% of the variation of the variable Inflation.

⇒ The sample regression function received is:  $= -29.829 + 1.394 * \text{Exchange Rate}$ .

**Explanation:**  $\beta_1 = 1.394$  shows that when the Interest Rate increases by 1\$/VND, the Inflation Rate increases to 1.394%.

Test hypothesis with parameters:

- $H_0: \beta_1 = 0$
- $H_1: \beta_1 \neq 0$

At the 5% significance level, we see:

P-value = 0.000767 <  $\alpha = 0.05$ . We reject the hypothesis  $H_0$ . So the variable Exchange Rate has an impact on Inflation Rate.

## 2.2 Oil Price

SUMMARY OUTPUT								
Regression Statistics								
Multiple R	0,502246095							
R Square	0,25225114							
Adjusted R Square	0,218262556							
Standard Error	1,086625217							
Observations	24							
ANOVA								
	df	SS	MS	F	Significance F			
Regression	1	8,76313735	8,76313735	7,421642998	0,012384363			
Residual	22	25,97659598	1,180754363					
Total	23	34,73973333						
	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95,0%	Upper 95,0%
Intercept	-0,514959926	1,127512871	-0,456721993	0,652348294	-2,853278503	1,823358651	-2,853278503	1,823358651
Oil Price	0,035916656	0,01318396	2,724269259	0,012384363	0,008574797	0,063258515	0,008574797	0,063258515

Test hypothesis with parameters:

- $H_0 = 0$  (no linear relationship between X and Y)
- $H_1 \neq 0$  (linear relationship exists between X and Y)

At the 5% significance level:

$$P(F > 7.42) = 0.012 < 0.05$$

=> Reject the  $H_0$  of no linear relationship. There is a linear relationship between Oil Price and Inflation Rate.

- Having  $R^2 = 0.252$  means that the variable Oil Price explains 25.2 % of the variation of the variable Inflation.

⇒ The sample regression function received is:  $= -0.514 + 0.03 * \text{Oil Price}$ .

**Explanation:**  $\beta_2 = 0.0359$  indicates that when the Oil Price increase by 1\$, Inflation will increase to 0.0359%.

Test hypothesis with parameters:

- $H_0: \beta_2 = 0$
- $H_1: \beta_2 \neq 0$

At the 5% significance level, we see:

P-value = 0.012 < 0.05. We reject the hypothesis  $H_0$ . So the Oil Price has an impact on Inflation Rate.

### 3. Conclusion based on the above analysis

After performing univariate regression analysis Inflation according to the remaining variables

We can summarize as follows:

- Exchange Rate and Oil Price have an impact on Inflation Rate . All variables are positively related
  - The variable Exchange Rate explains 40,8% of the variation of Inflation Rate variable which is quite high.
  - The variable Oil Price explains 25,25% of the variation of Inflation Rate variable
- ⇒ The performance of single-variable regression analysis gives the expected sign of variables are correct. Our group will continue to perform multiple regression to more comprehensively evaluate the impact of independent variables on the dependent variable.

### 4. Multiple Regression Analysis

Using Excel software and estimating the above model by OLS method, we have the results obtained in the following table:

SUMMARY OUTPUT								
Regression Statistics								
Multiple R	0,743254123							
R Square	0,552426692							
Adjusted R Square	0,509800663							
Standard Error	0,860469898							
Observations	24							
ANOVA								
	df	SS	MS	F	Significance F			
Regression	2	19,19115597	9,595577984	12,95984404	0,000215811			
Residual	21	15,54857737	0,740408446					
Total	23	34,73973333						
	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95,0%	Upper 95,0%
Intercept	-28,12566214	7,411173148	-3,795035087	0,001059436	-43,53804042	-12,71328385	-43,53804042	-12,71328385
Exchange rate (USD/VND)	1,220704667	0,325271032	3,752884657	0,001171222	0,544266525	1,897142809	0,544266525	1,897142809
Oil Price	0,027682102	0,010668117	2,594844186	0,016905764	0,005496538	0,049867666	0,005496538	0,049867666

Test hypothesis with parameters:

- $H_0 = 0$  (no linear relationship between X and Y).
- $H_1 \neq 0$  (linear relationship exists between X and Y).

At the 5% significance level:

$$P(F > 12.95) = 0.0002 < 0.05$$

⇒ Reject the  $H_0$  of no linear relationship. There is a linear relationship between Exchange Rate, Oil Price and Inflation Rate , the model is meaningful.

Through the results of running from the excel application, we see that the adjusted  $R^2$  is 0.5098 ( $0.5 < 0.5098 < 1$ ), which means that the model explains 50.98% of the variation in Inflation Rate depends on the variables in the model.

- *The multiple regression function is:*

$$\text{Inflation Rate}^{\wedge} = -28.1256 + 0.027 * \text{Oil Price} + 1.22 * \text{Exchange Rate}.$$

#### ***4.1. Explanation of the sample regression function received***

- $B_1 = 1.22$  indicates that when the The Exchange rate increase increases by 1\$/VND, the Inflation increase 1.22% as long as other factors remain constant.
- $B_2 = 0.027$  indicates that when the Oil Price increases by 1\$ , the Inflation increase 0.027% as long as other factors remain constant.

## **III. CONCLUSION**

After testing the model's hypotheses, it was not found that the estimated model violated the assumptions and expectations about the initial sign. Maybe say model:

$$\text{Inflation Rate} = -28.1256 + 0.027 * \text{Oil Price} + 1.22 * \text{Exchange Rate} + \varepsilon$$

is a good model

# DATA REFERENCES

- [1] Oil Price (monthly): <https://investing.com/>
- [2] USD/VND Exchange Rate (monthly): <https://investing.com/>
- [3] Inflation (monthly): <https://tradingeconomics.com/>