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The Exchange Rate Plays a Crucial Role in the Consumer Price Index as it Affects the Inflation

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Abstract

Purpose: This study aims to analyze the exchange rates and inflation on the Consumer Price Index (CPI) in Indonesia. Fluctuating exchange rates and high inflation are often major concerns in the economy, as both can affect people's purchasing power and overall economic stability.
Methodology: The method used in this study is multiple regression analysis, with CPI as the dependent variable, and exchange rates and inflation as independent variables. The data used covers the period 2020 to 2023 obtained from the Central Statistics Agency (BPS) and Bank Indonesia.
Finding: The results of the study show that both exchange rates and inflation have a significant effect on CPI. In particular, an increase in the exchange rate tends to increase the price of imported goods, which in turn drives up the CPI. In addition, high inflation contributes to an increase in people's cost of living.
Implication: The government needs to maintain exchange rate stability to prevent an increase in the price of imported goods that can affect the CPI. In addition, controlling inflation is key to maintaining people's purchasing power and economic stability.
Originality: This study makes a new contribution by analyzing the simultaneous impact of exchange rates and inflation on CPI in Indonesia during the period 2020-2023.
Keywords: Consumer Price Index, Exchange Rate, Inflation.

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1. Introduction

The debate on exchange rates and inflation in policy settings has evolved with the experience of different monetary regimes. For example in the UK in 1976, the UK Government once believed the first round effect of a 10 percent depreciation would increase the retail price index by about 2.9 percent after one year (Kara & Nelson, 2003). During the early 1990's the UK membership expressed a strong link between the Exchange Rate Mechanism (ERM), exchange rates, and inflation by making the statement that freedom of trade, combined with a commitment to the ERM, meant that costs and prices in the UK would not be able to move independently of their competitors for a long period (Bank of England, 2000; Treasury, 1993).

In Indonesia, the effect of the rupiah exchange rate (Kurs) on the Consumer Price Index (CPI) and inflation is complex and can be influenced by various factors. Some of the key points of influence can be both positive and negative. The positive impact of a higher exchange rate is that a stronger rupiah can make imports cheaper, potentially increasing economic activity. Inflation is a negative impact measured by the CPI, resulting in high Inflation reducing purchasing power and decreasing the value of company assets.

Svensson (1998) argues that the analysis of inflation targets a small open economy, Compared to a closed economy system, an open economy is mainly influenced by monetary policy transmission arising from the exchange rate. There are three channels of influence: the additional aggregate demand channel arising from the sensitivity of net trade to the exchange rate; the 'direct' exchange rate channel due to the presence of imported goods in the consumer price index; and finally, the relationship between the CPI and the exchange rate due to imports of intermediate goods. The implications of openness for inflation targeting in the UK, Svensson focuses on, are on the relationship between the exchange rate and consumer prices.

Economists argue that some exchange rate movements are simply changes in relative prices that do not necessarily affect the inflation rate. Others argue more pragmatically that the current disinflationary forces are so strong that such pressures do not pose a threat (Çitçi & Kaya, 2023). On the other hand, several state budget documents note that there is no experience of any effect on retail prices from a lower exchange rate (Treasury, 1993).

The importance of discussing the exchange rate and consumer prices has been widely debated in theoretical and policy discussions. Theoretical macroeconomic models of open economies overshadow the issue of the importance of exchange rate movements to inflation behavior. On the other hand, there are versions of the 'Scandinavian' model or the 'monetary approach' that predict a close and mechanical relationship between exchange rate changes and inflation and the consumer price index (Çitçi & Kaya, 2023). On the other hand, there are several market pricing models in which pricing decisions regarding all components of the CPI, including import prices, are determined independently of exchange rate movements, thus leading to a disconnection of the exchange rate effect from other macroeconomic variables (Devereux & Engel, 2002).

Between these two extremes, other models allow for a relationship between the exchange rate and goods prices but vary widely in terms of the role of domestic factors in determining import prices, the extent and speed of pass-through, the relative importance of imports of intermediate and consumer goods, and the extent to which the reaction function of monetary policy governs the response of the aggregate price level and inflation to exchange rate depreciation (Clarida et al., 2002).

2. Literature Review

The CPI is a measure by economists to track changes in the prices of goods and services that consumers buy. The Bureau of Labor Statistics calculates the CPI to determine how much people pay for energy, food, housing, and travel. The CPI is also one of the most popular measures of inflation and deflation (Kara & Nelson, 2003). As such, the CPI is commonly used by the Federal Reserve to monitor price changes and ensure that economic growth remains stable and is also used as a monetary policy tool if it detects too much inflation or deflation (Adam & Tzamourani, 2016). The CPI is calculated by taking the average cost of goods in a given month and dividing it by the engagement of the same goods in the previous month. It then multiplies this percentage by 100 to get the index number. Here is the formula for calculating the CPI:

Consumer Price Index = current month's cost of goods/last month's cost of goods x 100

The current year's CPI and the previous year's CPI are used to calculate the inflation rate. Here is the formula for calculating the inflation rate with the CPI.

Inflation Rate = New CPI Value – Previous CPI Value / Previous CPI Value x 100

The inflation rate can be calculated for a specific month or an annual period; in either case, the new and previous periods must be selected. The inflation rate is reported as a percentage and is often positive, assuming market prices appreciate (Aoki, 2001). Assuming the CPI value for last year was 100 and this year is 105, this indicates a 5% increase. This means the average prices of goods and services this year increased by 5% from last year. Another example, suppose the CPI this year is 110 and last year's CPI was 100, then there

was a 10% increase in average prices. If this year's CPI value is 90, there has been an average price decrease of 10%.

Each of the eight categories that make up the Consumer Price Index (CPI) has numerous subcategories. Food and Beverages: This includes all types of food and beverages, including food purchased away from home. Housing: This category covers expenses such as rent, fuel, and other household necessities like electricity and water. Apparel: This category includes clothing and footwear. Transportation: This includes expenses related to motor vehicles, gasoline, and public transportation. Medical Care: This includes medical and dental services, prescription drugs, and medical equipment. Recreation: This category covers entertainment expenses, such as movies, sports, and recreational equipment. Education and Communication: This category includes fees, books, and communication services like telephone and internet. Other Goods and Services: This category encompasses a wide range of goods and services, such as personal care items, household supplies, and tobacco products.

The CPI is useful for measuring the level of inflation, which is one of the biggest threats to a healthy economy. Inflation eats away at living standards when incomes do not keep pace with rising prices and the cost of living increases over time. High inflation can hurt an economy. Everything becomes more expensive, so manufacturers produce less and may be forced to lay off workers. The CPI allows us to measure these factors. So focusing on discussing and addressing the negative effects of the influence of various aspects of this important economic variable needs to be analyzed and used as a reference for monetary policy studies.

3. Methodology

This article will delve into the discussion of aggregate variables in macroeconomics, with a specific focus on the relationship between CPI inflation and the exchange rate. We aim to explore the extent to which this relationship relies on model specifications and policies, drawing implications for formulating suitable monetary policy targets. Importantly, our discussion will not encompass the relationship between the exchange rate and import price inflation, nor will it examine micro-level data. These topics have been addressed in a study by Campa and Goldberg (2002), which concentrates on the relationship between import price inflation and the exchange rate in various OECD countries. Within the macroeconomic framework, it is crucial to differentiate between factors that drive relationships, which remain fixed and unchanged by the monetary policy regime (e.g., production function parameters), and factors influenced by prevailing monetary policies (e.g., expectations in the Phillips curve relationship).

The correlation between exchange rates and inflation is primarily influenced by their quantitative movement. This relationship is also significantly impacted by monetary policy, as noted by (Gagnon et al., 2001; Taylor, 2000). Conversely, when the structural parameters depict the supply side, the model imposes constraints on the extent to which the exchange rate affects inflation, thereby diminishing the significance of policy, at least for moderate adjustments in monetary policy settings.

Throughout our analysis, we will contend that there are clear patterns in the relationship between the exchange rate and inflation when it comes to monetary policy. Across different economies, the connection between consumer price inflation and the exchange rate appears to be relatively weak, which challenges certain prominent open economy models. On the other hand, our findings align with the conclusions of (Campa & Goldberg, 2002) and indicate that the exchange rate disconnect or market-price approach does not effectively account for key trends in the UK data. In this study, we have included the following variables:

Tabel 1. Variable

Variable	Variables Name	Code
Y	Consumer Price Index	CPI
X1	Inflation	INF
X2	Exchange Rate	Kurs

The data analysis in this study utilized Multiplier Linear Regression, an extension of simple linear regression with more than one predictor variable. This type of analysis is used to test the relationship between one endogenous variable and two or more exogenous variables (Wooldrige, 2005). It also enables cateris paribus analysis. It will be controlled by many factors simultaneously that affect the endogenous variable. Mathematically, the following equation can be written:

$$Y=\alpha+\beta1X1+\beta2X2+\varepsilon$$

Y = CPI
X1= INF
X2= KURS
α = intercept
β12 = slope
ε = error term

4. Results and Discussion

The following results of executing the interaction model between variables.

Source	SS	df	MS	Number of obs	=	48
				F(2, 45)	=	17.80
Model	358.023696	2	179.011848	Prob > F	=	0.0000
Residual	452.521952	45	10.0560434	R-squared	=	0.4417
				Adj R-squared	=	0.4169
Total	810.545648	47	17.2456521	Root MSE	=	3.1711

CPI	Coef.	Std. Err.	t	P>|t|	Beta
INF	3.63165	1.646347	2.21	0.033	.2460091
KURS	.0046847	.0008295	5.65	0.000	.6298296
_cons	39.30161	12.29202	3.20	0.003	.

Figure 1. Interaction Model
Source: Data Processed (2024)

Based on the output results, the equation for the model above can be written as:

$$Y=39.30+0.2460INF+0.6298KURS+\varepsilon$$

The Adjusted R2 value produced by the model is 0.4417, which means that both predictors (INF and KURS) can explain the variation of the dependent variable (CPI) by 44.17%. The Root Mean Square Error value produced is 3.1711 which means that it is very good because the greater this value can indicate a good regression value. The F statistic value produced by the model is 17.80 with df = 45, and the F table is 3.23 because the calculated F statistic value is > F table and the probability of the resulting F statistic is 0.0000 < 0.05, which means that both predictors (INF and KURS) simultaneously have a significant effect on the dependent variable (CPI).

The predictor variable (INF) demonstrates a significant and positive effect on the dependent variable (CPI) with a P>|t| value of 0.000, indicating its impact is statistically significant. However, the Inflation variable exhibits a P>|t| value of 0.108, which is greater than 0.05. This suggests that the regression coefficient is negative, indicating an insignificant effect and a negative relationship between the predictor variable (KURS) and the dependent variable (CPI). Additionally, we will conduct the Ramsey Regression Specification Error Test (RESET) to assess the linear assumptions for each variable and evaluate their respective strengths as right-hand side variables influencing y.

Ramsey RESET test using powers of the fitted values of CPI
Ho: the model has no omitted variables
F(3, 42) = 12.42
Prob > F = 0.0000

From the results of the Ramsey test, it can be concluded that the model does not have a specification error with a probability value of 0.0000 <0.05 with a calculated F statistic value of 12.42 with a degree of freedom df = 42. Because the calculated F statistic value of 12.42 > 2.84, it can be concluded that there is no specification error in this model. Because specification error occurs when the resulting probability value is > 0.05. The next test is to test the normality of the data using the Shapiro-Francia normality test.

Shapiro-Francia W' test for normal data

Variable	Obs	W'	V'	z	Prob>z
KURS	48	0.95548	2.247	1.526	0.06347
INF	48	0.92464	3.803	2.519	0.00589
CPI	48	0.88222	5.944	3.361	0.00039

Figure 2. Shapiro-Francia Normality Test
Source: Data Processed (2024)

Based on the normality test results, it can be concluded that the data is not normal for two variables, namely INF and IHK, with resulting probability values of less than 0.05. For normal data, the probability value should be greater than 0.05. The only variable that meets this criterion is KURS, with a probability value of 0.06. To address this abnormal data, the data will be transformed into a square root form or undergo a square root transformation (sqrt) as recommended (Johnson et al., 2007).

Abnormal data on the INF and CPI variables were transformed into square root form and then tested again using the Shapiro-Wilk test to test the normality of the data. The following are the results of the Shapiro-Wilk test.

Shapiro-Wilk W test for normal data

Variable	Obs	W	V	z	Prob>z
sqINF	39	0.95020	1.931	1.382	0.08343
sqCPI	48	0.86921	5.957	3.797	0.07037

Figure 3. Shapiro-Wilk W test for Normal Data
Source: Data Processed (2024)

The results of the normality test show that the data for the INF and CPI variables are normal with a probability value > 0.05. Next, it continued with testing the model specifications using the data multicollinearity test to calculate the Variance Inflation Factor (VIF) to see the presence of multicollinearity between predictors in the model built.

. estat vif

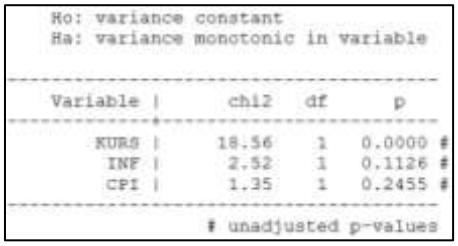
Variable	VIF	1/VIF
INF	1.00	0.997499
KURS	1.00	0.997499
Mean VIF	1.00	

Figure 4. Variance Inflation Factor (VIF)
Source: Data Processed (2024)

The VIF value obtained is 1.00 and the tolerance value is 0.99. Based on the output results, it can be concluded that all predictors produce a VIF value < 5 and a tolerance value

> 0.20. These results are in the recommended values, indicating no multicollinearity problem in the model.

The next test is the homoscedasticity test of the regression model using the Szroeter test. Homoscedasticity testing is carried out to ensure that each level of the predictor variable and the variance of the residual must be constant and not exceed the distance limit of the dependent variable estimate. The following are the results of the homoscedasticity test using the Szroeter test.



```
Ho: variance constant
Ha: variance monotonic in variable

-------------------------------------
Variable |      chi2   df      p
---------+---------------------------
    KURS |     18.56    1   0.0000 #
     INF |      2.52    1   0.1126 #
     CPI |      1.35    1   0.2455 #
-------------------------------------
                  # unadjusted p-values
```

Figure 5. Szroeter's test for homoskedasticity
Source: Data Processed (2024)

The test results indicate that the model exhibits consistent variance, assuming that all X values in the population are constant, or expressed as homoscedasticity. There is no heteroscedasticity problem because the P value for all variables is > 0.05.

5. Conclusion

Inflation has an impact on the Consumer Price Index (CPI) by causing a continuous increase in the prices of goods and services. This steady rise in prices results in the CPI calculation tending to increase as it reflects the rising average price of a group of goods and services consumed by households over a specific period. The increase in the prices of goods and services directly raises the CPI value, providing a direct indication of the level of inflation in an economy.

Changes in exchange rates can have a significant impact on the Consumer Price Index (CPI) in various ways. Specifically, fluctuations in the rupiah's exchange rate against the US dollar can directly influence import prices, subsequently affecting the prices of domestic goods and services, particularly those with a high import content, such as food items. These fluctuations can lead to changes in the CPI. Additionally, the exchange rate between the rupiah and the USD is closely tied to economic growth. A weaker rupiah exchange rate can pose challenges for producers in accessing raw materials and capital goods with a high import content, ultimately leading to increased import costs, thus affecting the CPI. In summary, exchange rates play a crucial role in influencing the CPI through their influence on import prices and economic growth.

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