Analysis of the Influence of Retail and Industrial Fuel Prices on the Consumer Price Index (CPI) in Palopo City

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Abstract

Retail and industrial fuel oil (BBM) prices (pertalite and diesel) on the Consumer Price Index (CPI) in the city of Palopo . By using linear regression analysis , The data used is the 2018 -2022 time series from the CPI for the Commodity group, namely foodstuffs; prepared food, beverages, cigarettes and tobacco; housing, water, electricity, gas and fuel; clothing; health; education, recreation and sports; and transportation, communications and financial services used in this research. The method is used to determine the magnitude of the influence of changes in a variable to test the error *correction* model (ECM) regression model for the level of the consumer price index in the city of Palopo. The research results show that simultaneously the three independent variables, namely retail pertalite, retail diesel and industrial pertalite have a significant effect on the Consumer Price Index (CPI) with a Probability or F-Statistic value of <0.05, namely 0.000.

Keywords: Consumer Price Index (CPI); Fuel, Industry; Commodity Group; Regression Linear; *Error Correction Model (ECM).*

1. Introduction

The One quite important indicator of inflation is the consumer price index (CPI) which is formed from the price index for commodity groups consisting of seven groups, namely: (1) foodstuffs; (2) prepared food, drinks, cigarettes and tobacco; (3) housing, water, electricity, gas and fuel; (4) clothing; (5) health; (6) education, recreation and sports; and (7) transportation, communications and financial services. As an indicator of inflation, developments in the CPI are always monitored because it is often used as a macroeconomic indicator. Regarding inflation [1] says "Inflation is the rate of change in prices, and the price level is the accumulation of previous inflations". The most commonly used indicator in measuring inflation is CPI inflation because CPI inflation reflects changes in the prices of goods and services needed by the wider community. In everyday life, it is CPI inflation that directly influences business and consumer decisions [2].

In 2018 to 2022, the CPI in Indonesia was very volatile. In general, the CPI experienced inflation, the highest occurring in December 2019 , namely 6.05 , which was contributed to inflation by commodity groups: foodstuffs, 10.17 ; prepared food, drinks, cigarettes and tobacco amounting to 5.15 ; housing, water, electricity, gas and fuel of 3.84; clothing amounting to 1 0.39 ; health of 2.87 ; Education was 7.77 and transportation, communication and financial services was 2.16 .

In the process of producing goods and services (commodities) requires costs used to purchase various production factors. There are at least two production factors used to produce goods and services, namely labor and capital goods [3]. On the capital goods side, there are many capital goods used in a production, depending on the type and number of products that will be produced in a production. For example, in the production of canned drinks, the capital goods used include buildings for production, mixing machines, can closing machines and mini tractors transporting final products to warehouses, electricity as an energy source for production machines, diesel oil to run tractors and so on . Energy sources such as electricity, fuel oil, natural gas, coal and others are important production factors in a production process/activity [4]. Without an energy source, production cannot run, various production equipment and machines cannot be operated, buildings do not receive lighting and so on. On the distribution side, energy sources are used as fuel to power various means of transportation (cars, motorbikes, trains, ships, etc.) as a means used in the distribution of goods and services [5].

In essence, energy sources play an important role in the process of production and distribution of goods and services. Likewise, the production and production activities of various commodities in the seven commodity groups that form the consumer price index are inseparable from the use of various energy sources. Food production, for example, the agricultural sector as a producer of food uses diesel fuel (BBM) to drive tractors to plow fields and fields, and turn on water pumps to irrigate agricultural land, and turn on transportation equipment to distribute agricultural products. Likewise, the production of other group commodities (finished food, drinks, cigarettes; housing, water, electricity, gas and fuel; clothing; education, recreation and sports; health; and transportation, communication and financial services) cannot be separated from the use of resources. energy. Fuel is one of the energy sources that is currently the most widely used for various production and distribution activities. Based on data, national fuel consumption is still the largest compared to other energy sources.

In the period 20 18 - 20 22 , fuel is the energy source that is most widely used every year. During this period, total fuel consumption reached 106.98 million kiloliters. This figure has increased from previous years. In Palopo, the selling price of fuel for household needs is set at the retail price, while to meet large industrial consumption it is set at the industrial price. Fuel selling prices during the period 20 18 – 20 22 retail and industrial fuel oil (BBM) prices experienced several changes. Retail fuel prices (premium and diesel) in the period 20 18 – 20 22 experienced changes 2 times for pertalite and 3 times for diesel [6]–[10] (Central Bereau Statistics Palopo, 2018-2022).

From the explanation above, this research aims to analyze the influence of retail and industrial fuel prices (pertalite and diesel) on the consumer price index (CPI) in the city of Palopo .

2. Methodology

This research is quantitative research, where the data source used is secondary data obtained from the Palopo Central Statistics Agency . The dependent variable used in this research is the Consumer Price Index (CPI) which is expressed in percent units calculated from a predetermined commodity price index . The independent variables used are retail pertalite (X1), retail diesel (X2), and industrial pertalite (X3). Retail Pertalite prices (X1) and retail diesel (X2) are taken from Palopo City fuel retail price data for 2018-2022 . Meanwhile, the price of industrial Pertalite (X 3) is taken from Palopo City fuel retail price data for 2018-2022 . This type of research data is secondary data, namely data obtained from secondary sources or related agencies whose data is ready to be used because the data is widely distributed in various sources and can be accessed [11].

This research uses time series data. Time series data in this research used data for the period 2018 -2022 . The data analysis method used in this research is linear regression analysis which is used to determine the magnitude of the influence of changes in a variable to test the error model regression or what is called an error correction model (ECM) at the level of the consumer price index in the city of Palopo . The model used is as shown in figure 1 of the framework below.

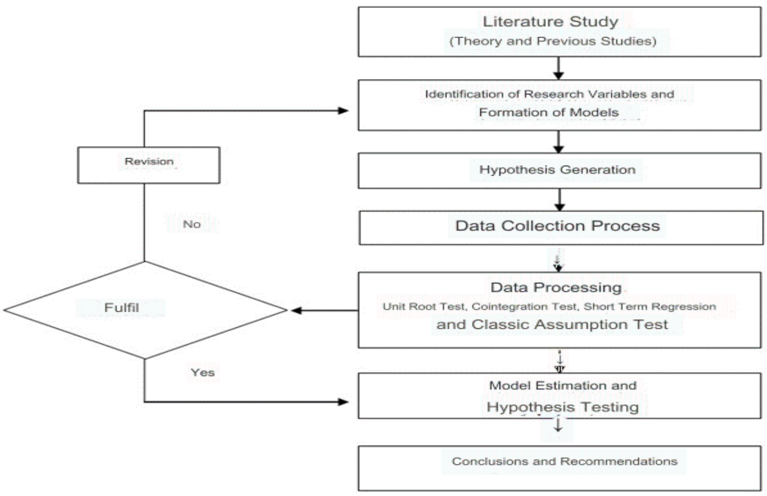

Figure 1. Framework of Thought

Eviews software application program . To simplify the calculations, the economic model used is the econometric method, where the dependent variable is CPI (Y), and the independent variables are retail pertalite (X1), retail diesel (X2), and industrial pertalite (X3). can be written as follows:

$$\mathbf{Y = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + e} \text{..(1)}$$

Y : Consumer Price Index (CPI)
X1 : Pertalite Retail
X2 : Retail Solar
X3 : Pertalite Industry
α : Constant

β1 β2 β3 : Parameter or regression coefficient of the independent variable

e : error or disturbing factor

3. Result and Discussion (Font 12, Times New Roman, 1.15 Spacing)

3.1. Analysis Results

In working with data using linear regression there are several stages, namely, stationarity test for each variable, long-term regression, ECT residual test and ECT unit root test, short-term regression (ECM), classical assumption test, and finally model estimation and hypothesis testing.

3.1.1 Stationary Test

Based on the stationary test for all variables, if the Test critical values are smaller than the t-Statistic value, it means the data is not stationary, conversely, if the Test critical values are greater than the t-Statistic value, it means the data is stationary .

Table 1. Stationary Test Data at level level

Variable	***Test critical values: level***			***t-Statistik***	**Prob.***
	1%	5%	10%		
Y	-3.546099	-2.911730	-2.593551	-1.365560	0.5930
X1	-3.546099	-2.911730	-2.593551	-0.475509	0.8882
X2	-3.546099	-2.911730	-2.593551	-0.832169	0.8024
X3	3.546099	-2.911730	-2.593551	-0.357883	0.9091

In table 1 it can be seen that the stationarity test at the level, all data is not stationary at a confidence level of 1%, 5% or 10%, so it is necessary to carry out further data stationary tests, namely the first difference , the results can be seen in table 2.

Table 2. Stationary Test Data at *First Differents level*

Variable	***Test critical values: level***			***t-Statistics***	**Prob.***
	1%	5%	10%		
Y	-3.548208	-2.912631	-2.594027	-7.552227	0.0000
X1	-3.548208	-2.912631	-2.594027	-7.615773	0.0000
X2	-3.548208	-2.912631	-2.594027	-7.516714	0.0000
X3	-3.548208	-2.912631	-2.594027	-7.894336	0.0000

In table 2 it can be seen that in the data stationary test in the first differentiation, all data is stationary at a confidence level of 1%, 5% or 10%, meaning that the data is stationary in the first differentiation . Because the data is stationary at the same degree (first degree).

3.1.2 Cointegrity Test

After carrying out the stationary test, the next step is to carry out a cointegrity test. This test was carried out to determine the long-term relationship between variables, then a new variable called ECT was created and ECT testing was carried out which is a residual variable. Which will then be cointegrated.

1) **Long Run Regression**

For the results of long-term regression data processing, the following results were obtained.

Dependent Variable: Y

Method: Least Squares
Date: 02/16/24 Time: 21:48
Sample: 2018M01 2022M12
Included observations: 60

Variables	Coefficient	Std. Error	t-Statistics	Prob.
X1	0.009504	0.001709	5.562736	0.0000
X2	0.001360	0.001336	1.017560	0.3133
X3	-0.040264	0.002470	-16.29841	0.0000
C	636.2566	36.46353	17.44912	0.0000

R-squared	0.843439	Mean dependent var	115.1142
Adjusted R-squared	0.835052	S.D. dependent var	12.13335
S.E. of regression	4.927812	Akaike info criterion	6.092008
Sum squared resid	1359.867	Schwarz criterion	6.231631
Log likelihood	-178.7602	Hannan-Quinn Criter.	6.146622
F-statistic	100.5629	Durbin-Watson stat	0.290295
Prob(F-statistic)	0.000000		

Figure 3. Long Term Regression Data

2) ECT *(Error Correction Term)*

After processing the long-term regression data, we will get new variables which will then produce root test data at the following levels.

Null Hypothesis: ECT has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=10)

			t-Statistics	Prob.*

Augmented Dickey-Fuller test statistics		-2.084340	0.2516
Test critical values:	1% level	-3.546099	
	5% level	-2.911730	
	10% levels	-2.593551	

*MacKinnon (1996) one-sided p-values.

In Figure 4 above, it can be seen that the ADF is still greater than the critical values at all levels, both 1%, 5% and 10%. So the results or residual values are not stationary at the level. So the test was carried out again at the first differences level with the results as follows.

Null Hypothesis: D(ECT) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=10)

		t-Statistics	Prob.*
Augmented Dickey-Fuller test statistics		-7.534929	0.0000
Test critical values:	1% levels	-3.548208	
	5% level	-2.912631	
	10% levels	-2.594027	

*MacKinnon (1996) one-sided p-values.

3) ***First different* level ECT data**

In the picture, it can be seen that in the data stationarity test on the first differences, all the data is stationary at a confidence level of 1%, 5% or 10%, meaning that the data is stationary on the second difference. Because the data is stationary at the same degree (second degree).

4) Short Term Regression (ECM Model)

After obtaining stationary data at the first different level in ECT, short-term regression data or an ECM model is then created. The result is like the following image.

Dependent Variable: D(Y)
Method: Least Squares
Date: 02/16/24 Time: 22:31
Sample (adjusted): 2018M02 2022M12
Included observations: 59 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.

D(X1)	0.008157	0.001798	4.537270	0.0000
D(X2)	0.002315	0.001553	1.490680	0.1419
D(X3)	-0.046288	0.004980	-9.294661	0.0000
ECT(-1)	-0.117283	0.064872	-1.807904	0.0762
C	0.230418	0.317234	0.726335	0.4708

R-squared	0.661303	Mean dependent var	-0.262542
Adjusted R-squared	0.636215	S.D. dependent var	3.899571
S.E. of regression	2.352011	Akaike info criterion	4.629356
Sum squared resid	298.7255	Schwarz criterion	4.805419
Log likelihood	-131.5660	Hannan-Quinn criter.	4.698084
F-statistic	26.35869	Durbin-Watson stat	1.905667
Prob(F-statistic)	0.000000		

Figure 5. Short Term Regression Data (ECM Model)

From the two regression results, both long term and short term, above, it can be seen that the probability value that is not significantly related is the variable X2 because the probability value is > 0.05. However, logically the R-squared decreases more measurably, where in the long term the value is $R^2 = 0.843439$, while in the short term the value of $R^2 = 0.661303$.

3.1.3 Classic assumption test

After carrying out the cointegrity test, we will then carry out a classical assumption test to find out whether there has been a violation of the classical assumption test or not. For the classical assumptions of linear regression in this research, two approaches were carried out including the multicollinearity test and the autocorrelation test.

1) **Multicollinearity Test**

Variance Inflation Factors

Date: 02/16/24 Time: 22:36

Sample: 2018M01 2022M12

Included observations: 59

Variables	Coefficient Variance	Uncentered VIF	Centered VIF
D(X1)	3.23E-06	3.651129	3.589246
D(X2)	2.41E-06	3.813717	3.797095
D(X3)	2.48E-05	1.524323	1.448335
ECT(-1)	0.004208	1.030047	1.029971
C	0.100637	1.073329	NA

From the data in the figure, it can be seen that the VIF value <10 means that there is no multicollinearity violation.

2) Autocorrelation Test

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	0.147333	Prob. F(2.52)	0.8634
Obs*R-squared	0.332449	Prob. Chi-Square(2)	0.8469

Test Equation:
Dependent Variable: RESID
Method: Least Squares
Date: 02/16/24 Time: 22:39
Sample: 2018M02 2022M12
Included observations: 59
Presample missing value lagged residuals set to zero.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(X1)	2.28E-05	0.001828	0.012483	0.9901
D(X2)	-6.78E-06	0.001578	-0.004295	0.9966
D(X3)	-4.09E-06	0.005061	-0.000808	0.9994
ECT(-1)	-0.028271	0.084066	-0.336295	0.7380
C	-0.001571	0.322382	-0.004872	0.9961
RESID(-1)	0.072179	0.159732	0.451872	0.6532
RESID(-2)	0.059868	0.156293	0.383050	0.7032

R-squared	0.005635	Mean dependent var	-3.76E-18
Adjusted R-squared	-0.109100	S.D. dependent var	2.269458
S.E. of regression	2.390053	Akaike info criterion	4.691502
Sum squared resid	297.0423	Schwarz criterion	4.937990
Log likelihood	-131.3993	Hannan-Quinn criter.	4.787721
F-statistic	0.049111	Durbin-Watson stat	2.007529
Prob(F-statistic)	0.999473		

From the data above it can be seen that the probability value for each variable is more than 0.05 so there is no autocorrelation. Or we can look at the prob value (F-statistic) > 0.05 so that there is no autocorrelation.

3.2. Discussion

Data obtained from various tests carried out then the regression equation obtained is

Y= 0 , 230418 + 0.008157 x_1 + 0.002315 x_2 + -0.04628 x_3 + e . Based on the stationarity test at level, all data is not stationary at a confidence level of 1%, 5% or 10% where all variables , including variables Y, X1, namely in the first difference (*First Difference*) . It can be seen that in the data stationary test in the first differentiation, all data is stationary at a confidence level of 1%, 5% or 10% because the probability value is <0.05 , meaning the data is stationary in the first differentiation . Because the data is stationary at the same degree (first degree).

After carrying out the stationary test, the next step is to carry out a cointegrity test. This test was carried out to determine the long-term relationship between variables, then a new variable called ECT was created and ECT testing was carried out which is a residual variable. Which will then be cointegrated.

From the long-term regression, it can be seen that the probability value that is not significantly related is the variable X2 because the probability value is > 0.05. However, logically for the R-squared, R^2 = 0.843439 . After carrying out a long-term regression test, the ECT test is carried out at level level. For the ECT test, the ADF value levels are still greater than the critical values at all levels, both 1%, 5% and 10%. So the results or residual values are not stationary at the level. Then the test was carried out again at the first differences level. in the data stationarity test on the first differences, all data is stationary at a confidence level of 1%, 5% or 10%, meaning that the data is stationary on the second difference. Because the data is stationary at the same degree (second degree).

After obtaining stationary data at the first different level in ECT, short-term regression data or an ECM model is then created. From the two regression results, both long term and short term, above, it can be seen that the probability value that is not significantly related is the variable X2 because the probability value is > 0.05. However, logically the R-squared decreases more measurably, where in the long term the value is R^2 = 0.843439 , while in the short term the value of R^2 = 0.661303 .

After carrying out the cointegrity test, we will then carry out a classical assumption test to find out whether there has been a violation of the classical assumption test or not. For the classical assumptions of linear regression in this research, two approaches were carried out including the multicollinearity test and the autocorrelation test. In the multicollinearity test of the data in the image, it can be seen that the VIF value <10 means that there is no multicollinearity violation. Meanwhile, in the data autocorrelation test, it was found that the probability value for each variable was more than 0.05, so there was no autocorrelation. Or we can look at the prob value (F-statistic) > 0.05 so that there is no autocorrelation.

this discussion section, authors need to create a "discussion" that fits with the presented research findings but does not repeat them. Authors need to compare the study's results with previous research findings (some of which are mentioned in the introduction). Perhaps the research results clarify, enhance, or even contradict previous research findings. Whatever the results, authors must engage in a "dialogue" with the findings of other researchers based on existing major theories. If the findings turn out to be different from those of others, this may be extraordinary, and in turn, authors must address it and convince readers that these findings are correct or better than before. Although this truth sometimes does not last long, as it will be refined with new truths reported by other researchers. That's how science works.

4. Conclusions

1. There is no violation of the classical assumption where the R-Square value is 66.13% where the variables X1, X2 and X3 have an effect on variable Y by 66.13%.
2. The results of the research show that the Retail Pertalite (X1) and industrial Pertalite (X3) variables have a significant effect on variable Y with a Probability or F-Statistic value of <0.05, namely 0.000, while the Retail Solar Variable (X2) has no significant effect on variable (Y) with a Probability or F-Statistics value > 0.05, namely 0.1419
3. The Regression Equation obtained is equal to

$$Y = 0\,,230418 + 0.008157\,_{X1} + 0.002315\,_{X2} + -0.04628\,_{X3} + e$$

5. Acknowledgement

The author would like to express his thanks to the lecturers of the development economics study program, especially to Cici Mahmu S.E., M.Si and Nurhuda S.E.I, M.Si, Faculty of Economics and Business, Andi Djemma Palopo University for facilitating the author to conduct research and facilitate him in attending this internasional seminar. Hopefully what is obtained from the result of this research and from this activity can be useful for Andi Djemma University, especialy the development economics study program.

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