ISSN No:-2456-2165

Empirical Analysis of the Interdependence of the Inflation Rate and the Unemployment Rate in the Economy of Montenegro

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Abstract:-Through history, the relationship between inflation and unemployment, has been represented with Philips curve model, which is highly prominent in macroeconomic theory and practice till this day. Proof of the relevance of this theoretical concept is the fact that there is no textbook in the field of macroeconomics, nor monetary economics, that does not include the Phillips curve in its content. Given that the appearance and disappearance of the inverse relationship between the inflation rate and the unemployment rate is impossible to predict, constant empirical research is conducted to test the validity of the Phillips curve in modern economies. The purpose of this paper is to formulate a suitable model of the Phillips curve for Montenegro and evaluate it based on empirical data taken from the website of the Central Bank of Montenegro.

Keywords:- *inflation, unemployment, Philips curve, dummy variables.*

I. INTRODUCTION

This paper will examine the quantitative interdependence between the inflation rate and the unemployment rate with the help of regression analysis, using the method of least squares (OLS), and the Granger causality test. The database, taken from the website of the Central Bank of Montenegro (hereinafter: CBCG), consists of: data on monthly inflation rates and unemployment rates in the period from January 2008 to December 2018. CBCG receives data on the inflation rate from the Administration for Statistics (Monstat), while data on the number of unemployed and employed is obtained from the Employment Agency of Montenegro and Monstat.

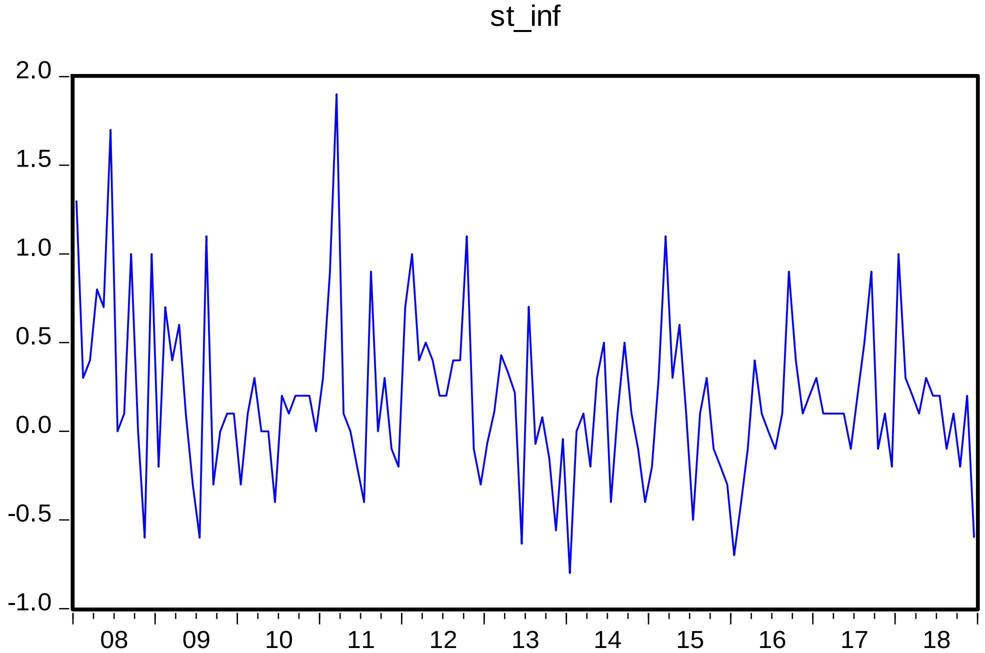
II. GRAPHICAL REPRESENTATION AND DESCRIPTIVE STATISTICS OF TIME SERIES

In the continuation of the work, the inverse relationship between the inflation rate, which plays the role of a dependent variable, and the unemployment rate as an independent variable is observed. For this reason, the first step is to test the normality and stationarity of the time series, which are used to form the model.

The inflation rate is calculated using the Consumer Price Index (CPI).[1] The Consumer Price Index (CPI) is an indicator of the average change in prices of all products and services used by households for consumption purposes. In addition to serving as a measure of inflation, it can be used: to adjust labor prices in private contracts; for harmonizing wages, pensions, social benefits, budgets, etc.; as a deflator in national accounts.[2]

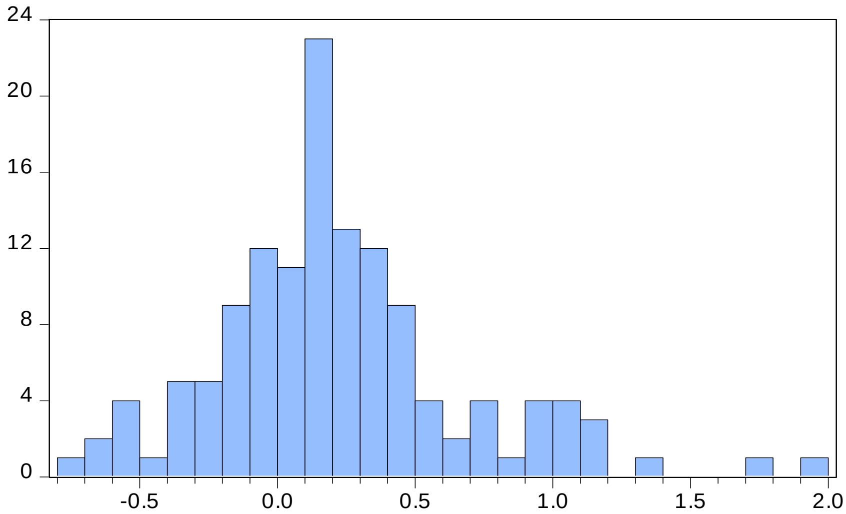
Graph 1 shows the trend of the inflation rate in the period from January 2008 to December 2018. It is noticeable that there are no significant fluctuations in the inflation rate and that its movement in the observed period can be considered stable, without a tendency to show increasing ordownward trend. The objective of the European Central Bank (ECB) is that the rate at which prices change over time - the inflation rate - remains low, stable and predictable; 2% in the medium term.[3] The CBCG successfully maintained the inflation rate at the desired level. The blue line, which shows the movement of the inflation rate for the observed period, did not exceed 2%. At the same time, there was no deflation, as can be seen on Graph 2 that the values did not even reach -1%.

[1]Since January 2008, MONSTAT has changed the method of calculating the inflation rate using the Consumer Price Index, while since January 2009 it has completely stopped publishing the Cost of Living Index and the Retail Price Index, which were previously used to calculate the inflation rate.
[2]Available at the link: https://www.monstat.org/cg/page.php?id=26&pageid=26
[3]Available at the link:https://www.ecb.europa.eu/ecb/educational/hicp/html/index.en.html



Graph 1: Movement of the inflation rate in the period from January 2008 to December 2018

In addition to the graphical representation, it is important to display the summary indicators of the time series. The goal of applying summary indicators is to look at the empirical distribution of a given time series. In order to better understand the characteristics of the time series of inflation rates, it should be presented with descriptive statistics and a histogram. With the series representing the inflation rate (st_inf), the following results are obtained (Graph 2):



Series: ST_INF	
Sample 2008M01 2018M12	
Observations 132	
Mean	0.178351
Median	0.100000
Maximum	1.900000
Minimum	-0.800000
Std. Dev.	0.457200
Skewness	0.862753
Kurtosis	4.578666
Jarque-Bera	30.08257
Probability	0.000000

Graph 2: Inflation rate histogram with accompanying descriptive statistics

The sample has 132 observations. The expected value is approximately 0.178%. As the median divides the series into two parts, 50% of the observations are above the 0.1% value, while the remaining 50% of the observations are below the 0.1% value. The maximum value of the inflation rate for the observed period is 1.9%, while the minimum value is -0.8%.

The standard deviation is 0.4572, which indicates that the deviations of the data from the average values are neither large nor significant.

Skewness (the third moment of the distribution, α_3) is a coefficient of asymmetry that shows whether the distribution is asymmetric to the left or to the right, and is 0.862753. Therefore, the value of the asymmetry coefficient is positive, which means that the series of inflation rates is asymmetric to the right. Kurtosis is the parameter that provides information about the spread of the distribution, i.e. it tells about the extent to which the values are spread around the arithmetic mean. This is the fourth moment of the distribution (α_4) and has a value of 3 if it is a normal distribution. The value of the flattening coefficient is 4.578666, which means that the distribution is peaked, but also that its deviation from the normal distribution is not large.

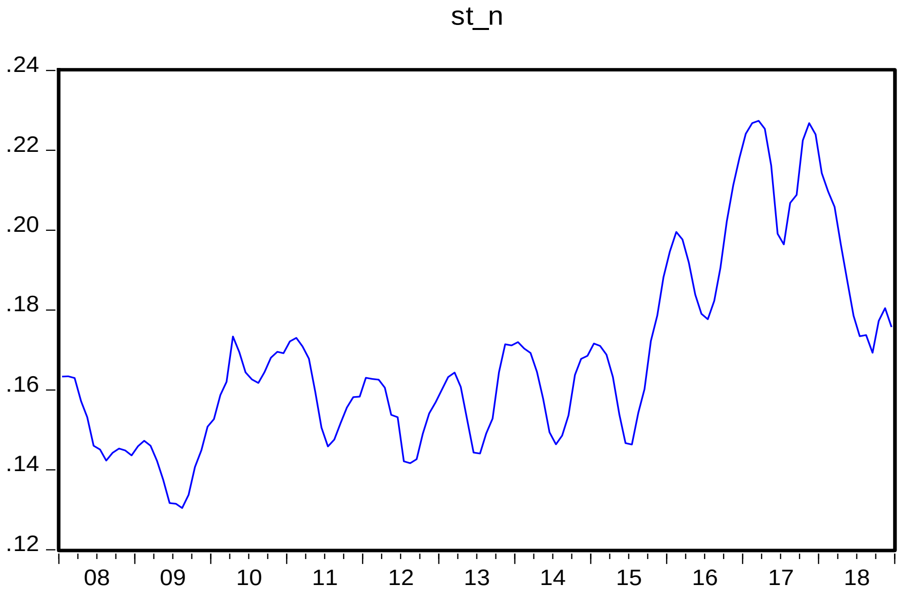
ISSN No:-2456-2165

The final decision on the normality of the distribution is made based on the associated probability for the Jarque-Bera (JB) statistic. The initial hypothesis of this test claims that the observed series has a normal distribution (α_3=0 and α_4=3), while the alternative hypothesis claims that the series does not have a normal distribution ($\alpha_3 \neq 0$ and $\alpha_4 \neq 3$). Based on the probability of the JB statistic, which is 0%, it is concluded that the percentage of error made by rejecting the starting hypothesis is 0%. Thus, the inflation rate series does not have a normal distribution.

Since there are no data on the unemployment rate, it was necessary to calculate it based on the following formula:

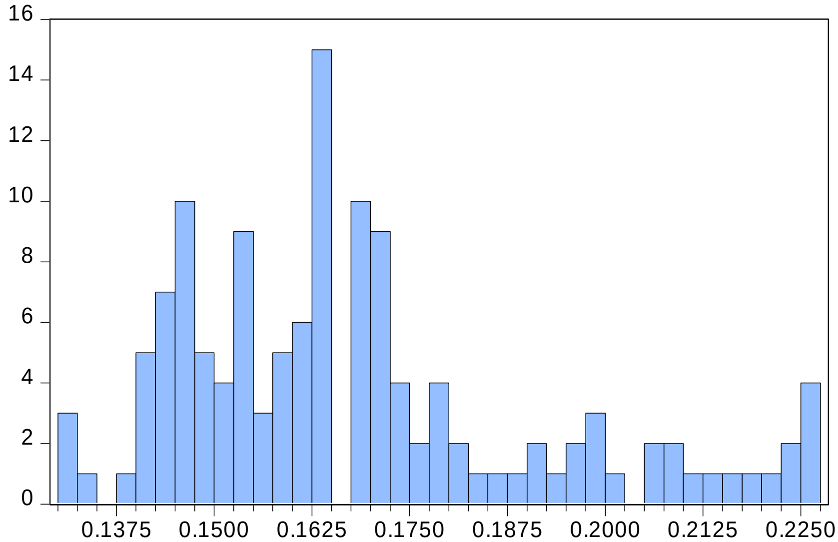
st_n=(br_n/ukupan_br_rss)*100
st_n - unemployment rate
br_n - number of unemployed
ukupan_br_rss - total number of working-age population (data on the total number of working-age population is obtained when the number of unemployed and the number of employed residents are added).

The same procedure is carried out for the analysis of the series of unemployment rates. Graph 3 shows no major changes in the trend of the unemployment rate, even a slight increase in unemployment in the period of 2016 and 2017, it decreases again in 2018. It is also noticeable that during the period of the world economic crisis (2008-2009), the unemployment rate decreased until it reached its lowest value in the first quarter of 2010, which would mean that after the crisis it started to rise slightly.



Graph 3: Movement of the unemployment rate in the period from January 2008 to December 2018

With the help of descriptive statistics, in the same way as the time series of inflation rates, the series of unemployment rates will be analyzed.



Series: ST_N	
Sample 2008M01 2018M12	
Observations 132	
Mean	0.168217
Median	0.163276
Maximum	0.227365
Minimum	0.130399
Std. Dev.	0.023526
Skewness	0.933170
Kurtosis	3.196656
Jarque-Bera	19.37042
Probability	0.000062

Graph 4: Histogram of the unemployment rate with accompanying descriptive statistics

ISSN No:-2456-2165

Based on the histogram (Graph 4), it can be concluded that the unemployment rate does not have a normal distribution. The maximum unemployment rate was 22.73%, while the minimum was 13.039%. The average unemployment rate was 16,821%. The median is 16.327%, that is, 50% of the series is below and 50% is above the value of 16.327%. The value of the standard deviation is 0.023526 and proves that the average deviation of the data from the mean value is not significant.

The third moment of the distribution is positive and equals 0.93317, so the series is asymmetric to the right. The fourth moment of the distribution is 3.196656, that is, the distribution is slightly more pointed than normal.

The Jarque-Bera (JB) test will be used to check the normality of the distribution. With a probability of 0%, we come to the conclusion that the series of unemployment rates does not have a normal distribution.

III. EXAMINING THE STATIONARITY OF TIME SERIES

Stationarity is a very important feature of time series, which implies that the mean value and variance are constant over time, that is, it means a series that moves along a recognizable path.

In the continuation of the paper, the stationarity of the time series of inflation rates, which is denoted by st_inf, is examined. The stationarity of the inflation rate time series will be tested using the Unit Root Test, which is based on the first-order AR(1) autoregression model. The model is evaluated, which explains the value at time t by the value of the same series from the previous period, i.e. t-1 period.

$$st\_inf_t = \rho * st\_inf_{t-1} + \varepsilon_t$$

If the value of ρ is approximately equal to 1 ($\rho \approx 1$), then the formal test is expected to confirm the existence of a unit root, otherwise when $\rho \leq 1$, the formal test will show that the series is stationary. Table 1 presents the model.

Dependent Variable: ST_INF
Method: Least Squares
Sample (adjusted): 2008M02 2018M12
Included observations: 131 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ST_INF(-1)	**0.247852**	0.083019	2.985502	**0.0034**

R-squared	-0.071166	Mean dependent var	0.169789
Adjusted R-squared	-0.071166	S.D. dependent var	0.448206
S.E. of regression	0.463880	Akaike info criterion	1.309223
Sum squared resid	27.97400	Schwarz criterion	1.331171
Log likelihood	-84.75408	Hannan-Quinn criter.	1.318141
Durbin-Watson stat	2.048734		

Table 1: Testing the stationarity of the inflation rate series

In Table 1, the coefficient with the inflation rate variable from the previous period is 0.247852, which is closer to zero, so it can be expected that the inflation rate series is stationary. In order to choose the appropriate unit root test, to determine stationarity, the existence of autocorrelation and heteroscedasticity problems in the AR(1) inflation rate model is examined. The following cases may occur:

- There is no autocorrelation and no heteroskedasticity, the stationarity of the series can be tested with the Dickey Fuller test;
- There is autocorrelation, no heteroskedasticity, then stationarity is tested with the help of the Augmented Dickey Fuller test (ADF);
- There is heteroskedasticity, but no autocorrelation, the Philips-Pheron test is used (also ADF can be used);
- There is autocorrelation and heteroskedasticity, stationarity is tested by Augmented Dickey Fuller test.

In the first step, the Breusch-Godfrey Serial Correlation LM autocorrelation test is performed test, and the results are in Table 2.

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	0.661504	Prob. F(2,128)	0.5178
Obs*R-squared	**0.000000**	**Prob. Chi-Square(2)**	**1.0000**

Table 2: Breusch-Godfrey Serial Correlation LM Test for Inflation Rate

In the test from Table 2, the null hypothesis is (H_0): there is no higher-order autocorrelation, while the alternative is (H_1): there is a higher-order autocorrelation. The results of the Breusch-Godfrey Serial Correlation LM

Test, with a probability of 100% and a risk of error of 10%, indicate that there is no autocorrelation of higher-order errors in the model.

The second step, after autocorrelation testing, is to test heteroskedasticity with the Breusch-Pagan-Godfrey test (Table 3). The initial hypothesis of this test claims that there is no heteroskedasticity problem in the model. Based on the associated probability of 88.90%, it is concluded that the problem of heteroskedasticity in the model does not exist.

Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	0.019188	Prob. F(1,129)	0.8900
Obs*R-squared	**0.019483**	**Prob. Chi-Square(1)**	**0.8890**
Scaled explained SS	0.035869	Prob. Chi-Square(1)	0.8498

Table 3: Breusch-Pagan Godfrey heteroskedasticity test for inflation rate

Given that there is neither an autocorrelation problem nor a heteroskedasticity problem in the model, stationarity testing will be performed with the Dickey Fuller test (Table 4).

Null Hypothesis: ST_INF has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic - based on SIC, maxlag=1)

		t-Statistic
Elliott-Rothenberg-Stock DF-GLS test statistic		**-2.330345**
Test critical values:	1% level	-2.582872
	5% level	-1.943304
	10% level	**-1.615087**

Table 4: Dickey Fuller stationarity test for inflation rate series

Based on the critical values (-1.615087) and on the basis of the t-test value (-2.330345), with an error risk of 5% and 10%, the conclusion is that the series of inflation rates is stationary.

The same procedure will be carried out for the unemployment rate series. The autoregression model of the unemployment rate is estimated:

$st\_n_t = \rho * st\_n_{t-1} + \varepsilon_t.$

The rating of this model is given in Table 5.

Dependent Variable: ST_N
Method: Least Squares
Sample (adjusted): 2008M02 2018M12
Included observations: 131 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ST_N(-1)	**1.000008**	0.002904	344.3717	**0.0000**

R-squared	0.942880	Mean dependent var	0.168254
Adjusted R-squared	0.942880	S.D. dependent var	0.023613
S.E. of regression	0.005643	Akaike info criterion	-7.509060
Sum squared resid	0.004140	Schwarz criterion	-7.487112
Log likelihood	492.8434	Hannan-Quinn criter.	-7.500142
Durbin-Watson stat	0.779151		

Table 5: Testing the stationarity of the unemployment rate series

The value of the coefficient ρ is 1, which suggests that the series is non-stationary. However, this needs to be verified with a formal test. In the second step, autocorrelation testing is performed.

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	38.83936	Prob. F(2,128)	0.0000
Obs*R-squared	49.45237	Prob. Chi-Square(2)	**0.0000**

Table 6: Breusch-Godfrey Serial Correlation LM Test for Unemployment Rate

The results of the Breusch-Godfrey Serial Correlation LM test indicate that there is no autocorrelation problem in the model (Table 6). After autocorrelation testing, the presence of heteroscedasticity problems is checked. The results obtained by applying Glejser's test are shown in Table 7.

Heteroskedasticity Test: Glejser

F-statistic	9.485725	Prob. F(1,129)	0.0025
Obs*R-squared	**8.972982**	**Prob. Chi-Square(1)**	**0.0027**
Scaled explained SS	8.970263	Prob. Chi-Square(1)	0.0027

Table 7: Glejser heteroscedasticity test for the unemployment rate

Based on the p value of 0.27%, the conclusion is that the problem of heteroscedasticity exists. When the problem of autocorrelation is not present and the problem of heteroscedasticity appears, then the ADF test can be applied to test stationarity.

Null Hypothesis: ST_N has a unit root
Exogenous: Constant
Lag Length: 12 (Automatic - based on SIC, maxlag=12)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		**-3.529712**	**0.0088**
Test critical values:	1% level	-3.486064	
	5% level	-2.885863	
	10% level	**-2.579818**	

Table 8: Augmented Dickey Fuller stationarity test for the unemployment rate series

Based on the value of the t-statistic (-3.529712) and the critical values (-2.579818) of the ADF test, with an error risk of 10%, the series of unemployment rates is stationary, that is, its movement is predictable.

The examination of the series so far leads to the conclusion that both series are stationary, so there is no need to differentiate them, nor to examine the cointegration, and in the next step we approach to the specification of the model.

IV. SPECIFICATION OF THE LINEAR REGRESSION MODEL IN MONTENEGRO

The inflation rate will be defined as the dependent variable while the unemployment rate is the independent one. In order to determine the interdependence between inflation rate and unemployment rate, a regression analysis will be used. More precisely, classic linear regression model will be formulated to check whether there is an inverse relationship between these two important macroeconomic variables in the economy of Montenegro.

The model specification is as follows:
$st\_inf = \beta_1 * st\_n + \varepsilon_t$

Dependent variable: st_inf – inflation rate Independent variable: st_n – unemployment rate
εt – stochastic term. The results of the model evaluation are shown in Table 9.

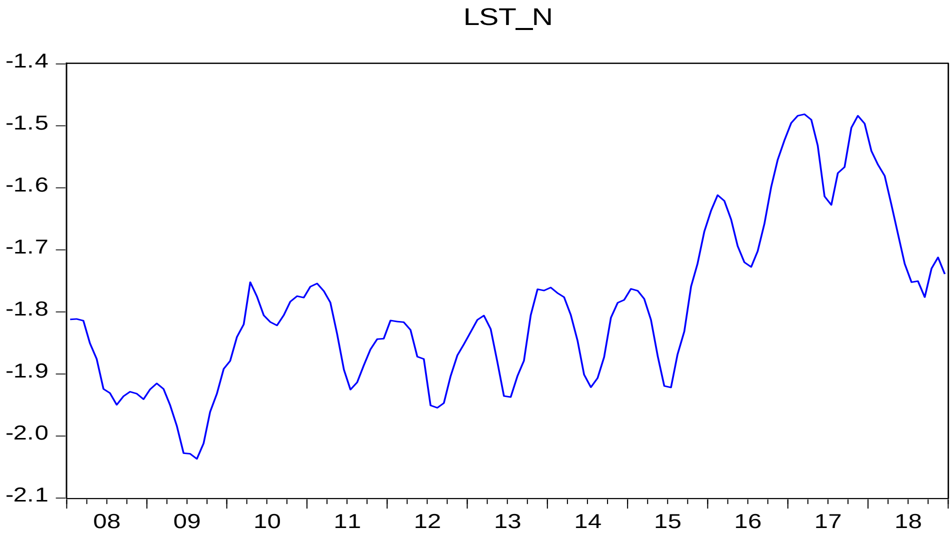
Dependent Variable: ST_INF
Method: Least Squares
Sample: 2008M01 2018M12
Included observations: 132

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ST_N	1.024527	0.235164	4.356650	0.0000

R-squared	0.007378	Mean dependent var	0.178351
Adjusted R-squared	0.007378	S.D. dependent var	0.457200
S.E. of regression	0.458884	Akaike info criterion	1.287507
Sum squared resid	27.58521	Schwarz criterion	1.309346
Log likelihood	-83.97543	Hannan-Quinn criter.	1.296381
Durbin-Watson stat	1.655638		

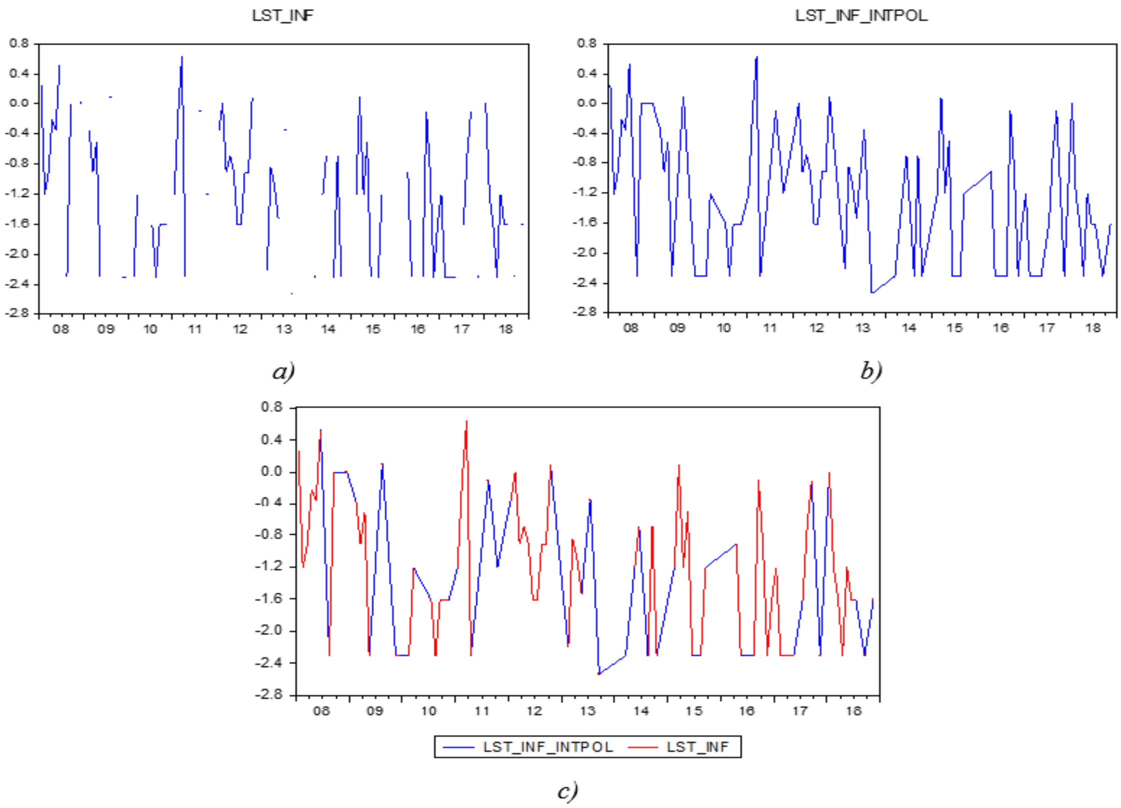
Table 9: Evaluation of the model st_inf = β1*st_n + εt

In Table 9, based on the p value (0%), the conclusion is reached that there is a statistically significant effect of the unemployment rate on the inflation rate. If the unemployment rate increases by 1%, the inflation rate will increase, on average, by 1.024527%. The value of the coefficient of determination (R-squared) indicates that only 0.7378% of the variability of the inflation rate is explained by the variability of the unemployment rate, which means that the model is not good for further analysis (even the adjusted correlation coefficient (adjusted R-squared) has the same value) . Given that the original series are stationary, the same results are obtained when using their differences, which are also stationary, so the original series is logarithmized. Graph 5 shows the logarithmic series of unemployment rates and it can be concluded that there is a great similarity in the graph with the original series, which has already been analyzed (see Graph 3).



Graph 5: Logarithmic series of unemployment rate data

However, by logarithmizing the values from the series of inflation rates, a different result is obtained. The explanation is based on the fact that the unemployment rate depends on the number of unemployed. The number of unemployed cannot be negative, but equal to zero (which is not possible in real conditions), or it is some positive value, which varies more or less depending on the current state of the economy. For this reason, the value of the logarithmic data series for the unemployment rate is obtained without a break in the graph, because the logarithm of a positive number can always be calculated. Since the values of the series of inflation rates are not only positive, there are months when the inflation rate was equal to zero or negative (the logarithm of a negative number or zero cannot be determined), this will be shown on the graph in the form of a broken line (Graph 6. (a)) . Such interruptions indicate that these data have been lost, and that now the number of data is reduced, so it is possible that the analysis results in a model that is not credible due to the lack of data.



Graphic 6 shows the solution to the problem. When the logarithmic series (a) is obtained, its interpolation (b) is performed and the data for all 132 observations are obtained again, and on the same graph under c) you can clearly see the blue line that indicates the logarithmic series and the red line that represents the interpolation of the logarithmic series .

Graph 6: a) Logarithmic data series (inflation rate); b) Interpolated logarithmic data series (inflation rate); c) Joint display of series under a) and b)

Now we approach the formation of a model in which the dependent variable is an interpolated logarithmic series of the inflation rate (labeled as lst_inf_intpol), while the independent variable will be a logarithmic series of the unemployment rate (labeled as lst_n). It is important to note that both series are stationary. The specification of the equation is as follows: $lst\_inf\_inpol = \beta_0 + \beta_1 * lst\_n + \varepsilon_t$. The rating of this model isshown in Table 10.

Dependent Variable: LST_INF_INTPOL
Method: Least Squares
Sample (adjusted): 2008M01 2018M11
Included observations: 131 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-3.789531	0.921250	-4.113466	0.0001
LST_N	-1.391455	0.512662	-2.714179	0.0076

R-squared	0.054022	Mean dependent var	-1.296010
Adjusted R-squared	0.046689	S.D. dependent var	0.802704
S.E. of regression	0.783741	Akaike info criterion	2.365674
Sum squared resid	79.23827	Schwarz criterion	2.409570
Log likelihood	-152.9516	Hannan-Quinn criter.	2.383510
F-statistic	7.366768	Durbin-Watson stat	1.037976
Prob(F-statistic)	0.007553		

Table 10: Evaluation of the model $lst\_inf\_inpol = \beta_0 + \beta_1 * lst\_n + \varepsilon_t$

ISSN No:-2456-2165

From the evaluation of the model, it can be seen that the associated probability with the independent variable is less than 5%, which means that the null hypothesis is rejected and it is concluded that the unemployment rate has a statistically significant influence on the inflation rate. The model is statistically significant, which can be concluded based on the associated probability for the F-statistic, which is less than 5% and amounts to 0.7%. Also, if the unemployment rate increases by one percent, the inflation rate will decrease by 1.39% on average, which means that there is an inverse relationship between the inflation rate and the unemployment rate, as in the original Phillips curve model. However, the value of the coefficient of determination indicates that a very small percentage of the variability of the inflation rate is explained by the unemployment rate (only 5%), so the model is not good for predicting the movement of the inflation rate. The value of the Durbin-Watson statistic is 1.037976, which indicates that it is possible in the model existence of positive autocorrelation.

The movement of the inflation rate and the unemployment rate largely depends on the behavior of economic subjects (macroeconomic decision makers and households). Over time, changes occur not only in the political environment (which is perhaps the most influential for our circumstances), but cause-and-effect changes also occur in the institutional environment (voting of laws and their implementation). The influence of such quantitatively unmeasurable factors on the movement of the dependent variables is modeled by including new explanatory variables called dummy variables.

Considering that for the period we are analyzing (from 2008 to 2018) there were certain changes in the economy, the factors that caused those changes can affect the unemployment rate, and thus the inflation rate, therefore it is necessary to include those variables in the model and evaluate whether they really have an impact on the validity of the model and increase the value of the coefficient of determination. Two dummy variables, V_1 and V_2, will be included in the model.

V_1 represents an dummy variable that captures the impact of the world economic crisis on the inflation rate for the period from January 2008 to July 2009, so for observations on this part of the sample, the dummy variable takes the value 1, while for the rest of the observed period it has the value 0.

V_2 is an dummy variable that represents the period from the introduction of allowances for mothers with three or more children until its abolition, and that is the period from January 2016 to July 2017. According to the amended Law on Amendments to the Law on Social and Child Protection, Article 54a and 54b ("Official Gazette of Montenegro", no. 27/13 and 01/15) the following was valid: "Employed mothers with three or more children, who are 25 or 15 years of service, will receive a lifetime monthly allowance in the amount of 70 percent of the average net salary in Montenegro, earned in the year preceding the one when that right was earned. A woman who gives birth to three or more children, and has been registered with the Employment Service for at least 15 years, will have the right, if she wishes, to a lifetime monthly allowance in the amount of 40 percent of the average net salary in Montenegro. That right cannot be used during the duration of the employment relationship and excludes the possibility of simultaneously using the pension."[4] According to this Law, by accepting the allowance, women who meet the conditions leave their jobs (if they worked), do not receive a pension, nor do they have that option, so the number of unemployed increased. What further justifies the introduction of this dummy variable, in order to assess its impact on the model, is the fact that on Graphs 4 and 6 there is a noticeable increase in the unemployment rate in the period in which V_2 was introduced. For observations in the period from January 2016 to July 2017, the artificial variable has the value 1, while for the rest of the observed period it has the value 0.

The new model will be specified as follows:

$$lst\_inf\_intpol = \beta_0 + \beta_1 * lst\_n + \beta_2 * V_1 + \beta_3 * V_2 + \varepsilon_t.$$

Table 11 shows the results, based on which we come to the conclusion that the variables lst_n and V_2 are not statistically significant, that the coefficient of explanation is only 14.1838%, but that based on the F-statistics, the model is significant.

[4]By the Law on Amendments to the Law on Social and Child Protection ("Official Gazette of Montenegro", No. 042/17 of 30.06.2017), Article 54a and 54b were deleted from the Law on 30 June 2017, but the Law on compensation for former beneficiaries of benefits based on the birth of three or more children ("Official Gazette of Montenegro", number 145/21) enabled them to exercise their rights by submitting a request for compensation from January 8 to March 9, 2022.

Dependent Variable: LST_INF_INTPOL
Method: Least Squares
Sample (adjusted): 2008M01 2018M11
Included observations: 131 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-1.940372	1.154506	-1.680694	0.0953
LST_N	-0.325587	0.637982	-0.510339	0.6107
V1	0.714024	0.205158	3.480354	0.0007
V2	-0.270791	0.233800	-1.158219	0.2489

R-squared	0.141838	Mean dependent var	-1.296010
Adjusted R-squared	0.121567	S.D. dependent var	0.802704
S.E. of regression	0.752332	Akaike info criterion	2.298781
Sum squared resid	71.88247	Schwarz criterion	2.386573
Log likelihood	-146.5702	Hannan-Quinn criter.	2.334455
F-statistic	6.996913	Durbin-Watson stat	1.166682
Prob(F-statistic)	0.000215		

Table 11: Rating of the model lst_inf_intpol = $\beta_0 + \beta_1 * lst\_n + \beta_2 * V_1 + \beta_3 * V_2 + \varepsilon_t$

The Wald test was used to assess the significance of the variables in the model. The results of this test will make it possible to reach a conclusion whether it is statistically justified to introduce or reject variables from the model and to determine whether the model contains only useful variables. The Wald test (Table 12) will check whether the constant (β_0) is significant for the model (in Table 12, the constant β_0 is marked with C(1)).

Wald Test:

Test Statistic	Value	df	Probability
t-statistic	-0.510339	127	0.6107
F-statistic	0.260446	(1, 127)	0.6107
Chi-square	0.260446	1	0.6098

Null Hypothesis: C(1)=0
Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
C(1)	-0.325587	0.637982

Table 12: Wald's test

Based on the results of the Wald test and the corresponding probability for the chi-statistic (0.6098) and F-statistic (0.6107), the null hypothesis is accepted that the constant has a value of zero, which means that it is not significant for the model. Omitting β_0 from the model gives the following results (Table 13):

Dependent Variable: LST_INF_INTPOL
Method: Least Squares
Sample (adjusted): 2008M01 2018M11
Included observations: 131 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LST_N	0.744266	0.042957	17.32585	0.0000
V1	0.820161	0.196584	4.172073	0.0001
V2	-0.499774	0.191350	-2.611830	0.0101

R-squared	0.122751	Mean dependent var	-1.296010
Adjusted R-squared	0.109044	S.D. dependent var	0.802704
S.E. of regression	0.757676	Akaike info criterion	2.305512
Sum squared resid	73.48128	Schwarz criterion	2.371356
Log likelihood	-148.0110	Hannan-Quinn criter.	2.332267
Durbin-Watson stat	1.152161		

Table 13: Rating of the model lst_inf_intpol = $\beta_1 * lst\_n + \beta_2 * V_1 + \beta_3 * V_2 + \varepsilon_t$

In the model without a constant, all variables are statistically significant, but only 12.2751% of inflation rate variations are explained by the model, while the remaining percentage of variations (97.63%) is not explained by the model and is attributed to factors whose effect is included in the model error. The DW statistic is 1.152, suggesting that there may be positive autocorrelation in the model.

A. Ramsey Reset Test

The Ramsey Reset Test is a general specification test for a linear regression model that is used to test for specification errors, more precisely it tests whether non-linear combinations of analyzed variables help to form a better model. This test assesses whether the model is well specified. The initial hypothesis of the Ramsey Reset test asserts that there are no specification errors in the model.

The following models were taken into consideration:

Model 1: lst_inf_intpol = $\beta_0 + \beta_1$*lst_n + ε_t (estimated in Table 10)

Model 2a: lst_inf_intpol = β_1*lst_n + β_2*V_1 + β_3*V_2 + ε_t (estimated in Table 13)

Based on the p value of 22.91%, it is concluded that there are no specification errors in Model 1 (Table 14).

Ramsey RESET Test
Specification: LST_INF_INTPOL C LST_N
Omitted Variables: Squares of fitted values

	Value	df	Probability
t-statistic	1.208399	128	0.2291
F-statistic	1.460229	(1, 128)	0.2291
Likelihood ratio	1.485993	1	0.2228

F-test summary:

	Sum of Sq.	df	Mean Squares
Test SSR	0.893757	1	0.893757
Restricted SSR	79.23827	129	0.614250
Unrestricted SSR	78.34452	128	0.612067

LR test summary:

	Value	df
Restricted LogL	-152.9516	129
Unrestricted LogL	-152.2086	128

Unrestricted Test Equation:
Dependent Variable: LST_INF_INTPOL
Method: Least Squares
Sample: 2008M01 2018M11
Included observations: 131

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-21.18823	14.42748	-1.468603	0.1444
LST_N	-9.139713	6.432390	-1.420889	0.1578
FITTED^2	2.049744	1.696247	1.208399	0.2291

R-squared	0.064692	Mean dependent var	-1.296010
Adjusted R-squared	0.050078	S.D. dependent var	0.802704
S.E. of regression	0.782347	Akaike info criterion	2.369597
Sum squared resid	78.34452	Schwarz criterion	2.435441
Log likelihood	-152.2086	Hannan-Quinn criter.	2.396353
F-statistic	4.426639	Durbin-Watson stat	1.054226
Prob(F-statistic)	0.013839		

Table 14: Ramsey Reset Test for Estimated Model 1: lst_inf_intpol = -3.789531 - 1.391455*lst_n

In Model 2a, the Ramsey Reset Test, based on a probability of 3.35%, confirms the existence of a specification error. (Table 15)

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Ramsey RESET Test
Specification: LST_INF_INTPOL LST_N V1 V2
Omitted Variables: Squares of fitted values

	Value	df	Probability
t-statistic	2.149168	127	0.0335
F-statistic	4.618923	(1, 127)	0.0335
Likelihood ratio	4.679807	1	0.0305

F-test summary:

	Sum of Sq.	df	Mean Squares
Test SSR	2.578690	1	2.578690
Restricted SSR	73.48128	128	0.574073
Unrestricted SSR	70.90259	127	0.558288

LR test summary:

	Value	df
Restricted LogL	-148.0110	128
Unrestricted LogL	-145.6711	127

Unrestricted Test Equation:
Dependent Variable: LST_INF_INTPOL
Method: Least Squares
Sample: 2008M01 2018M11
Included observations: 131

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LST_N	2.131144	0.646698	3.295423	0.0013
V1	2.969592	1.018738	2.914972	0.0042
V2	-2.216353	0.820706	-2.700544	0.0079
FITTED^2	1.375440	0.639987	2.149168	0.0335

R-squared	0.153536	Mean dependent var	-1.296010
Adjusted R-squared	0.133541	S.D. dependent var	0.802704
S.E. of regression	0.747187	Akaike info criterion	2.285055
Sum squared resid	70.90259	Schwarz criterion	2.372848
Log likelihood	-145.6711	Hannan-Quinn criter.	2.320729
Durbin-Watson stat	1.174513		

Table 15: Ramsey Reset Test for evaluated Model 2a: lst_inf_intpol=0.744266*lst_n+0.820161*V1-0.499774*V2

With all the models that have been tested so far, based on DW statistics, it is noted that there is a possibility of positive autocorrelation. For this reason, a formal test will examine its existence. If the existence of autocorrelation is established, it will be eliminated.

Given that the evaluated Model 2a contains dummy variables that are statistically significant and the explanatory power of the model is higher compared to the evaluated Model 1, it will be tested whether the possible existence of autocorrelation causes errors in the specification of Model 2a. The existence of autocorrelation will be tested with the Breusch-Godfrey Test.

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	15.46124	Prob. F(2,126)	0.0000
Obs*R-squared	25.81431	Prob. Chi-Square(2)	0.0000

Table 16: Breusch-Godfrey Test for Estimated Model 2a: lst_inf_intpol=0.744266*lst_n+0.820161*V1-0.499774*V2

In Table 16, based on the probability of 0%, it is concluded that there is a problem of autocorrelation of errors in the model. In order to remove autocorrelation, a dependent variable (a logarithmic and interpolated series of inflation rates) with a first-order lag is added to the model. The rating of Model 2 after removing autocorrelation is shown in Table 17.

Dependent Variable: LST_INF_INTPOL
Method: Least Squares
Sample (adjusted): 2008M02 2018M11
Included observations: 130 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LST_N	0.416912	0.071180	5.857179	0.0000
V1	0.386159	0.194870	1.981629	0.0497
V2	-0.305901	0.176156	-1.736541	0.0849
LST_INF_INTPOL(-1)	0.437059	0.079795	5.477248	0.0000

R-squared	0.276707	Mean dependent var	-1.307997
Adjusted R-squared	0.259486	S.D. dependent var	0.793950
S.E. of regression	0.683219	Akaike info criterion	2.106284
Sum squared resid	58.81536	Schwarz criterion	2.194516
Log likelihood	-132.9085	Hannan-Quinn criter.	2.142136
Durbin-Watson stat	1.858952		

Table 17: Evaluation of Model 2a after removing autocorrelation

In the estimated Model 2a after removing autocorrelation, all parameters are statistically significant. The correlation coefficient of the model has increased and is 27.6707%. With the help of the Ramsey Reset Test, it will be determined whether, after removing the autocorrelation, the model is well specified.

Ramsey RESET Test
Specification: LST_INF_INTPOL LST_N V1 V2 LST_INF_INTPOL(-1)
Omitted Variables: Squares of fitted values

	Value	df	Probability
t-statistic	1.150062	125	**0.2523**
F-statistic	1.322643	(1, 125)	0.2523
Likelihood ratio	1.368323	1	0.2421

F-test summary:

	Sum of Sq.	df	Mean Squares
Test SSR	0.631303	1	0.631303
Restricted SSR	60.29431	126	0.478526
Unrestricted SSR	59.66301	125	0.477304

LR test summary:

	Value	df
Restricted LogL	-134.5227	126
Unrestricted LogL	-133.8386	125

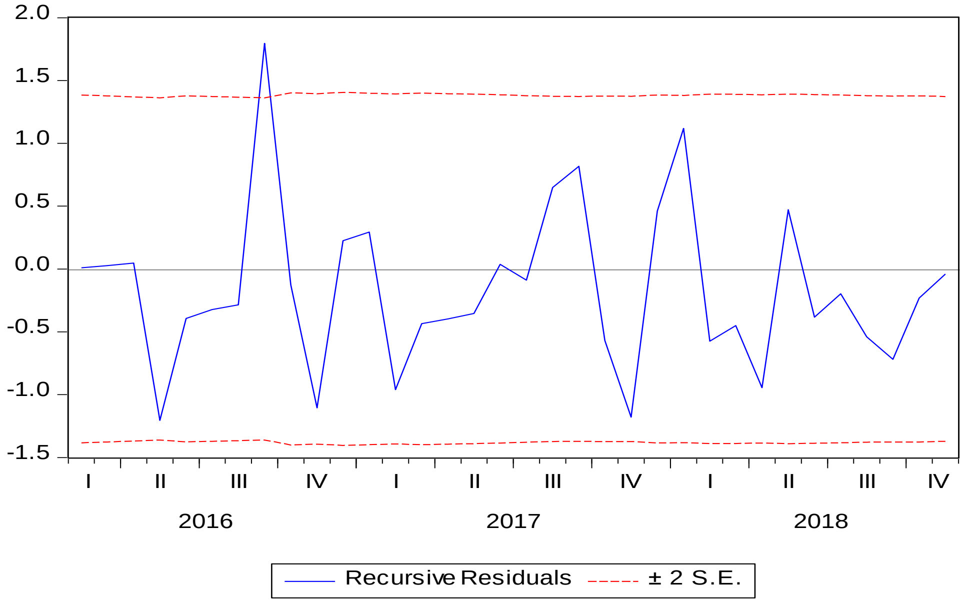
Unrestricted Test Equation:
Dependent Variable: LST_INF_INTPOL
Method: Least Squares
Sample: 2008M02 2018M11
Included observations: 130

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LST_N	0.330280	0.112108	2.946086	0.0038
V1	0.091972	0.248750	0.369735	0.7122
V2	0.189736	0.299529	0.633446	0.5276
LST_INF_INTPOL(-1)	0.051758	0.364826	0.141871	0.8874
FITTED^2	-0.357665	0.310996	-1.150062	0.2523

R-squared	0.266283	Mean dependent var	-1.307997
Adjusted R-squared	0.242804	S.D. dependent var	0.793950
S.E. of regression	0.690872	Akaike info criterion	2.135978
Sum squared resid	59.66301	Schwarz criterion	2.246268
Log likelihood	-133.8386	Hannan-Quinn criter.	2.180792
Durbin-Watson stat	1.879992		

Table 18: Ramsey Reset Test after removing autocorrelation

Based on the results of the t statistic (1.150062) and a probability of 25.23%, it is confirmed from Table 18 that the model is well specified. The sensitivity of the specification in the sample can be examined on the basis of recursive residuals (Graph 7). The x-axis shows the sample size, while the recursive residuals are plotted around the zero line with a limit of plus and minus two standard deviations. Residuals outside these limits suggest instability of the estimated model in a given observation. Therefore, the model is stable because the blue line does not touch or cross the red line, except in September 2016 (Graph 7).



Graph 7: Testing the stability of the evaluated Model 2a (after removing autocorrelation) based on residuals

However, in order to reliably estimate the impact of an external shock on the improvement of the model, dummy variable for September 2016 (V_{2016m9}) is introduced. V_{2016m9} takes the value 1 for September 2016, and the value 0 for the rest of the time period.

Dependent Variable: LST_INF_INTPOL
Method: Least Squares
Sample (adjusted): 2008M02 2018M11
Included observations: 130 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LST_N	0.379806	0.066130	5.743310	0.0000
V1	0.384280	0.246455	1.559228	0.1215
V2	-0.406531	0.171773	-2.366674	0.0195
LST_INF_INTPOL(-1)	0.468701	0.077236	6.068434	0.0000
V2016M9	2.009955	0.687686	2.922780	0.0041

R-squared	0.314833	Mean dependent var	-1.307997
Adjusted R-squared	0.292908	S.D. dependent var	0.793950
S.E. of regression	0.667623	Akaike info criterion	2.067517
Sum squared resid	55.71508	Schwarz criterion	2.177806
Log likelihood	-129.3886	Hannan-Quinn criter.	2.112331
Durbin-Watson stat	1.899266		

Table 19: Model score: $lst\_inf\_intpol = \beta_1 * lst\_n + \beta_2 * V_1 + \beta_3 * V_2 + \beta_4 * lst\_inf\_intpol(-1) + \beta_5 * V_{2016m9} + \varepsilon_t$

By introducing dummy variable, V_{2016m9}, model with a higher coefficient of determination (31.48%) is obtained. The explanation for the impact of V_{2016m9} can be attributed to the holding of parliamentary elections in September 2016. Also, the results of the evaluation of the model from Table 19 indicate that all independent variables have a statistically significant influence on the dependent variable (logarithmic and interpolated series of inflation rates), except for variable V_1, so in the next chapter, the Redundant Variable test will examine the relevance of all variables in rated model.

B. Redundant Variable Test

In Table 20, using the Redundant Variable Test, it was examined whether the unemployment rate variable is significant for the model. The null hypothesis of this test claims that the unemployment rate is not relevant to the model. With a probability of 0%, the nullhypothesis is rejected and it is concluded that the unemployment rate is relevant for the model.

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Redundant Variables Test
Specification: LST_INF_INTPOL LST_N V1 V2 LST_INF_INTPOL(-1) V2016M9
Redundant Variables: LST_N

	Value	df	Probability
t-statistic	5.743310	125	0.0000
F-statistic	32.98561	(1, 125)	0.0000
Likelihood ratio	30.44473	1	0.0000

F-test summary:

	Sum of Sq.	df	Mean Squares
Test SSR	14.70237	1	14.70237
Restricted SSR	70.41745	126	0.558869
Unrestricted SSR	55.71508	125	0.445721
Unrestricted SSR	55.71508	125	0.445721

LR test summary:

	Value	df
Restricted LogL	-144.6109	126
Unrestricted LogL	-129.3886	125

Restricted Test Equation:
Dependent Variable: LST_INF_INTPOL
Method: Least Squares
Sample: 2008M02 2018M11
Included observations: 130

Variable	Coefficient	Std. Error	t-Statistic	Prob.
V1	-0.217781	0.249762	-0.871957	0.3849
V2	-0.412175	0.192341	-2.142942	0.0340
LST_INF_INTPOL(-1)	0.839298	0.047530	17.65841	0.0000
V2016M9	2.239370	0.768740	2.913037	0.0042

R-squared	0.134028	Mean dependent var	-1.307997
Adjusted R-squared	0.113410	S.D. dependent var	0.793950
S.E. of regression	0.747575	Akaike info criterion	2.286322
Sum squared resid	70.41745	Schwarz criterion	2.374554
Log likelihood	-144.6109	Hannan-Quinn criter.	2.322174
Durbin-Watson stat	2.120610		

Table 20: Redundant Variable test for variable lst_n

The Redundant Variable test will analyze the justifications for introducing other variables into the model. From Table 21, based on probabilities for independent variables: V_2, lst_inf_intpol(-1), V_{2016m9}, their relevance to the model is confirmed. However, in the case of variable V_1 the p value is 12.15% (which is higher than the desired significance level of 10%). Such a result suggests that V_1 is not relevant to the model. Also, the results of the evaluated model from Table 19 indicate that V_1 does not have a statistically significant influence on the dependent variable, which justifies the fact that it can be removed from the model specification in order to improve the results.

Redundant Variables Test
Specification: LST_INF_INTPOL LST_N V2 V3 LST_INF_INTPOL(-1) V2016M9
Redundant Variables: **V1**

	Value	df	Probability
t-statistic	1.559228	125	**0.1215**
F-statistic	2.431193	(1, 125)	0.1215
Likelihood ratio	2.504167	1	0.1135

Redundant Variables: **V2**

	Value	df	Probability
t-statistic	2.366674	125	0.0195
F-statistic	5.601145	(1, 125)	0.0195
Likelihood ratio	5.698452	1	0.0170

Redundant Variables: **LST_INF_INTPOL(-1)**

	Value	df	Probability
t-statistic	6.068434	125	0.0000
F-statistic	36.82589	(1, 125)	0.0000
Likelihood ratio	33.56694	1	0.0000

Redundant Variables: **V2016M9**

	Value	df	Probability
t-statistic	2.922780	125	0.0041
F-statistic	8.542643	(1, 125)	0.0041
Likelihood ratio	8.593925	1	0.0034

Table 21: Redundant Variable Test for variables: V_1, V_2, V_{2016m9} and lst_inf_intpol(-1)

After the tests, the specification of the final model is as follows: lst_inf_intpol = β_1*lst_n + β_2*V_2 + β_3*lst_inf_intpol(-1) + β_4*V_{2016m9} + ε_t, while the evaluation of the model is given in Table 22. This model will be labeled Model 2.

Dependent Variable: LST_INF_INTPOL
Method: Least Squares
Sample (adjusted): 2008M02 2018M11
Included observations: 130 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LST_N	0.335948	0.060189	5.581565	0.0000
V2	-0.413743	0.172683	-2.395969	0.0180
LST_INF_INTPOL(-1)	0.507452	0.073542	6.900125	0.0000
V2016M9	2.033696	0.691411	2.941371	0.0039

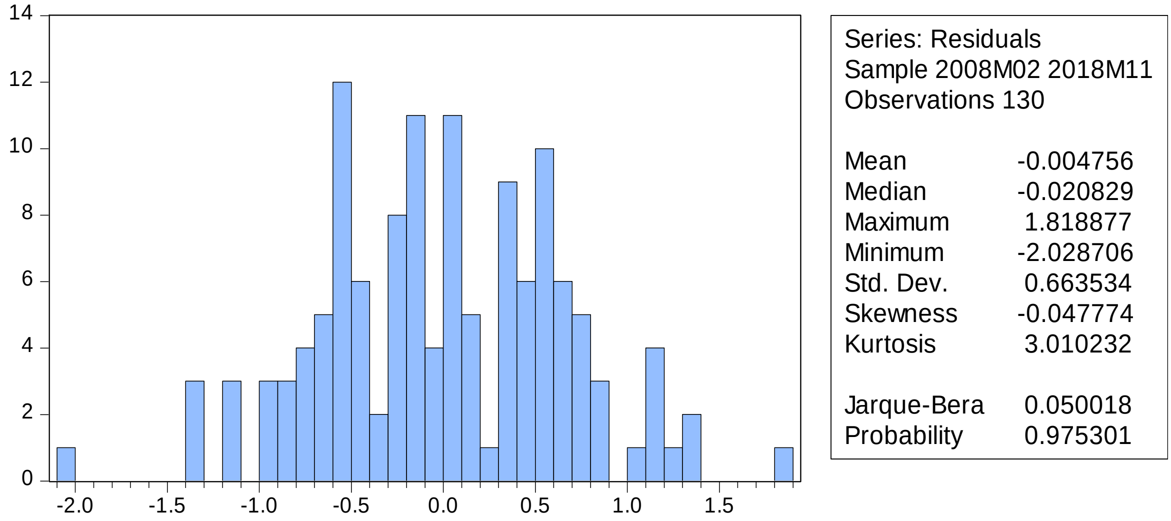
R-squared	0.301507	Mean dependent var	-1.307997
Adjusted R-squared	0.284876	S.D. dependent var	0.793950
S.E. of regression	0.671404	Akaike info criterion	2.071395
Sum squared resid	56.79872	Schwarz criterion	2.159627
Log likelihood	-130.6407	Hannan-Quinn criter.	2.107246
Durbin-Watson stat	1.892277		

Table 22: Evaluation of Model 2: lst_inf_intpol = β_1*lst_n + β_2*V_2 + β_3*lst_inf_int(-1) + β_4*V_{2016m9}+ ε_t

In relation to all tested models, the rated Model 2 from Table 22 was selected: lst_inf_intpol = 0.33*lst_n + (-0.41)*V_2 + 0.51*lst_inf_intpol(-1) + 2.03*V_{2016m9}. In the following, a random error normality test of the selected model and a Granger causality test will be conducted.

C. Jarque-Bera Test

Random error plays an important role in the specification of the model, so it is important that it has a normal distribution, which is also one of the assumptions of the classic linear regression model. Therefore, as a next step, testing the normality of the random error distribution is implied. On Graph 9, the calculated probability is 97.53%, so we come to the conclusion that the series of residuals of the model has a normal distribution.



Graph 9: Histogram of residuals of evaluated Model 2: lst_inf_intpol = 0.33*lst_n - 0.41*V2 + 0.51*lst_inf_int(-1) + 2.03*V2016m9

D. Granger Causality Test

By applying the Granger causality test, it is examined whether the data, obtained on the basis of the value of one variable from the previous period, enable a more precise prediction of the current value of another variable. Granger causality indicates that there is a correlation between the past values of one variable and the current value of another. The null hypothesis of this test is that there is no causality between the variables. To test the hypothesis, the value of the F-statistic is observed, and the conclusion is made based on the associated probability. If the calculated probability is lower than the desired level of significance, then the null hypothesis is rejected, that is, the conclusion is reached that the variables influence each other.

Pairwise Granger Causality Tests
Sample: 2008M01 2018M12
Lags: 2

Null Hypothesis:	Obs	F-Statistic	Prob.
LST_N does not Granger Cause LST_INF_INTPOL	129	1.23631	0.2940
LST_INF_INTPOL does not Granger Cause LST_N		2.62401	0.0765
LST_INF_INTPOL(-1) does not Granger Cause LST_N	129	2.38339	0.0965
LST_N does not Granger Cause LST_INF_INTPOL(-1)		1.58840	0.2084

Lags: 3

Null Hypothesis:	Obs	F-Statistic	Prob.
LST_N does not Granger Cause LST_INF_INTPOL	128	0.71268	0.5463
LST_INF_INTPOL does not Granger Cause LST_N		1.86037	0.1399
LST_INF_INTPOL(-1) does not Granger Cause LST_N	128	1.90111	0.1330
LST_N does not Granger Cause LST_INF_INTPOL(-1)		0.97505	0.4069

Table 23: Granger causality test

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Ho: LST_N does not affect LST_INF_INTPOL, while the alternative hypothesis would be H1: LST_N affects LST_INF_INTPOL. The test leads to the conclusion that, with a significance level of 10% and a probability of 29.40%, there is no influence of the unemployment rate on the inflation rate. However, the inflation rate from the transition period affects the unemployment rate. The conclusion is that there is a one-way causality from the inflation rate to the unemployment rate, the opposite is not true. At the 3-lag level, there is no mutual influence of the variables.

V. ASSESSMENT AND EVALUATION OF THE MODEL IN MONTENEGRO

From the previous research, by adjusting the series in order to form a valid model, a model was chosen in which all variables are statistically significant and which at the same time has the highest coefficient of determination. In order to evaluate the evaluated model, econometric tests will be carried out in the following chapters. By conducting econometric tests, it is checked whether the assumptions of the classic linear regression model are fulfilled, through testing the existence of autocorrelation, heteroscedasticity and multicollinearity.

A. *Autocorrelation test: Breusch-Godfrey Serial Correlation LM Test*

Autocorrelation testing in the model will be conducted with the Breusch-Godfrey Serial Correlation LM test (Table 24). The results of the test indicate that the percentage of error made, in the case of rejecting the null hypothesis, is equal to 59.88%. Therefore, the conclusion is that there is no problem of autocorrelation of errors in the model

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	0.496271	Prob. F(2,124)	0.6100
Obs*R-squared	1.025627	Prob. Chi-Square(2)	0.5988

Test Equation:
Dependent Variable: RESID
Method: Least Squares
Sample: 2008M02 2018M11
Included observations: 130
Presample missing value lagged residuals set to zero.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LST_N	0.045477	0.130465	0.348576	0.7280
V2	-0.037332	0.196164	-0.190312	0.8494
LST_INF_INTPOL(-1)	-0.068081	0.187532	-0.363037	0.7172
V2016M9	-0.031036	0.697701	-0.044483	0.9646
RESID(-1)	0.118533	0.202872	0.584276	0.5601
RESID(-2)	-0.032835	0.129866	-0.252834	0.8008

R-squared	0.007889	Mean dependent var	-0.004756
Adjusted R-squared	-0.032115	S.D. dependent var	0.663534
S.E. of regression	0.674104	Akaike info criterion	2.094192
Sum squared resid	56.34769	Schwarz criterion	2.226539
Log likelihood	-130.1225	Hannan-Quinn criter.	2.147969
Durbin-Watson stat	1.992324		

Table 24: Autocorrelation Testing: Breusch-Godfrey Test for Model 2: lst_inf_intpol = 0.33*lst_n - 0.41*V_2 + 0.51*lst_inf_int(-1) + 2.03*V_{2016m9}

B. *Heteroscedasticity test: Glejser test*

The existence of heteroskedasticity in the model will be examined by Glejser's test. The null hypothesis is (H_0): The random errors have a constant variance (they are homoscedastic), while the alternative hypothesis is (H_1): The variance of the random error is not constant (the errors are heteroscedastic). At the significance level of 5%, and based on the probability value (Table 25), which is 5.99%, the conclusion is that the null hypothesis is valid, which claims that there is no problem of heteroskedasticity in the model.

Heteroskedasticity Test: Glejser

F-statistic	2.337560	Prob. F(4,125)	0.0589
Obs*R-squared	9.047481	Prob. Chi-Square(4)	0.0599
Scaled explained SS	8.479592	Prob. Chi-Square(4)	0.0755

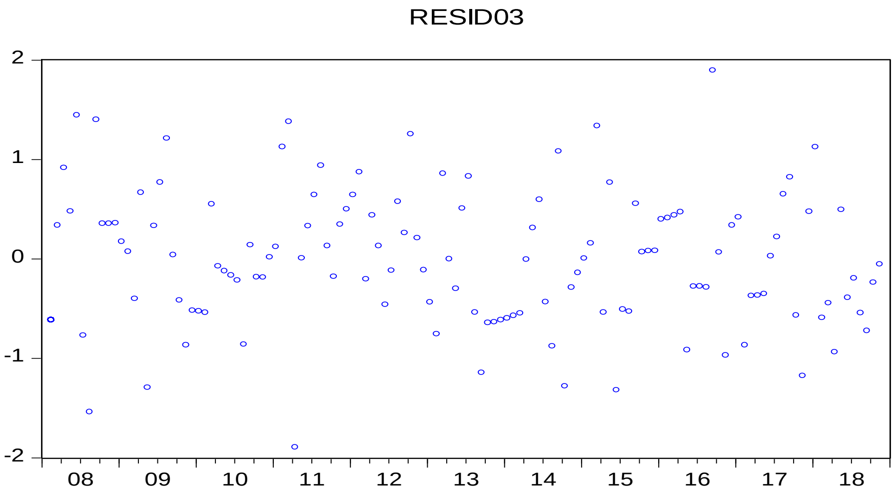
Test Equation:
Dependent Variable: ARESID
Method: Least Squares
Sample: 2008M02 2018M11
Included observations: 130

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.651931	0.589446	1.106005	0.2708
LST_N	-0.012562	0.316391	-0.039703	0.9684
V2	-0.116738	0.120935	-0.965290	0.3363
LST_INF_INTPOL(-1)	0.094646	0.043591	2.171233	0.0318
V2016M9	-0.338084	0.397770	-0.849948	0.3970

R-squared	0.069596	Mean dependent var	0.532343
Adjusted R-squared	0.039823	S.D. dependent var	0.393337
S.E. of regression	0.385426	Akaike info criterion	0.968766
Sum squared resid	18.56913	Schwarz criterion	1.079056
Log likelihood	-57.96979	Hannan-Quinn criter.	1.013580
F-statistic	2.337560	Durbin-Watson stat	1.663034
Prob(F-statistic)	0.058926		

Table 25: Heteroscedasticity testing: Glejser's test for estimated Model 2: lst_inf_intpol = 0.33*lst_n - 0.41*V_2 + 0.51*lst_inf_intpol(-1) + 2.03*V_{2016m9}

The existence of heteroskedasticity can also be examined informally (graphically), that is, with a scatter diagram of the residuals (shown in Graph 10). The graph clearly shows that there is no dependence between the variances of random errors and independent variables for the selected model, i.e. random errors are homoscedastic.



Graph 10: Heteroskedasticity testing using a scatter plot

C. Multicollinearity

Given that the final model contains several independent variables, the problem of multicollinearity will be present, so an important question is the degree to which multicollinearity is expressed. The answer to this question gives the value of the variance growth factor (VIF). According to the data from Table 26, the VIF ranges from 1.06 to 3.37. Thus, multicollinearity is moderate.

Variance Inflation Factors
Sample: 2008M01 2018M12
Included observations: 130

Variable	Coefficient Variance	Uncentered VIF
LST_N	0.003623	3.373222
V2	0.029819	1.256855
LST_INF_INTPOL(-1)	0.005408	3.613864
V2016M9	0.478049	1.060485

Table 26: Multicollinearity testing (for estimated Model 3)

Considering the current characteristics of the selected and evaluated model, as well as the value of the coefficient of determination, it is not desirable to make any forecasts, nor to use it for the purposes of creating economic policy.

VI. FINAL INTERPRETATION OF THE RESULTS

The research was conducted on empirical data of time series of inflation rates and unemployment rates, which were downloaded from the CBCG website. At the very beginning, the characteristics of the time series were determined with the help of descriptive statistics. The normality of the data distribution and the stationarity of the time series were tested. The original series are stationary and do not have a normal distribution. The specification of the desired model defines that the inflation rate is the dependent variable and the unemployment rate is the independent variable. In the model evaluated in this way, the parameters are not statistically significant and the correlation coefficient is 0.7378%. The model estimated that if the inflation rate increases by one percent, the unemployment rate will increase by approximately 1.02%, which is contrary to the theoretical assumption. In the next step, the original series were transformed by their logarithmization. In the model with logarithmic series (Model 1), it was shown that the variables are statistically significant, however, the coefficient of determination was still very low, only 5.4%. The rating of Model 1 is as follows: lst_inf_intpol = -3.78 - 1.39*lst_n.

Since there were certain changes in the economy during the examined period, which could affect unemployment and inflation, it was necessary to include them in the model and see what kind of impact they have. For the period from 2008 to 2018, two dummy variables were included. V_1 represents dummy variable that includes the impact of the world economic crisis on the inflation rate, for the period from January 2008 to July 2009, while V_2 is a dummy variable that represents the period from the introduction of allowances for mothers with three or more children until its abolition and it is the period from January 2016 to July 2017. The newly formed model did not give good results, because the unemployment rate is not a statistically significant variable. Although there is an inverse relationship between the unemployment rate and the inflation rate, the coefficient of determination is still low, only 14.18%.

The Wald test proved that the constant was not significant for the model, so it was excluded. After that, the Ramsey Reset test confirmed that the model is not well specified and that there is a problem of autocorrelation of errors. After removing the autocorrelation, it turned out that all variables from the model are statistically significant. At the same time, there was an increase in the coefficient of determination to 27.67%. The relationship between the inflation rate and the unemployment rate is such that if the inflation rate increases by one percent, the unemployment rate will increase by 0.41% on average.

The stability of the model was tested with a graphical display of recursive residuals, where it was determined that there was a break in September 2016 (parliamentary elections), so an artificial variable, V_{2016m9}, was introduced for that period, which increased the coefficient of determination to 31.48%. The Redundant Variable Test confirmed that all independent variables in the model were justifiably introduced and relevant, except for V_1, so it was removed from the model (Model 2). The score of Model 2 is as follows: lst_inf_intpol = 0.37*lst_n - 0.41*V_2 + 0.51*lst_inf_int(-1) + 2.03*V_{2016m9}. The conducted econometric tests confirmed that there is no problem of autocorrelation and heteroscedasticity of errors, nor multicollinearity, while the residuals have a normal distribution.The Granger causality test suggests that there is unidirectional causality from the inflation rate to the unemployment rate.

The same results were obtained through empirical analysis in Romania, Albania, Macedonia, Serbia and Bosnia and Herzegovina, where it was confirmed that, in the listed countries of Southeastern Europe, in the period from 1995 to 2015, the Phillips curve rule does not apply, but that there is a unidirectional causality between the investigated variables. (Lojanica, N., & Obradović, S.)

By examining the Phillips curve in the Baltic countries, the impact of real marginal costs on inflation is included in the analysis, but not proven. The results actually suggest that current inflation is determined by previous inflation rates. (Dabusinskas, A., Kulikov, D.) In a large number of works, where the impact of the output gap and inflationary expectations is included, it has been proven that it contributes to a better evaluation of the model. It is a fact that inflation is influenced by a large number of variables, and that their inclusion in the model is justified, hence, in a large number of works, the Phillips curve model is subject to various empirical specifications, as well as causal and theoretical interpretations. For this reason, special attention should be paid when the results obtained in this way are interpreted and applied in real situations.

Forecasts or the use of this model in the creation of economic policy is not justified due to the characteristics it showed in the evaluation process, as well as due to the value of the coefficient of determination, and for this reason this step was not implemented. Therefore, the Phillips curve theory has no empirical confirmation in Montenegro.

VII. CONCLUSION

The research results suggest that there is no inverse relationship between the rate of inflation and rate of unemployment in the economy of Montenegro for the observed period, from 2008 to 2018, but that there is a one-way causality, which indicates that changes in the inflation rate cause changes in the unemployment rate in the short term. Similar results were obtained by empirical analyzes in other transition economies. The goal of all transition countries, including Montenegro, is to increase economic activity and employment while simultaneously maintaining a stable and low inflation rate. As no consensus has been reached in the domestic or foreign literature on the existence of the Phillips curve, the results of all research must be interpretedcarefully when applying them in the creation of economic policy.

In conclusion, when interpreting the results of the model for the economy of Montenegro, one must take into account the simplicity of the analyzed model, the short observed time period, the inaccuracy in the measurement of the observed variables, considering the problem of the gray economy. Also, it is possible to expand the model with additional variables and increase the number of examined observations, which represents an excellent basis for all further research of the Phillips curve model in Montenegro.

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