Relationship Between Inflation and Unemployment: The Case Study of Former Yugoslav Countries

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Abstract. Unemployment remains a constant concern for national governments and often causes social unrest. This study addresses the relationship between inflation and unemployment known as Phillips Curve, for the seven countries that emerged from former Yugoslavia. This phenomenon is investigated with annual data covering the period from 2003 to 2020. According to the OLS outcomes, there is a negative tradeoff within unemployment and inflation for Slovenia, Croatia, and Montenegro, which stands in line with the Phillips curve paradigm. In the case of Kosovo, North Macedonia, Serbia, and Bosnia, OLS findings indicate a positive relationship between inflation and unemployment. VAR results show that only in the case of Slovenia inflation is positively influenced by past unemployment. The impulse response function confirms that in former Yugoslav countries, positive unemployment shock to inflation holds only a short-run effect except for North Macedonia where the effect also stands in the long-run. The Johansen test shows that there is a co-integration relation between inflation and unemployment for the six selected countries except for Slovenia. From a policy perspective, results provide reliable indications for the national institutions in these countries on the importance of inflation and unemployment targeting.

Keywords: Phillips Curve, Inflation, Unemployment, Former Yugoslav countries.

JEL Classification: E31, E24.

1. Introduction

Government actions that lowers unemployment rate and keeps inflation at acceptable levels stands as a daily concern of any economic policy. As a conventional macroeconomic theory, the Phillips curve has been widely used as a tool to understand the relationship between inflation and unemployment. The model became very popular

mainly due to the analytical simplicity of explaining the relationship between inflation and unemployment while it posed a significant influence in constructing macroeconomic policies. At the same time, the model served as a comparative analysis technique of conventional economic paradigms such as Keynesianism, monetarism and rational expectations. In this context, William Phillips in his study from 1861 to 1957 for the United Kingdom evidenced an inverse relationship between wage rates and unemployment level. Moreover, the author determined that the rate of change of money wage rates can be explained by the movements in the unemployment level (Phillips, 1958). In addition, various scholars and policymakers followed this technique to explain the relationship between inflation and unemployment for other economies, modifying it with the country context. Following this approach, Samuelson and Solow (1960) tested the model using the American data and also confirmed the negative relationship between unemployment and inflation as that one confirmed with the UK data. According to numerous scholars, this model could only explain the short-run relation within unemployment and inflation. In this context, Phelps (1967) suggested that frictional unemployment could be reduced in the short run using inflation, mainly because economic actors have incorrect expectations of inflation rate. In light of this finding, the policymakers could exploit this short-term relationship to reduce unemployment through raising inflation.

Prices are important signals for the allocation of resources both in the financial market and in the real economy (Aliu et al, 2020). Nevertheless, the Phillips curve has been strongly critiqued as a model arguing that the inverse relationship might not be permanent and raising inflation cannot be used as a policy to reduce unemployment (Friedman, 1968; Meade and Thornton, 2012). According to Friedman (1968), the unemployment level is not exactly related to inflation per se but to the unanticipated inflation which stands as a targeting metric by the central banks. The prevailing view has been that the Phillips curve in the long-run is vertical, meaning that the monetary policy actions do not affect the unemployment level. To this end, Friedman (1968) presented the concept of the natural rate of unemployment which points out that in the long-run changes in the inflation rate hold only limited effect since unemployment eventually returns to the natural rate. Moreover, Friedman (1977) pointed out that the relationship between unemployment and inflation might be positive due to the distortionary effects of the inflation tax. The short-term relationship within unemployment and inflation was found by several scholars such as that of Malinov and Sommers (1997) for OECD countries, Çatik et al. (2011) for Turkey. In the long run the trade-off between inflation and unemployment was found in a study by Naghdi et al. (2011) for Iran and another one for Malaysia by Tang and Lean (2007). In this context, the work by Niskanen (2002) found that inflation can even cause unemployment if the inflation rate is lagged one year suggesting a positive relationship between these two macroeconomic variables. Another study also found a positive relationship where inflation leads to unemployment in 3 to 4 years ahead (Haug and King, 2014). However, considering shortcomings of the Phillips theoretical paradigm such as the instability of the variables, flattening of the curve and inferior forecasting,

suggest that the relationship should be considered as useless tool by policymakers (Niskanen, 2002; Reichel, 2004).

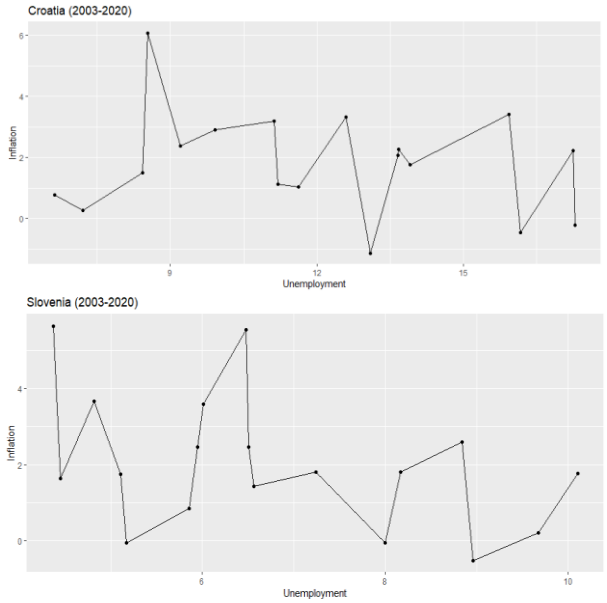
The empirical evidence for former Yugoslav countries also suggests mixed outcomes. A study for Bosnia and Herzegovina by Omerčević and Nuroğlu (2014) consider that the relationship between unemployment and inflation in the short term is positive while only increases in real wage would increase employment rate. On the other side, Dimitrijevic (2010) indicates that the Phillips curve could not be applicable in Yugoslavia for the period of 90s because system did not hold continuous economic and also due to very limited effects of the market mechanism in place. The Phillips curve after 2000 was not a model that could explain the phenomenon by which the inflation rate could impact unemployment level, mainly due to the stagnation of economic growth in Serbia (Dimitrijevic, 2010). Although Šergo et al (2012) presents no evidence of a negative relationship between unemployment and inflation for Croatia. In this context, Ciupac and Beju (2014) found that there is a positive short-term relationship between the two variables for Slovenija. An important question for the economic development of transition countries and more specifically those that emerged from Yugoslavia is whether in these countries exists an unemployment-inflation trade-off and to what extent it can be used as economic policy to target economic growth and reduce unemployment. This study offers insight into the relationship between inflation and unemployment for the seven countries that emerged from former Yugoslavia. We have covered the following countries such as Croatia, Slovenia, Bosnia and Herzegovina, Serbia, North Macedonia, Kosovo, and Montenegro. Section 2 provides a short description of the contextual factors of this analysis. The relationship of the two variables is tested on the country level, using Ordinary Least Square (OLS), Vector Autoregressive Model (VAR), Johansen co-integration test, Granger Causality Test, and Impulse Response Function (IRF). The methodology is presented in fourth section while concluding remarks are presented in the final section. Based on the identified problem the following question is asked:

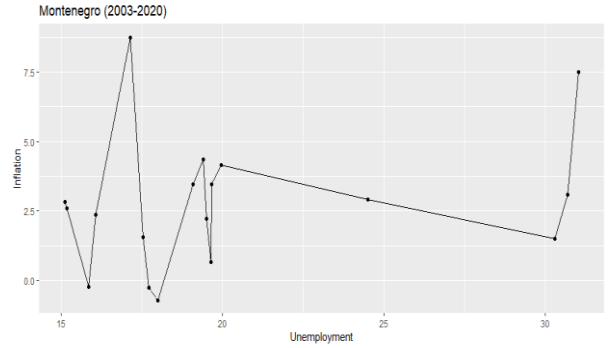
Q1: *What is the relationship between unemployment and inflation in the context of seven former Yugoslav countries?*

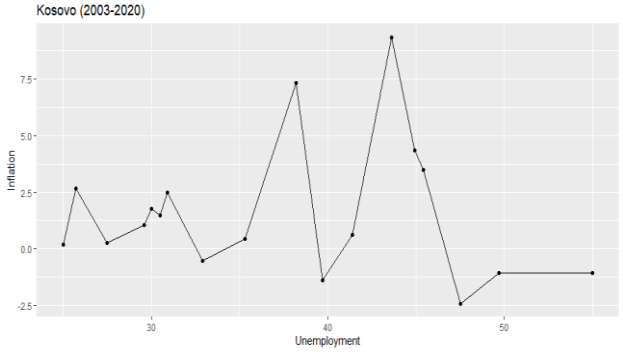
2. Inflation and unemployment in the context of former Yugoslav countries.

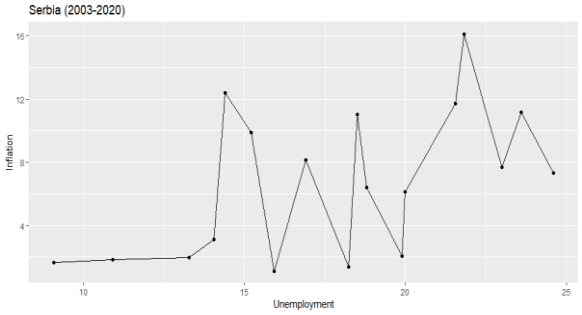
The Socialist Federal Republic of Yugoslavia since its inception experienced a double-digit unemployment rate, followed by hyperinflation in the late 1990s. The former Yugoslav countries have undergone a solid transformation of their economies moving from a semi-centralized economy to a free market economy. Many industries were socially owned and the privatization process was inevitable, bearing social consequences such as a rise in the unemployment rate and high inflation. Privatization of state and publicly owned companies was one of the methods to transform the ownership structure in these countries (Aliu, 2014). The financial system is mainly

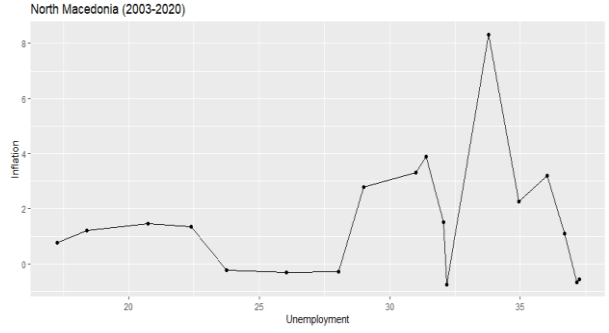
organized and managed from the private incentives where the Central Banks in these countries remain a key player regarding money supply and banking supervision. Kosovo and Montenegro use the Euro but are not part of the Eurozone while the other countries possess their national currencies and independent monetary policies. The liberalization of the banking industry for the foreign investors went together with an increase in the interest rate, not reflecting the risk of domestic economies (Aliu and Nadirov, 2016). Former Yugoslav countries inherited the problems of high unemployment and inflation due to war and unsolved political issues. Slovenia, unlike other western Balkan countries, managed to get on a good economic track and joined the European Union in early 2004. However, other western Balkan countries struggled from high unemployment and uncontrolled inflation since the disintegration of the Socialist Federal Republic of Yugoslavia (SFRJ). In this context, Serbia followed an inflation targeting policy of 3% since monetary policies in the past were not efficient to keep inflation within the allowed targets (Fabris, 2015). In North Macedonia, inflation fluctuated from -1.28% to 7.52% from 1996 till 2020 while in 2008 reached the highest peak. While in Kosovo the inflation is mainly a phenomenon generated from international trade due to a deep trade deficit. In the case of Kosovo and Montenegro, central banks in the absence of monetary policies (because they use the Euro) mainly carry out activities of supervising the financial system. Figure 1 indicates the relationship between inflation and unemployment in the seven former Yugoslav countries, from 2003 to 2020. The relationship between unemployment and inflation is not clear even though the series are short and cover only 17 years' time period.


Croatia (2003-2020)
Inflation
Unemployment
Slovenia (2003-2020)
Inflation
Unemployment


Montenegro (2003-2020)
Inflation
Unemployment
7.5
5.0
2.5
0.0
15
20
25
30


Kosovo (2003-2020)
Inflation
Unemployment
7.5
5.0
2.5
0.0
-2.5
30
40
50


Serbia (2003-2020)
Inflation
Unemployment
16
12
8
4
10
15
20
25


North Macedonia (2003-2020)
Inflation
Unemployment
8
6
4
2
0
20
25
30
35

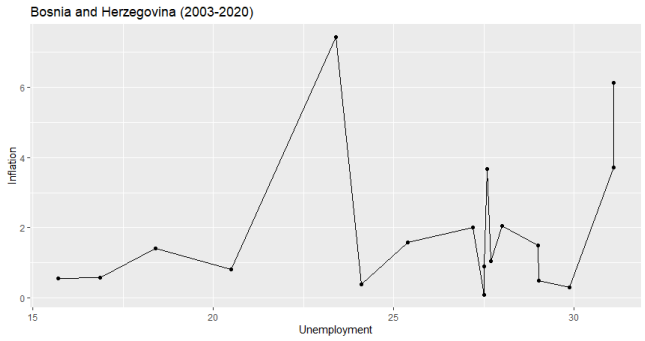


Fig. 1. Tradeoff within unemployment and inflation for the former Yugoslav countries. Source: Authors elaborations based on the World Bank database [Prepared in R-Studio].

The macroeconomic indicators in western Balkan countries are improving but still, there is a long way to converge with the EU member states. Some of the Balkan countries such as Slovenia and Croatia are part of the European Union while the others are pursuing the ambition to join it. As one of the main pillars to join the EU membership is a functional market economy, trade liberalization, and reducing the corruption rate. It is expected that western Balkan countries will try to improve the macroeconomic condition, make their economies functional, considering all the risks that structural reforms carry. Therefore, unemployment and inflation will remain serious issues for the upcoming years that will challenge the national governments of these countries.

3. Methodology

The methodology part is separated into two sections where section 3.1 describes the process of data collection while 3.2 indicates the methods used.

3.1. Data

This study investigates the validity of the Phillips curve in the context of the countries that emerged from the former Socialist Federal Republic of Yugoslavia. The analysis of the Phillips curve continues with the seven countries such as Croatia, Slovenia, Bosnia and Herzegovina, Serbia, North Macedonia, Kosovo, and Montenegro. We have included seven countries where two of them are part of the European Union (EU) while others stand on various stages of integration. Data on these countries related to inflation and unemployment are also collected on an annual basis from the World Bank database (WB, 2021), covering the period from 2003 to 2020. To measure the inflation rate, Consumer Price Index (CPI) was used which also contains imported products.

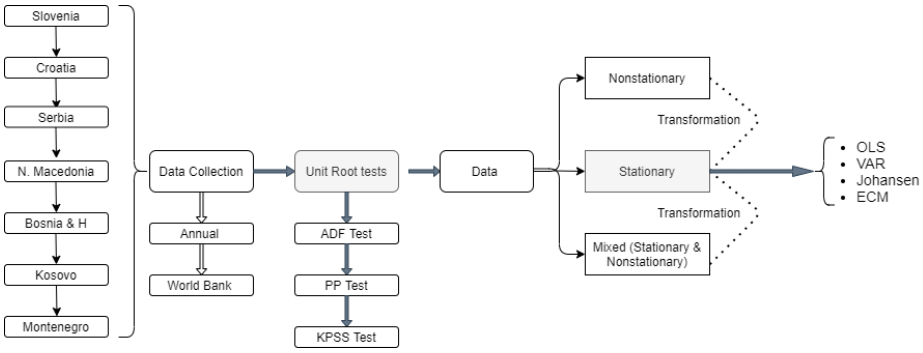


Fig. 2. Steps followed and implemented during the research process.
Source: Authors elaborations.

To visually explain the research process, Figure 2 shows briefly the steps and statistical tests used in our work. Since we are dealing with macroeconomic issues, it is highly likely that the data might be nonstationary and have a unit root. To clarify this dilemma, three kinds of tests were implemented to identify stationarity issues, such as the Augmented Dickey-Fuller test (ADF), Phillips-Peron test (PP), and Kwiatkowski, Phillips, Schmidt, and Shin test (KPSS).

Table 1 indicates three different tests to check for the stationarity issue of our time series variables. For the data to be stationary, the p-value in the ADF test and PP test should be less than a 5% significance level ($p <= 0.05$). However, in the case of the KPSS test stationary data must hold a p-value higher than 5% significance level ($p > 0.05$). According to the ADF test, some of the data concerning unemployment and inflation were stationary while the others were nonstationary. Although the log transformation and differencing are used, still some of the data remain nonstationary. In the case of the KPSS test, all the data become stationary after we use the log transformation and difference. Phillip Peron's test is not a good metric for identifying stationarity since our study contain small data set.

Table 1. ADF, PP, and KPSS test in the case of seven former Yugoslav countries.

	ADF p-value	**ADF (I dff) p-value**	**PP p-value**	**PP (I dff) p-value**	**KPSS p-value**	**KPSS (I dff) p-value**
Log10 Unem (CRO)	0.12	0.56	0.87	0.69	0.1	0.1
Log10 Infl (CRO)	0.25	0.17	0.42	0.24	0.04	0.1
Log10 Unem (SLO)	0.53	0.60	0.85	0.55	0.1	0.1
Log10 Infl (SLO)	0.01	0.01	0.07	0.01	0.03	0.1
Log10 Unem (BH)	0.61	0.40	0.78	0.34	0.04	0.1
Log10 Infl (BH)	0.05	0.02	0.16	0.01	0.01	0.1

Log10 Unem (SRB)	0.96	0.08	0.87	0.44	0.1	0.1
Log10 Infl (SRB)	0.45	0.28	0.35	0.04	0.02	0.1
Log10 Unem (NM)	0.95	0.59	0.71	0.01	0.02	0.1
Log10 Infl (NM)	0.05	0.21	0.08	0.01	0.1	0.1
Log10 Unem (RKS)	0.40	0.46	0.37	0.37	0.02	0.1
Log10 Infl (RKS)	0.43	0.16	0.26	0.04	0.1	0.1
Log10 Unem (MNT)	0.01	0.01	0.81	0.45	0.03	0.1
Log10 Infl (MNT)	0.07	0.02	0.16	0.17	0.05	0.1

Source: Authors elaborations based on the World Bank database [Prepared in R-Studio].

Applying the appropriate methodology that suits the time series data is very important to generate reliable estimates. The determination of the methods to be used largely depends on the outcomes achieved from the unit root tests.

3.2. Methods

The application of the methods for the type of data we possess is crucial in the reliability of the results we deliver. The outcomes generated from the unit root tests also determine the methods applied to the time series data. In our case we have used Ordinary Least Square (OLS), Vector Autoregressive Model (VAR), Johansen co-Integration test, Granger Causality Test, Impulse Response Function (IRF) to analyze the relationship between unemployment and inflation for the seven former Yugoslav countries. In case the data are non-stationary OLS is not preferred, but we have used it only to identify the direction of coefficients. The following equations indicate the OLS with two variables:

$$Y_i = b_i + b_2 X_i + e_i \qquad (1)$$

or

$$= Y_i - b_i - b_2 X_i - e_i \qquad (2)$$

Where the Y_i represents the inflation rate (dependent variable) for the seven respective countries while the X_i stands for the unemployment rate (independent variable). However, the estimated coefficients are represented through b_i and b_2. The OLS has been implemented for the seven former Yugoslav countries independently and with an identical methodological approach. VAR is a method generally used in analyzing macroeconomic policies, forecasting events, and structural inferences. Usually, this method measures the causal effect of the independent variables on the dependent one based on the past data. VAR model built with two variables and with one lag is named as bivariate VAR:

$$y_t = a_1 + a_{11}y_{t-1} + a_{12}x_{t-1} + u_t \quad (3)$$

$$x_t = a_2 + a_{21}y_{t-1} + a_{22}x_{t-1} + u_t \quad (4)$$

Another important component is the determination of the number of lags within the VAR model. To determine the number of lags, four diverse information criteria were used, such as Hannan-Quin (HQ), Schwarz (SC), Akaike Information Criterion (AIC), and Akaike Final Prediction Error (FPE). On the other hand, Johansen co-Integration test is used to identify the short and long-run integration among time series variables. We have used trace statistics and maximal eigenvalue to obtain results from the Johansen test. As with the VAR model, information criteria (AIC, FPE, SC, and HQ) must be also specified in the Johansen Test.

4. Results

The results display outcomes of the OLS, VAR, Johansen co-Integration test, Impulse Response Function, and Granger Causality test.

4.1. OLS Outcomes

The study analyze the relationship between inflation rate and unemployment level for the former Yugoslav states. Table 2 indicates the OLS outcomes of individual countries selected for our work. Although we are aware that OLS is not a suitable model when data are non-stationary, we have used it only to identify the signs of the coefficients. The Phillips Curve assumes that the relationship between inflation and unemployment is negative. So the increase in the inflation rate affects the reduction of the unemployment rate and the other way around.

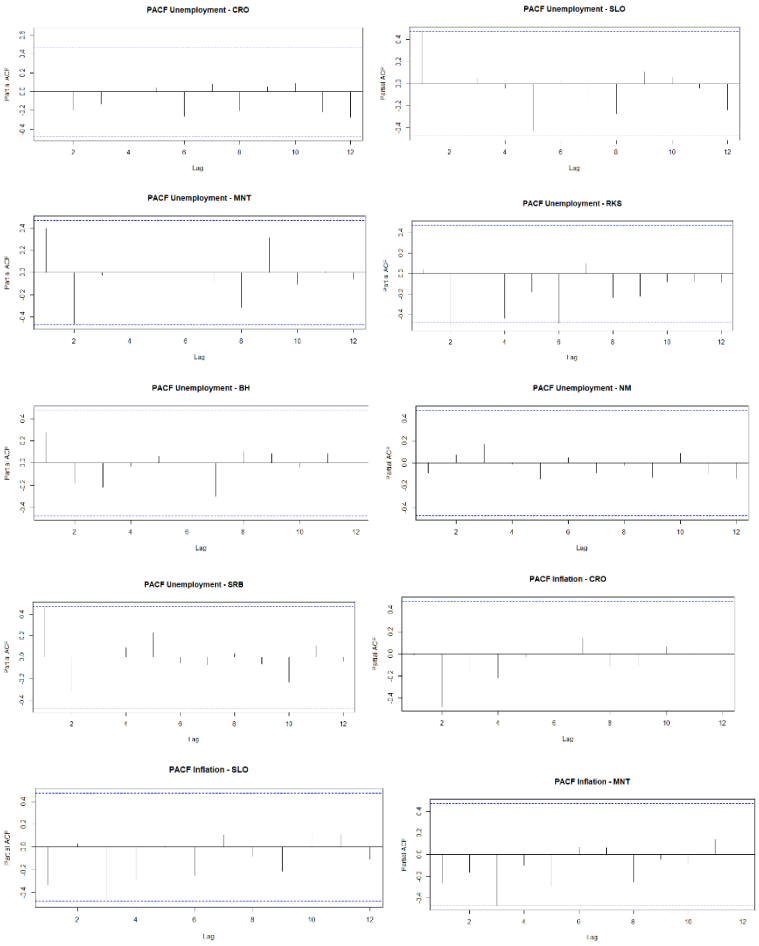
Table 2. OLS Results generated independently for seven respective countries.

	Est. Coefficients	**St. Error**	**Pr(>|t|)**	R^2	**Adj.**R^2
Log10 Unem (CRO)	-1.56	1.38	0.27	0.07	0.02
Log10 Unem (SLO)	-3.18	2.31	0.12	0.15	0.09
Log10 Unem (BH)	1.45	4.26	0.73	0.01	-0.05
Log10 Unem (SRB)	0.23	0.94	0.80	0.004	-0.06
Log10 Unem (NM)	3.21	5.55	0.56	0.02	-0.03
Log10 Unem (RKS)	3.28	4.55	0.47	0.01	-0.04
Log10 Unem (MNT)	-6.84	3.15	0.04	0.23	0.18

Source: Authors elaborations based on the World Bank database [Prepared in R-Studio].

According to Table 2 estimated coefficients for Croatia, Slovenia and Montenegro hold negative signs which stand in line with Phillips Curve. In contrast, coefficients for Kosovo, North Macedonia, Bosnia, and Herzegovina, and Serbia stand positive. The highest coefficient stands for Montenegro where an increase in the inflation rate of 1%

reduces unemployment by 6.84%. The paradox of this relationship between inflation and unemployment for Montenegro lies in the fact that the country uses the euro and does not hold a monetary policy. Although none of the estimated coefficients appear significant since the p-value is higher than the 5% significance level ($p > 0.05$). To determine the persistence of the model, partial autocorrelation (PACF) was conducted for individual countries. According to Figure 3, it is clear that most of the lags in each country were within the significance threshold (blue lines). The PACF-unemployment lags for Montenegro and Kosovo touch the significance threshold but do not cross them. Identically, in the case of Bosnia, the PACF-inflation lags approach the significance threshold but does not exceed it.



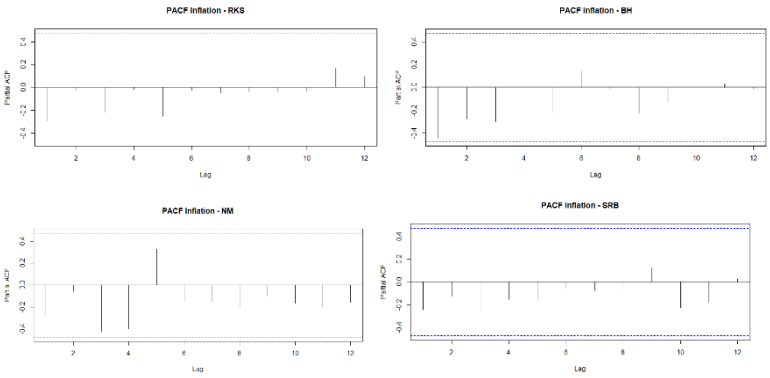


Fig. 3. Partial Autocorrelation (PACF) concerning inflation and unemployment of the seven former Yugoslav countries.
Source: Authors elaborations based on the World Bank database [Prepared in R-Studio].

4.2. VAR Estimation results

The VAR model enables identifying the relationship between unemployment and inflation toward its lags. In this context, one of the important criteria is to determine the number of optimal lags within the VAR model. Several lags were obtained from Akaike Information Criterion (AIC), Hannan-Quin (HQ), Schwarz (SC), and Akaike Final Prediction Error (FPE). The number of lags was set for each country independently. However, we were interested only in the equations representing the effect of unemployment (Un_{met}) and past inflation ($Infl_{t-1}$) on the inflation rate ($Infl_t$). The following equation represents the VAR estimation model for Croatia :

$$log\ log\ (Infl_{CRO}) = -0.07 - 0.02log(Infl_{t-1}) + 0.61log\ (Unem_{t-1}) - 0.56log(Infl_{t-2}) - 0.87log\ (Unem_{t-2})$$

The model is stable since all the roots stand within the characteristic polynomial (0.7554, 0.7554, 0.7471, 0.7471). Although we could see that the effect of the variable is non-significant, with p-value > 0.05. The VAR model concerning inflation for Slovenia stands as follows:

$$log\ log\ (Infl_{SLO}) = -0.001 + 0.04log(Infl_{t-1}) + 1.09 * log\ (Unem_{t-1}) + 0.019log(Infl_{t-2}) + 0.53log\ (Unem_{t-2})$$

The information criteria for Slovenia according to AIC, HQ, SC and FPE indicate using 2 lags. The results show that past unemployment $* log\ (Unem_{t-1})$ holds positive significance on the inflation rate with p-value = 0.01. Moreover, all the roots stand within the unit circle. In the case of Bosnia and Herzegovina, the VAR model stands as follows:

$$log\ log\ (Infl_{BH})\ = 0.05 - 0.04log(Infl_{t-1}) + 4.98log\ (Unem_{t-1}) - 0.26log(Infl_{t-2}) - 0.12log\ (Unem_{t-2})$$

Also in the case of Bosnia, the information criteria confirm using 2 lags. The unit root was within the cycle while none of the variables show significance levels since p-value > 0.05. The VAR estimated equation for Serbia holds the following equation:

$$log\ log\ (Infl_{SRB})\ = -0.08 - 0.31log(Infl_{t-1}) + 0.29log\ (Unem_{t-1}) - 0.15log(Infl_{t-2}) - 0.09log\ (Unem_{t-2})$$

In the case of Serbia again the p-value of each variable stands higher than the 5% significance level. The roots for Serbia stand within the unit circle (0.5851, 0.5851, 0.3786, 0.3786). For North Macedonia, the equation takes this form:

$$log\ log\ (Infl_{NM})\ = -0.0004 - 0.29log(Infl_{t-1}) + 5.95log\ (Unem_{t-1}) - 0.04log(Infl_{t-2}) - 9.43log\ (Unem_{t-2})$$

The optimal legs for North Macedonia are 2 while only one root stands beyond the cycle (1.188, 0.7035, 0.3613, 0.3613). The p-value in each of the variables exceeds the 5% significance level. VAR model in the case of Kosovo takes the following form:

$$log\ log\ (Infl_{RKS})\ = 0.02 - 0.41log(Infl_{t-1}) + 3.13log\ (Unem_{t-1}) + 0.03log(Infl_{t-2}) + 0.34log\ (Unem_{t-2})$$

The model for Kosovo indicates a p-value > 5% while all the roots are within the unit circle (0.7309, 0.7309, 0.4369, 0.1112). While the equation for Montenegro stands in this form:

$$log\ log\ (Infl_{MNT})\ = -0.09 - 0.59log(Infl_{t-1}) - 8.75log\ (Unem_{t-1}) - 0.02log(Infl_{t-2}) + 6.71log\ (Unem_{t-2})$$

The VAR model for Montenegro indicates that none of the variables linked with past inflation and past unemployment do significantly affect the inflation rate. The p-value of each variables is above 5% significance level except $log\ (Unem_{t-1})$ where p-value = 0.052. However, the VAR estimation models for each country can be better interpreted after using the impulse response function.

4.3 **Diagnostic Tests and Impulse Response Function**

To identify the serial correlation issues, a Portmanteau Test (asymptotic) has been conducted. Since the p-value > 0.05, then the model for each country does not suffer from the serial correlation problems.

Table 3. Testing for normality, serial correlation, and heteroscedasticity.

	Serial correlation test (Portmanteau Test)/ p-value	**ARCH (multivariate) Heteroscedasticity/ p-value**	**JB-Test (multivariate) Normality Test/ p-value**	**Skewness Normality Test/ p-value**	**Kurtosis Normality Test/ p-value**
Croatia	0.97	1	0.62	0.31	0.85
Slovenia	0.93	1	0.98	0.95	0.90
Bosnia and H.	0.83	1	0.03	0.04	0.13
Serbia	0.91	1	0.57	0.24	0.94
Montenegro	0.95	1	0.94	0.71	0.95
Kosovo	0.97	1	0.98	0.92	0.97
N. Macedonia	0.98	1	0.35	0.13	0.79

Source: Authors elaborations based on the World Bank database [Prepared in R-Studio].

According to Table 3, ARCH (multivariate) indicates that the p-value is higher than the 5% significance level and none of the country's models contains heteroscedasticity issues. Standing on the JB-Test, Skewness, and Kurtosis we can consider that the VAR model passes the normality tests. The countries where the p-value is higher than the 5% significance level indicate that data are normally distributed. However, in the case of Bosnia and Herzegovina, our data do not pass the normality test since the pa-value for JB-Test and Skewness is lower than 5%.

Table 4 shows the Granger causality test linked with the relationship between inflation and unemployment for each respective state. The first hypothesis (H0) claims that inflation does not cause unemployment. We cannot reject the first hypothesis since the p-value is higher than 5% for each country. The second hypothesis (H0) shows that unemployment does not Granger cause inflation and also this one we cannot reject since the p-value is higher than 5%. We can conclude that inflation does not Granger cause unemployment and the other way around. Standing on the results of Table 4 there is no causal effect between inflation and the unemployment rate.

Table 4. Granger causality test about unemployment and inflation.

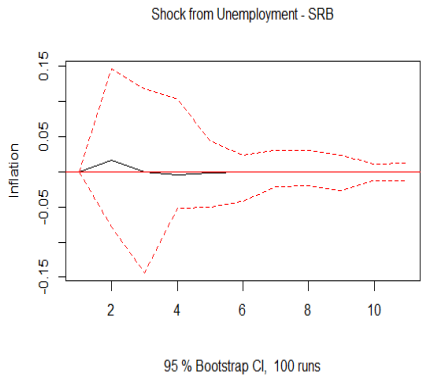
	Granger causality H0: Inflation do not Granger-cause Unemployment	**Granger causality H0: Unemployment do not Granger-cause Inflation**
Croatia	p-value = 0.90	p-value =0.95
Slovenia	p-value =0.75	p-value =0.42
Bosnia and Herzegovina	p-value =0.92	p-value =0.48
Serbia	p-value =0.36	p-value =0.97
Montenegro	p-value =0.46	p-value =0.09

Kosovo	p-value =0.77	p-value =0.55
North Macedonia	p-value =0.74	p-value =0.77

Source: Authors elaborations based on the World Bank database [Prepared in R-Studio].

Figure 5 represents the effect from the impulse response function (irf) analyzing shocks from unemployment to inflation, coded in R-studio for 20 periods ahead. The positive shock on the unemployment rate tends to deliver diverse results for each country. In the case of Slovenia (SLO) the positive shock of unemployment tends to bring a negative effect on inflation while in the long run the effect is smoothed. Because of the large error term, the shocks from unemployment to inflation are hard to identify in the case of Croatia (CRO). The case of Bosnia and Kosovo shows that shock of unemployment holds only a positive short-run effect on inflation. To this end, no short-run or long-run effect is detected in the case of Serbia. Inflation in Montenegro in the short run tends to react negatively and then positively from the unemployment shocks. The best representation is North Macedonia where the positive shocks from unemployment are associated with short and long-run effects and the very low error term.


Shock from Unemployment - BH
Inflation
0.4
0.2
0.0
-0.2
-0.4
2
4
6
8
10
95 % Bootstrap CI, 100 runs


Shock from Unemployment - SRB
Inflation
0.15
0.05
-0.05
-0.15
2
4
6
8
10
95 % Bootstrap CI, 100 runs


Shock from Unemployment - MNT
Inflation
0.4
0.2
0.0
-0.2
-0.4
2
4
6
8
10
95 % Bootstrap CI, 100 runs

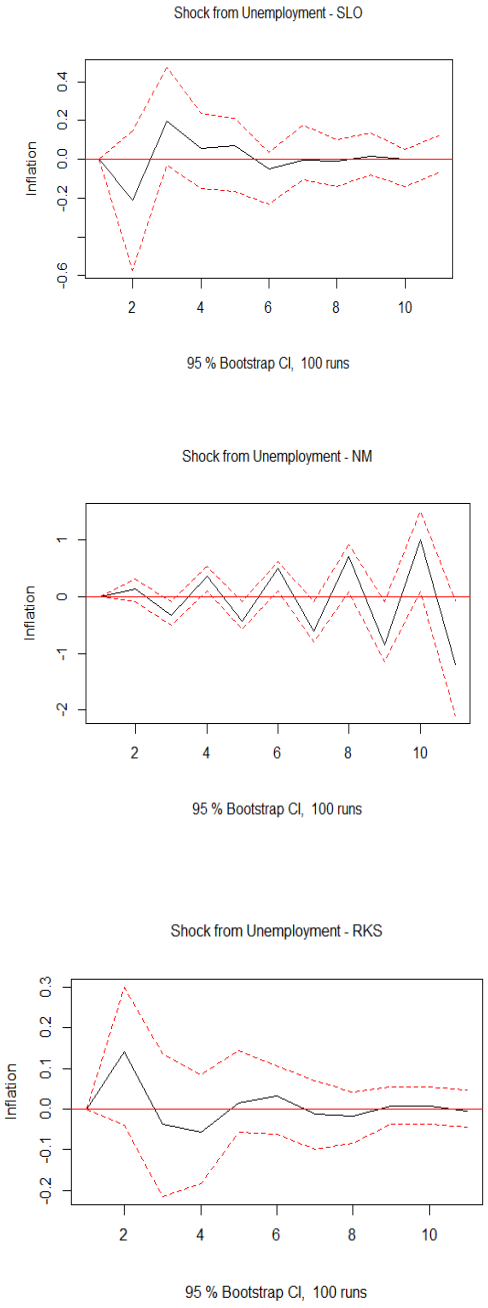


Fig. 5. Impulse response function of positive shocks caused from unemployment to inflation.
Source: Authors elaborations based on the World Bank database [Prepared in R-Studio].

4.4 **Johansen Co-integration test**

Johansen Co-integration test is one of the widely used techniques for measuring the relationship between time series variables. We have used this method separately for each country by implementing identical criteria. Table 5 identifies the integration between unemployment and inflation using Trace Statistics and Maximum Eigenvalue. One of the necessary steps in this process is defining the information criteria based on HQ, SC, AIC, and FPE. Outputs generated from the R-studio program suggest using n=5 lags, so in this case we have used 4 (n-1) lags in each model. Following the required procedures, we have used a 5pct significance level since in the social sciences it is preferred to be used this level of significance.

Table 5. Johansen Co-integration test based on Trace Statistics and Maximum Eigenvalue.

		Trace Statistics				**Maximum Eigenvalue**			
		test	10pct	5pct	1pct	test	10pct	5pct	1pct
Croatia	r <= 1	2.51	7.52	9.24	12.97	2.51	7.52	9.24	12.97
	r = 0	38.13	17.85	19.96	24.60	35.62	13.75	15.67	20.20
Slovenia	r <= 1	4.75	7.52	9.24	12.97	4.75	7.52	9.24	12.97
	r = 0	14.18	17.85	19.96	24.60	9.43	13.75	15.67	20.20
Bosnia	r <= 1	9.26	7.52	9.24	12.97	9.26	7.52	9.24	12.97
	r = 0	23.40	17.85	19.96	24.60	14.14	13.75	15.67	20.20
Serbia	r <= 1	5.59	7.52	9.24	12.97	5.59	7.52	9.24	12.97
	r = 0	35.70	17.85	19.96	24.60	30.11	13.75	15.67	20.20
Montenegro	r <= 1	3.85	7.52	9.24	12.97	3.85	7.52	9.24	12.97
	r = 0	24.79	17.85	19.96	24.60	20.94	13.75	15.67	20.20
Kosovo	r <= 1	3.09	7.52	9.24	12.97	3.09	7.52	9.24	12.97
	r = 0	22.23	17.85	19.96	24.60	19.14	13.75	15.67	20.20
Macedonia	r <= 1	2.87	7.52	9.24	12.97	2.87	7.52	9.24	12.97
	r = 0	27.06	17.85	19.96	24.60	24.18	13.75	15.67	20.20

Source: Authors elaborations based on the World Bank database [Prepared in R-Studio].

Results from Table 5 indicate the number of co-integration relations we have in our system. Since we are dealing with two variables for each country, the system could deliver maximum one co-integration relation. For r = 0 in the case of Croatia considering trace statistics, test statistics (38.13) is higher than 5pct (19.96) while for r <= 1 test statistics (2.51) is lower than 5pct (9.24). Identical outcomes follow results from Maximum Eigenvalue where for r = 0, test statistics is higher than 5pct while for r <=1 the results show that test statistics is lower than 5pct. According to the Trace Statistics and Maximum Eigenvalue there exist one co-integration relation between unemployment and inflation for Croatia. In the case of Slovenia, no co-integration relation is detected between unemployment and inflation, since test statistics are lower than 5pct both in Trace Statistics and Maximum Eigenvalue. However, for the other

countries such as Bosnia and Herzegovina, Serbia, Montenegro, Kosovo, and Macedonia there exists one co-integration relation between unemployment and inflation.

5. Conclusion

Uncontrolled inflation seems to be a phenomenon of the last century, although in the meantime it exist in countries with fragile democracy. Recently the hyperinflation revealed in Venezuela and the former Republic of Rhodesia (Zimbabwe) had catastrophic consequences for the economies and peoples' lives. The Socialist Federal Republic of Yugoslavia inherited a collective memory of uncontrolled inflation and high unemployment at the same time. Even though these countries come from the common semi-planned economies, they currently apply diverse monetary policies, tax systems and practice unique economic incentives. In this context, Kosovo and Montenegro apply the euro without being part of the Eurozone while other countries possess their national monetary policies. The study analyzes the relationship between inflation and unemployment for the seven former Yugoslav countries covering the period from 2003 to 2020. The coefficients from Ordinary Least Square show that the inverse relationship between inflation and unemployment holds only for Montenegro, Slovenia, and Croatia. On the other hand, the VAR estimation model indicates that only in the case of Slovenia past unemployment tends to significantly influence past inflation. The Granger causality test for the seven former Yugoslav countries confirms that both inflation and unemployment do not contain a granger effect on each other. The impulse response function (irf) shows that the positive shock of unemployment hold only a short-term impact on the inflation rate in the context of Serbia, Bosnia, Kosovo, Croatia, Slovenia, and Montenegro. In contrast, irf outcomes for North Macedonia tend to be different where the shock from unemployment to inflation carry not only short-run but also long-run effects. The results from the Johansen co-integration test indicate that there exists one co-integration relation between unemployment and inflation for six selected countries, besides for Slovenia. The limitations of this study are mainly related to the period it covers and the fact that the model is constructed on solely two variables. Future studies might investigate why this unclear relationship exists between unemployment and inflation in these countries by involving other macroeconomic indicators.

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