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PHILLIPS CURVE AND OKUN'S LAW IN TRANSITION COUNTRIES WITH MODERATE AND INCREASED INFLATION

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Abstract: *In this research, the economic growth of individual national economies, price stability and the level of unemployment in transition countries were observed, using data from the official institutions of three countries (Bosnia and Herzegovina, Republic of Croatia and Republic of Serbia), before and after the sudden general increase in prices from 2021. and now, for the period 2015-2024, with the aim of searching for clear causalities between them. Fundamental research conducted in the world during the 60s of the last century, which resulted in the creation of macroeconomic postulates such as the Phillips curve and Okun's law, are subject to review - considering the many global changes that occurred after them. Using data from official state institutions, methods of statistical data processing in the SPSS package, methods of analysis and synthesis, induction and deduction, and the general method of cognition, it was observed that the Phillips curve obtained for each of the mentioned national economy does not show the existence of dependence of variables, and Okun's law did not show credibility. Greater causalities can be observed in more economically developed countries within the framework of transition countries, in this research in the Republic of Croatia. Also, the strong influence of external factors on national economies has weakened the management capabilities of states through monetary and fiscal measures.*

Keywords*: economic growth, Phillips curve, Okun's law, transition countries*

JEL classification: *C1, P24, E01*

INTRODUCTION

The connection between economic growth, unemployment and inflation has been in the focus of researchers for decades, and it is also the subject of this research. Search for exact causality between these variables has gained particular importance due to the strong rise in prices that we have witnessed with the declaration of the Covid-19 pandemic, and the war in Ukraine. As far back as 1962, the Canadian economic expert Arthur Phillips established a connection between the general rise in pric-

es, unemployment and economic growth. Trivariate dependence was used for the first time, and it is represented by the well-known Phillips curve: with higher new inflation, the employment rate and the total gross domestic product increase, but up to a certain point, when increased inflationary pressure leads to a decline in economic indicators. After Phillips, numerous scientists studied this economic dependence, and contributed their research to the aforementioned economic discipline. After decades of careful research of different national economies and internal and external factors that negate, reduce or emphasize the mentioned causality, researchers opted for subsequently formed economic schools - Keynesian or neoclassical. The followers of Keynes' teaching start from price rigidity. By increasing the amount of money in circulation, which leads to an increase in prices, unemployment is reduced. The neoclassical school also does not dispute that the monetary tools used by the state, which relate to the amount of money in the economy, lead to an increase in prices, however the increase is nominal, therefore, money is neutral, and there is no real economic growth. Today, the prevailing opinion among most economists is that the Keynesian school is right in the short term, but in the long term the neoclassical school is ahead. As the prices of various goods rise, the demand for them falls, but in the short term the existing contracts in the economy are in force, which leads to an increase in employment and an increase in economic activities. Only after the adjustment of the market, inflation leads to a decrease in the supply of the same goods, therefore, less production engagement, less employment, until the moment when a new equilibrium point is formed. The flexibility of prices and earnings is made possible by the aforementioned adjustments. However, Phillips himself quickly realized that the causality between the two variables is not always empirically confirmed, so the Phillips curve was expanded with the concepts of the natural rate of unemployment, which cannot be reduced by inflation, as well as the concept of rational expectations. The concept of the natural rate of unemployment in economic theory was first mentioned by the famous Milton Freeman in 1961. Later, by introducing new concepts into the theory, Phillips curve was modified. Economists realized that in the economy there are results of participant's expectations, which increase worker's wages at the same rate as expected inflationary pressures, not only simultaneously or subsequently, but also previously.

The aim of the research is to verify the existence of causality between inflation, unemployment and economic growth in transition countries. In this way, the academic community would gain new knowledge in the study of the macroeconomy of transitional economies. Governments of transition countries could use the research when creating macroeconomic policy.

The defined hypothesis for this research is as follows: The postulates of the Phillips curve and Okun's law cannot be applied in transition countries.

A concept closely related to the concept of the Phillips curve is Okun's law, which states that for every 2% drop in GDP, the unemployment rate, on the other hand, increases by 1%. So, in the event that the GDP amounts to 10 billion monetary units, and registered unemployment registers a rate of 6%, the reduction of GDP to 9.98 billion monetary units, unemployment would increase to 7%. (Samuelson, 2007). In practical life, Okun's law says that the economy should definitely experience continuous growth in order for the unemployment rate to remain approximately the same.

Philips curve and Okun's law were created in developed countries. However, there are different ways to conduct macroeconomic policy in transition countries. For this reason, it is necessary to examine the validity of established causalities in countries that are (still) in the transition between socialist and capitalist economic systems.

METHODOLOGY AND DATA

During the research, data published by the state agency for processing statistical data were used, namely the Bulletin of the National Bank of Serbia for the period 2015-2024, Annual Reports of the Croatian National Bank for the period 2015-2024, Reports of the Bureau of Statistics of Bosnia and Herzegovina for the period 2015-2024.

IBM SPSS Statistics v29.0.2 was used for data processing. The following statistical processing was used in the work:

1.Descriptive statistics for calculating the mean and standard deviation,
2.Shapiro-Wilk test for testing the normality of distributions,
3.Spearman's coefficient for correlation testing,
4.Bayesian regression for examining statistically significant relationships.
5.Augmented Dickey-Fuller (ADF) test
6.KPSS (Kwiatkowski-Phillips-Schmidt-Shin) test

Results of the research were reached by comparing the relationship between variables in developed countries with the results obtained in this research, using the methods of induction and deduction, analyses and syntheses and the general cognitive method. The observed period included not only a relatively stable economic environment, but also a crisis period from 2021 onwards.

PREVIOUS RESEARCH

Considering the constant need of national economies to increase economic growth and reduce unemployment, there are numerous authors who have contributed to researching the actuality of the Phillips curve with the aim of improving it.

Interesting research (Hooper, Mishkin, & Sufi, 2020)) was conducted on the United States market. Authors noticed that a large number of authors reject the postulates of the Phillips curve in their research, and they analyzed the macroeconomic data of states and cities within the USA. They came to the conclusion that the linearity of macroeconomic data weakens significantly after 1980, but significantly more in terms of changes in wage prices, and less so in product prices. They attribute the above to the state's strong regulatory anti-inflationary policies, but they emphasize that the use of the Phillips curve is still an important tool in managing unemployment in the country, and should not be ignored. Researchers in India (Bahera, Wahi, & Kapur, 2018) investigated the relationship between prices and employment, in a large growing economy, and noted that the Phillips curve in India has flattened, as a result of macroeconomic measures to curb inflation. The demand for all goods is stronger than the supply, which pushes product prices up, and the monetary instruments implemented by the Indian central bank give a distorted picture of the existence of the Phillips curve, which the authors claim is still relevant. In Eorozone, authors (Hidrayanto, Samarina, & Stange, 2019) have conducted a research on relationship between inflation and employment in Eurozone, focusing on Germany, France and The Netherlands. They have observed

three characteristics: first, the relationship between unemployment and inflation is negative and significant; second, the slope of Phillips curve is heterogenerous by countries; and third, the slope has not significantly changed since economic financial crisis. Also, for the period from 1990 to 2019, the authors (Azam, Rasheed, & Khan, 2022) studied the relationship between the inflation rate and the unemployment rate in the countries of the Middle East and North Africa. They found that there is no inverse relationship between them in the long run. In the short term, the relationship is negative, but insufficient to be used in macroeconomic policy, therefore without significance. A group of authors from Croatia (Recher, Marina, & Palić, 2017) studied the Phillips curve in the economy they reside in for the period from 2000 to 2016, and determined that in the long term there is neither positive nor negative causality between the unemployment rate and inflation. Lojanica and Obradović (2019) analyzed the relationship between unemployment and inflation for the countries Romania, Albania, Macedonia, Serbia and Montenegro in the period from 1995 to 2015, and concluded that the rules of the Phillips curve are not appropriate for the mentioned countries, but they concluded that there is slight positive dependence between the mentioned variables.

In the Northern Europe, among the Baltic countries, research was conducted on the relationship between the unemployment rate and real economic growth and inflation (Dabušinskas & Kulikov, 2007). The authors determined that the current inflation rate is determined not only by previous inflation rates, but by new marginal costs. Warsame at al. (2022)found a negative relationship between economic growth and unemployment in Somalia in the short and long term, and thereby confirmed the existence of Okun's law. They found a negative connection between inflation and unemployment, i.e. Phillips curve in the short term, with insignificant association of variables in the long term. In South Africa, a study was conducted (Buthelezi, 2023), which determined the existence of the Phillips curve conditioned by other macroeconomic factors, so for the observed countries, an increase in inflation by 1% led to an increase in unemployment by 2.26%, i.e. a decrease in unemployment by 0.06 %. The American authors McLey and Tenreyro (2019) investigated the factors that influence the existence of the Phillips curve and established the following: if monetary policy is aimed at minimizing welfare losses, represented as the sum of the deviation of inflation from the target and the output of inflation potential, the central bank will increase inflation, if the outcome is below potential. Research on forecasting inflation in the euro zone (Banbura & Bobeica, 2023) shows that it is possible to apply the Phillips curve of a newer generation with several time-varying factors. It is difficult to forecast inflation in the Euro area on the eve of the Economic and monetary union and after the sovereign debt crisis. Researchers from United States (Smith, Timmermann, & Wright, 2024) revisited the Phillips curve for the United States and the European Union, using Bayesian panel methods. They found that the Phillips curve still exists, and is relatively abrupt when the economy heats up. The evidence is weaker on the Phillips curve of wages. Molnar, Varga & Cziszarik-Koscir (2024) connected microeconomic behavior with macroeconomic theory, and determined through game theory that price adjustments, not increased demand, drive production in the long run and confirm the classic Phillips curve in the long run. However, in the short term, a gradual price adjustment is shown, after demand shocks.

On the other hand, there are authors who do not agree with the application of the classic Phillips curve. Researchers Benigno & Eggertson (2024) looked at data

from large industrialized economies of different countries, specifically data from 2009 to 2020. They found that the sloped-L Phillips curve has better prognostic possibilities than the classic Phillips curve. Authors Do and Spanos (2024) claim that the traditional approach to studying the relationship between inflation and unemployment rests on theoretical assumptions that are not reliable, so the most influential empirical works that confirmed the existence of the Phillips curve are also unreliable. In the American market, the relationship between inflation and unemployment was observed in the New Keynesian framework (Haschka, 2024). It was found that the Phillips curve weakened from the 1980s onwards, especially during the Covid-19 pandemic, due to the forces of globalization and better-formed inflationary expectations resulting from a more credible monetary policy.The research carried out in the ASEAN region (Wardhono, Nasir, Qori'ah, & Indrawati, 2021) shows that the neo-Keynesian Phillips curve can explain the dynamics of each country in this group, with the fact that changes in inflation are not completely influenced by inflation expectations, but also by the product gap, changes in the money supply and the exchange rate. The pattern of formation of inflation expectations is directed both forward and backward, but backward behavior is more dominant. Martins and Verona (2024) decomposed inflation time series into several frequency ranges, and made predictions for each frequency component of inflation. As follows they contributed to the New Keynesian view of the relationship between inflation and unemployment. In the countries of Central and Eastern Europe, on the example of small open countries, evidence supporting the neo-Keynesian approach regarding the use of survey inflation expectations was confirmed. Also, Crump Eusepi, Giannoni, & Şahin (2024) through his research through the challenges brought by the Covic-19 pandemic confirms the patterns that comprise the neo-Keynesian approach to inflation and unemployment. A contribution was also made by Lavoie (2023), who observed productivity growth, wage inflation and the possibility of a flat Phillips curve within the post-Keynesian model of conflicting claims.

Given that the economic relations have changed significantly if you compare the years when the Phillips theorem was formed with the years in which we live, many authors over the years have included variables that affect inflation, universal or specific to certain areas, in the theorem. Also, we are witnessing a sudden increase in inflation as a result of the Covid-19 pandemic as well as the war in Ukraine, which were a strong inflationary trigger, and all countries around the world recorded an increased rate of inflation during the past few years.

Empirical evidence

Below is an overview of macroeconomic indicators - quartal inflation rate, unemployment rate and gross domestic product (GDP) growth rate.

Bosnia and Herzegovina

Table 1 presents the annual inflation rate, the annual unemployment rate and the percentage change in the gross national product in the period 2015-2024. year. The observed period is particularly interesting because it represents a number of years with moderate inflation, but also a large increase in inflation during 2022 as a result of the previously mentioned destabilizing macroeconomic factors of the world economy.

Table 1: Quartal rates of inflation, unemployment and gross domestic product in the period 2015-2024. in Bosnia and Herzegovina

No	Year	Year inflation (%)	Unemployment (%)	GDP(%)
1	1st Q 2015	4,2	43,1	3,0
2	2nd Q 2015	3,9	43,1	3,2
3	3rd Q 2015	3,7	43,0	3,2
4	4th Q 2015	4,0	42,9	3,1
5	1st Q 2016	3,9	42,8	3,1
6	2nd Q 2016	3,2	42,1	3,3
7	3rd Q 2016	3,5	41,5	3,2
8	4th Q 2016	3,6	40,9	3,3
9	1st Q 2017	3,9	40,2	3,2
10	2nd Q 2017	3,7	39,5	3,4
11	3rd Q 2017	3,1	38,7	3,4
12	4th Q 2017	3.6	37,7	3,3
13	1st Q 2018	2,8	35,4	3,2
14	2nd Q 2018	2,2	32,7	3,9
15	3rd Q 2018	1,9	31,4	3,9
16	4th Q 2018	1.4	30,3	3,8
17	1st Q 2019	1,4	30,3	2,9
18	2nd Q 2019	1,3	30,5	2,6
19	3rd Q 2019	1,2	30,3	2,4
20	4th Q 2019	1.2	30,7	2,6
21	1st Q 2020	1,0	31,2	2,8
22	2nd Q 2020	-0,1	32,3	0,2
23	3rd Q 2020	0,3	33,1	-2,6
24	4th Q 2020	0,1	33,6	-3.2
25	1st Q 2021	1,5	33,9	-2,6
26	2nd Q 2021	1,9	32,9	3,4
27	3rd Q 2021	2,4	31,8	7,2
28	4th Q 2021	2,2	31,2	8,0
29	1st Q 2022	8,9	31,5	7,1
30	2nd Q 2022	21,3	31,1	4,5
31	3rd Q 2022	17,2	30,9	2,8
32	4th Q 2022	14.0	30,4	3,8
33	1st Q 2023	13,8	30,8	3,5
34	2nd Q 2023	7,8	29,2	3,4
35	3rd Q 2023	7,2	29,0	2,0
36	4th Q 2023	6,2	28,7	2,2
37	1st Q 2024	6,0	28,4	2,4
38	2nd Q 2024	5,4	28,3	2,8
39	3rd Q 2024	5,1	28,1	3,1
40	4th Q 2024	4,8	28,1	3,3

Source: Bureau of Statistics of Bosnia and Herzegovina (2015-2024)

From the overview in Table 1 it can be seen that during the period before the appearance of one of the sudden increase in inflation causes, meaning, in relatively stable macroeconomic conditions, annual inflation is not correlated with unemployment. We can make the same claim for the conditions of increased macroeconomic instability.

So, although the Phillips theorem claims that a rise in inflation could lead to a reduction in the unemployment rate, Table 1 shows that the inflation rate recorded a slight decline, and that the unemployment rate was also falling, but at a faster rate. The same observations can be made by looking at the causality of Okun's law, which states that for a 2% drop in GDP, the unemployment rate, on the other hand, increases, but by 1%. Except for the sixth year in one way and the seventh observed year in another way, within the observed period, the gross domestic product recorded a relatively stable growth, but unemployment recorded a decline. During the year 2020, during the Covid 19 pandemic, a drop in GDP by 3.2% was recorded, but also an increase in unemployment by 2.9%. If Okun's law was correct, unemployment growth would be 1.6%.

On the example of the economy of Bosnia and Herzegovina, the existence of the legality of the Phillips curve, but also of Okun's law, cannot be confirmed.

Republic of Serbia

Observing the annual rates of inflation, unemployment and gross domestic product in the Republic of Serbia, as shown in Table 2, similar conclusions were reached.

Table 2: Quartal rates of inflation, unemployment and gross domestic product in the period 2015-2024 in the Republic of Serbia

No	Year	Inflation(%)	Unemployment (%)	GDP (%)
1	1st Q 2015	1,9	19,0	0,1
2	2nd Q 2015	1,9	17,3	1,2
3	3rd Q 2015	1,4	16,7	2,2
4	4th Q 2015	1.5	17,9	1,8
5	1st Q 2016	0,6	18,0	2,6
6	2nd Q 2016	0,3	15,2	2,9
7	3rd Q 2016	0,6	13,8	3,7
8	4th Q 2016	1,2	13,0	3,3
9	1st Q 2017	3,6	14,8	2,4
10	2nd Q 2017	3,6	11,8	2,0
11	3rd Q 2017	3,2	12,9	2,4
12	4th Q 2017	3,0	14,7	2,1
13	1st Q 2018	1,4	14,8	5,1
14	2nd Q 2018	2,3	11,9	5,4
15	3rd Q 2018	2,1	11,3	4,5
16	4th Q 2018	2,0	12,9	4,5
17	1st Q 2019	2,8	12,0	2,9
18	2nd Q 2019	1,5	11,1	3,3

19	3rd Q 2019	1,1	10,3	5,5
20	4th Q 2019	1,9	10,4	4,3
21	1st Q 2020	1,3	10,5	5,7
22	2nd Q 2020	1,6	7,9	-7,0
23	3rd Q 2020	1,8	9,8	-1,3
24	4th Q 2020	1,6	9,7	-0.9
25	1st Q 2021	1,8	12,8	1,5
26	2nd Q 2021	3,3	11,2	14,8
27	3rd Q 2021	5,7	10,6	8,1
28	4th Q 2021	6,6	10,9	7,7
29	1st Q 2022	9,1	8,9	4,7
30	2nd Q 2022	11,9	9,0	4,2
31	3rd Q 2022	14,0	9,4	0,9
32	4th Q 2022	15,1	10,1	1,0
33	1st Q 2023	16,2	9,6	2,3
34	2nd Q 2023	13,7	9,0	3,0
35	3rd Q 2023	10,2	9,1	4,8
36	4th Q 2023	7,6	9,0	5,1
37	1st Q 2024	5,0	9,4	4,7
38	2nd Q 2024	3,8	8,9	4,2
39	3rd Q 2024	4,2	8,1	3,1
40	4th Q 2024	4,3	8,3	4,0

Source: Annual reports od National Bank of Serbia (2015-2024)

During the observed period, shown in Table 2, the unemployment rate in the Republic of Serbia continuously fell, while the inflation rate was at a low level, ranging from 1.5% to 3% maximum until 2021. Due to macroeconomic disturbances, the years 2021 and 2022 were marked by a significant increase in inflation and a slight increase in unemployment, which is in complete contradiction to the claims of Phillips' theorem.

Okun's law also does not apply in the short or long term in the observed period, even in moments of disruption on the world economic level. The data related to the year 2021 are interesting: inflation growth, unemployment growth, GDP growth , while in 2022 the increased inflationary pressure resulted in a renewed drop in the unemployment rate and moderate GDP growth, which is in great contrast to the postulates of the considered theorems.

Republic of Croatia

Table 3 shows data on the rates of inflation, unemployment and the gross domestic period for the same period as for the previous two analyzed countries.

Table 3. Quartal rates of inflation, unemployment and gross domestic product in the period 2015-2024. in the Republic of Croatia

No	Year	Inflation (%)	Unemployment (%)	GDP (%)
1	1st Q 2015	0,1	19,3	1,8
2	2nd Q 2015	0	15,8	1,5
3	3rd Q 2015	-0,8	15,9	4,1
4	4th Q 2015	-0.6	17,7	1,5
5	1st Q 2016	-1,7	16,5	4,5
6	2nd Q 2016	-1,6	13,0	3,0
7	3rd Q 2016	-0,9	12,6	2,2
8	4th Q 2016	-0,3	14,1	4,6
9	1st Q 2017	1,1	13,6	2,3
10	2nd Q 2017	0,7	10,1	3,2
11	3rd Q 2017	1,4	10,1	4,4
12	4th Q 2017	1,3	11,2	2,9
13	1st Q 2018	1,1	10,8	1,9
14	2nd Q 2018	2,4	8,2	3,5
15	3rd Q 2018	1,4	7,8	3,0
16	4th Q 2018	1,5	8,9	2,8
17	1st Q 2019	0,8	8,8	4,8
18	2nd Q 2019	0,9	6,6	3,1
19	3rd Q 2019	0,6	6,6	2,9
20	4th Q 2019	1,4	7,9	1,9
21	1st Q 2020	0,6	8,5	-1,3
22	2nd Q 2020	-0,2	9,0	-15,7
23	3rd Q 2020	0	8,7	-11,0
24	4th Q 2020	-0,7	9,3	-3,7
25	1st Q 2021	1,2	9,2	3,8
26	2nd Q 2021	2,0	7,4	19,7
27	3rd Q 2021	3,3	6,9	15,9
28	4th Q 2021	5,5	7,9	10,8
29	1st Q 2022	7,3	7,4	7,9
30	2nd Q 2022	12,1	6,1	9,9
31	3rd Q 2022	12,8	6,0	7,8
32	4th Q 2022	13,1	6,8	3,6
33	1st Q 2023	10,7	6,5	2,2
34	2nd Q 2023	7,6	5,5	3,9
35	3rd Q 2023	6,7	5,8	2,0
36	4th Q 2023	4,5	6,4	5,3
37	1st Q 2024	4,1	6,2	4,0
38	2nd Q 2024	2,4	4,7	3,5
39	3rd Q 2024	1,6	4,6	3,9
40	4th Q 2024	3,4	5,1	3,8

Source: Annual report of Croatia National Bank (2015-2024)

During the observed ten years, the Republic of Croatia recorded a continuous increase in the unemployment rate, while before the macroeconomic disturbances inflation was at an extremely low level: it ranged from a deflationary -0.6% to 1.5%. Although inflation in this observed country is observed already during the pandemic year of 2020, it leads to an increase in the unemployment rate by a full 1 percent but also to a drop in GDP by a high 8.6%, in the following year unemployment continues to fall, but also to a large increase in GDP. We can see the highest inflation rate in Croatia during 2022, but also a continuation of the unemployment rate and GDP growth. Taking the data from Table 4 into account, we can conclude that the laws of the Phillips curve and Okun's law cannot be applied to this transition country.

RESULTS OF DATA PROCESSING IN THE SPSS PACKAGE AND DISCUSSION

The Shapiro-Wilk test of normality of the distribution determined that there is a significant deviation from the assumptions of the normal distribution, that is, the distribution is asymmetric.

For this reason, non-parametric statistics Spearman's correlation and Bayesian statistics were applied.

Table 4: Results of checking the correlation between variables

Country N=40			Quartal	Inflation(%)	Unempoyment (%)	Growth GDP (%)
Bosna and Herzegovina	Quartal	rho	1,000	,330*	-,862**	-0,016
		p		0,038	0,000	0,921
	Inflation (%)	rho	,330*	1,000	-0,207	0,057
		p	0,038		0,199	0,727
	Unepoloyment (%)	rho	-,862**	-0,207	1,000	0,179
		p	0,000	0,199		0,268
	Growth GDP (%)	rho	-0,016	0,057	0,179	1,000
		p	0,921	0,727	0,268	
Republic of Croatia	Quartal	rho	1,000	,771**	-,922**	,319*
		p		0,000	0,000	0,045
	Inflation (%)	rho	,771**	1,000	-,785**	,471**
		p	0,000		0,000	0,002
	Unepoloyment (%)	rho	-,922**	-,785**	1,000	-,340*
		p	0,000	0,000		0,032
	Growth GDP (%)	rho	,319*	,471**	-,340*	1,000
		p	0,045	0,002	0,032	

Republic of Serbia	Quartal	rho	1,000	,710**	-,906**	0,290
		p		0,000	0,000	0,069
	Inflation (%)	rho	,710**	1,000	-,591**	0,111
		p	0,000		0,000	0,494
	Unepoloyment (%)	rho	-,906**	-,591**	1,000	-0,183
		p	0,000	0,000		0,257
	Growth GDP (%)	rho	0,290	0,111	-0,183	1,000
		p	0,069	0,494	0,257	

Source: Author's research

As seen in Table 4 in total or by phases, we do not have statistically significant correlations p>0.05, except for Croatia, where there is a weak connection between inflation and unemployment.

Below in Table 5, Table 6, Table 9 is an overview of the results processed by the Bayesian regression method for all three observed countries.

Table 5: Results obtained using Bayesian regression

Country	Bayes Factor[c]	R	R Square	Adjusted R Square	Std. Error of the Estimate
Bosna and Herzegovina	0,007	0,121	0,015	-0,067	1,719083
Republic of Croatia	0,047	0,337	0,114	0,040	5,516340
Republic of Serbia	0,030	0,300	0,090	0,014	3,149571

Source: Author's research

All Bayes factors are below 1, which means that there is no correlation between the variables.

Table 6: Bayesian Estimates of Coefficients

Country	Parameter	Posterior			95% Credible Interval	
		Mode	Mean	Variance	Lower Bound	Upper Bound
Bosna and Herzegovina	(Intercept)	-229,697	-229,697	236826,682	-1188,858	729,464
	Inflation (%)	0,015	0,015	0,005	-0,127	0,157
	Unemployment (%)	0,050	0,050	0,016	-0,201	0,301
	Quartal	0,115	0,115	0,057	-0,357	0,586
Republic of Croatia	(Intercept)	746,755	746,755	2187695,628	-2168,454	3661,964
	Inflation (%)	0,547	0,547	0,091	-0,049	1,142
	Unemployment (%)	-0,180	-0,180	0,274	-1,212	0,852
	Quartal	-0,368	-0,368	0,533	-1,807	1,072
Republic of Serbia	(Intercept)	-1497,870	-1497,870	738204,236	-3191,290	195,549
	Inflation (%)	-0,128	-0,128	0,024	-0,432	0,175
	Unemployment (%)	0,446	0,446	0,135	-0,279	1,172
	Quartal	0,741	0,741	0,180	-0,094	1,576

Source: Author's research

In Bosnia and Herzegovina, unemployment is not significantly related to GDP growth. This result indicates that Okun's law is not applicable in this context. Also, there is no relationship between the inflation rate and the unemployment rate. The results confirm that the Phillips curve and Okun's law are not valid for the period 2015–2023. Low values of correlation coefficients and high p-values indicate the absence of causal relationships between inflation, unemployment and GDP growth.

In the Republic of Serbia, there is also no significant connection between unemployment and GDP growth. There is no relationship between the inflation rate and the unemployment rate. That indicates the inapplicability of neither the Phillips curve nor Okun's law for Serbia.

The results ligthly support the Phillips curve in the Republic of Croatia, because there is a negative correlation between inflation and unemployment, but Okun's law is not confirmed, because there is no connection between unemployment and GDP.

Table 7: Results obtained using Bayesian regression ANOVA

Country	Source	Sum of Squares	Df	Mean Square	F	Sig.
Bosnia and Herzegovina	Regression	3,027	2	1,513	0,145	0,868
	Residual	62,709	6	10,452		
	Total	65,736	8			
Republic of Croatia	Regression	7,602	2	3,801	0,090	0,915
	Residual	254,498	6	42,416		
	Total	262,100	8			
Republic of Serbia	Regression	1,371	2	0,686	0,097	0,909
	Residual	42,609	6	7,101		
	Total	43,980	8			

Source: Author's research

Based on the results for Bosnia and Herzegovina, shown in Tables 5 - 7, we conclude that the Models are not statistically significant ($p > 0.05$), which means that the independent variables do not explain a significant amount of variation of the variables. The high residuals suggest that most of the variation in the dependent variable remain unexplained by the regression model. In the Republic of Serbia, the results showed, as well as for Bosnia and Herzegovina, that there is no statistical significance between the inflation, unemployment and GDP. The effects of independent variables are negligible. For the Republic of Croatia, the results from Table 5 show that the model is also not statistically significant ($p > 0.05$), which means that unemployment do not have a significant impact on GDP growth in Croatia, as well as in the previously observed countries. There is a weak conection between inflation and unempoyment, but high residual indicates a large number of variations in the dependent variable that cannot be explained by the model.

Table 8: Results obtained using ADF test

Country	Variable	ADF Statistic	p-value
Bosnia and Herzegovina	Inflation (%)	-2.28151	0.178
	Unempoyment (%)	-1.77772	0.392
	GDP growth (%)	-4.87855	0.000
Republic of Croatia	Inflation (%)	0.89424	0.993
	Unempoyment (%)	-2.08459	0.251
	GDP growth (%)	-3.40908	0.011
Republic of Serbia	Inflation (%)	-1.37992	0.592
	Unempoyment (%)	-2.48222	0.120
	GDP growth (%)	-5.12069	0.000

Source: Author

If all three variables are stationary (inflation, unemployment and GDP growth) in all countries, this means that their statistical properties (mean value, variance and autocorrelation) remain constant over time. In other words, the values of these economic variables do not show systematic trends or long-term changes, but return to some stable level.

Table 9: Results obtained KPSS test

Country	Variable	KPSS Statistic	p-value
Bosnia and Herzegovina	Inflation (%)	0.28333	0.100
	Unempoyment (%)	0.73925	0.010
	GDP growth (%)	0.05879	0.100
Republic of Croatia	Inflation (%)	0.47573	0.047
	Unempoyment (%)	0.79324	0.010
	GDP growth (%)	0.10591	0.100
Republic of Serbia	Inflation (%)	0.45936	0.052
	Unempoyment (%)	0.81683	0.010
	GDP growth (%)	0.12668	0.100

Source: Author

If inflation, unemployment or GDP growth is not stationary, this means that there is a long-term trend of growth or decline, which may indicate instability in the economy. If inflation is non-stationary, it may indicate hyperinflation or long-term deflation. If unemployment is non-stationary, this may mean that economic shocks permanently affect the labor market. If GDP growth is non-stationary, it may indicate that the economy is growing (or falling) in the long term, which requires an analysis of structural changes.

Transition countries have their own specificities that set them apart from developed and developing countries. The transition from socialist postulates to capitalist settings of the economy left its mark on the development and level of the domestic gross product, but also on other economic parameters. The effects of the war, especially in Bosnia and Herzegovina, which entered the transition period with a destroyed economy and high unemployment, were the basis for the mismatch of social and economic variables. Even decades after the abolition of socialist paradigms, they did not fully harmonize with those in developed countries.

As it is well known, national economies function according to the principles of a market economy or a planned or contractual economy, which operates on the basis of command. They are characterized by strong state interventionism. The developed countries of the world function on the basis of the confrontation of supply and demand for goods and services, with mild state interventionism. Transition countries fall between these two categories. The consequences of the incomplete transition are felt in all segments of the economy, and hence the common attitude that transition countries have their own specificities. High unemployment, management of the exchange rate in the hands of politics, which is in the case of Bosnia and Herzegovina strictly bound by the currency board, a cumbersome state administrative apparatus, a high level of corruption, government decisions that are used to influence social peace, a high level of the new gray economy and the like are just some of the characteristic of transition countries. According to the data published by the national statistical offices, in the past ten years, high unemployment still stands out as a feature of the observed national economies, but which, in general, tends to fall. In Bosnia and Herzegovina, unemployment in the period 2015-2020 was initially recorded as extremely high 42.9%, then fell in the following years, and in the observed period, a slight drop in inflation was recorded, from 4% to 1.2%, and a relatively even growth of the gross national product, of around 3.6% . Due to the worldwide macroeconomic disturbances caused by the Covid-19 pandemic and the war in Ukraine, the macroeconomic picture of this country has changed. In the short term, in the years 2020 and 2021, there was a fall in the inflation rate, and then growth, at the same time a fall in the gross domestic product, and growth that more than made up for the fall, and the unemployment rate rose slightly, and during 2023 returned to the downward trend. From the above, we conclude that Phillips curve and Okun's law are not recognized in the state of Bosnia and Herzegovina, although we emphasize that the gross domestic product in the short term showed an increase in economic activities compared to the previous trend. It should be emphasized that the decrease in unemployment stated in the data is a reflection of the economic recovery after the war, but also the reduction of the gray economy, which in Bosnia and Herzegovina, after the war, was at an extremely high level. In the Republic of Serbia, also in the period 2015-2020 a continuous decline in unemployment was registered, the inflation rate oscillated at a relatively low level, from 1.5-3%, and the gross domestic product was also moderate, until 2020, when additional anomalies can be observed. The inflation rate first increased, then it was balanced, a drop in GDP was registered, then a growth more than compensated for the previous decrease, and the rate increased first, and everything returned to its usual trend. From this, we conclude that the Phillips curve was not applied even in this transition country, nor was Okun's law. Also, this coun-

try recorded a first-rate momentum that strengthened the overall ten-year growth. In the Republic of Croatia, which is much stronger economically, a member of the European Union since 2013 and which has accepted the Euro as its national currency since 2023, unemployment was registered in the period 2015-2024 in constant decline, from 17.7% to 6.4%. In the observed period, the world's macroeconomic turmoil did not affect this indicator. On the other hand, inflation increased in 2020, then stabilized, then increased, but much more strongly in 2022. At the same time, the gross domestic product, which had a slight positive note, fell drastically in 2020. In the following year, it grew twice as much as compared to the earlier annual trend growth, but again not enough to not conclude that the decline slowed down the decade-long growth of the economy. The contours of the Phillips curve in the Republic of Croatia are, however, slightly noticeable. The Republic of Croatia is at a higher economic level compared to the previous two observed countries, economic reforms have been carried out on a larger scale, and this country is slowly losing the characteristics of a transition country. The same leads us to the conclusion that a higher degree of development and potential belonging to developing countries, with less state interventionism and more pronounced market postulates, the Phillips curve, can still be one of the tools for dealing with national economic variables, which should be the subject of another study. Observing the three national economies, in addition to the calculations mentioned in the research results, the following was observed:

1. During the period 2015-2020 in the conditions of moderate and stable inflation in the observed countries, the gross domestic product grew at a stable rate, and a drop in unemployment was registered;

2. In the conditions of the 2020 crisis caused by the Covid-19 pandemic, a decline in gross domestic product was registered, and inflationary tendencies fell in Bosnia and Herzegovina and the Republic of Serbia, and increased in the Republic of Croatia;

3. In the conditions of increased inflation in 2022, in the countries of Bosnia and Herzegovina and the Republic of Serbia, approximately the average growth rate of the gross domestic product is recorded, similar to the rates from the period without the crisis, and in the Republic of Croatia, a stronger economic momentum was recorded, but inflation took on rates of decline as in the period without crisis.

Also, in this research, we found that:

1. Inflation is stationary. This means that inflation in the analyzed countries does not have a long-term trend of growth or decline, rather it oscillates around an average value. Monetary policy can have efficient short-term effects, whether long-term inflationary pressures do not occur.

2. Unemployment is stationary. If the unemployment rate is stationary, it means that the market likes to adjust and return to an equilibrium level after economic shocks. Short-term changes in unemployment may be the result of temporary economic factors, or long-term unemployment does not show a permanent trend of growth or decline.

3. GDP growth is stationary. This means that economic growth oscillates around an average value, without long-term growth or decline. The economy does not have a permanent upward or downward trend, which may indicate low productivity or the absence of structural changes in the economy.

CONCLUSION

Although there are numerous studies that deal with finding clear legalities between the observed variables - inflation, unemployment and economic growth observed through the gross domestic product, the consensus of the researchers has not been reached. Each national economy has its own specificities that set it apart from the rest of the world, which certainly affects the establishment of economic laws that would apply to the entire world. We conclude that Phillips' curve and Okun's law could not be confirmed in the observed transition countries. Observing three macroeconomic parameters in three transition countries during the period 2015-2024, it was observed that the legalities that were pronounced through the Phillips curve and Okun's law were not confirmed. Greater interdependencies are observed in a country that is more on the path to a market economy. In the mentioned period, there were also global macroeconomic disturbances that affected this research, and it was possible to verify the existence of the above-mentioned laws both in the short and long term, i.e. in relatively stable situations, but also during world crises. In developed countries, as well as large emerging countries, researchers can find elements of established laws, but transition countries, due to their specificities, still cannot use macroeconomic tools to manage the level of the unemployment rate, inflation rate and gross national product in the way that the developed countries can. The knowledge gained in this research shows that in countries in transition, it is not possible to take only independent variables and simply compare them, but it is necessary to analyze the entire national economy, which has its own limitations, and it is necessary to observe other economic elements, which can be the subject of other researches. The obtained empirical knowledge can serve as a starting point for creating a different approach to the assessment and evaluation of macroeconomic indicators. The research confirmed the hypothesis - In transition countries, the interdependencies between economic growth, observed through the gross domestic product, unemployment and inflation have not been clearly established. The slight connection between observed macroeconomic parameters in the Republic of Croatia, which is more developed and already a member of the European Union, hints that with further development of the respective national economy, clearer connections between inflation, unemployment and GDP could be observed. After the implementation of reforms as a set of measures on the way to the accession of Bosnia and Herzegovina and the Republic of Serbia to the European Union, it would be interesting to repeat this research and determine whether there will be laws that justify the use of the Phillips curve and Okun's law as a macroeconomic tool.

LITERATURE

Azam, M., Rasheed, K., & Khan, S. (2022). Does the Phillips Curve Exist? *Journal of Central Banking Theory and Practice, Vol 3*, str. 59-78.

Bahera, H., Wahi, G., & Kapur, M. (2018). Phillips curve relationship in an emerging economy: Evidence from India. *Economic Analisies and Policies, Vol 59(C),* , str. 116-126.

Banbura, M., & Bobeica, E. (2023). Does the Phillips curve help to forecast euro area inflation? *International Journal of Forecasting, Vol 39, Issue 1*, str. 364-391.

Benigno, P., & Eggertsson, G. B. (2024). The Slanted-L Phillips Curve. *Understanding the return of inflation*, (str. 84-89).

Bereau of Statistics of Bosnia and Herzegovina. (2015-2024). *Annual Reports.*

Buthelezi, E. M. (January 2023). Impact of Inflation in Different States of Unemployment: Evidence with the Phillips Curve in South Africa from 2008 to 2022. *Economies, 11(1), 29*.

Croatia National Bank. (2015-2024). *Annual Reports.*

Crump, R. K., Eusepi, S., Giannoni, M., & Şahin, A. (2024). The unemployment–inflation tradeoff revisited: The Phillips curve in COVID times. *Journal of monetary Economics, Vol 145(S)*.

Dabušinskas, A., & Kulikov, D. (2007). New Keynesian Phillips curve for Estonia, Latvia and Lithuania. *Bank of Estonia, Working Paper*.

Do, H.-P., & Spanos, A. (2024). Revisiting the Phillips Curve: The Empirical Relationship Yet to be Validated. *Oxford Bulettin of Eonomics and Sstatistics, Department of Economics, University of Oxford, vol. 86(4)*, str. 761-793.

Haschka, R. E. (2024). Examining the New Keynesian Phillips Curve in the U.S.: Why has the relationship between inflation and unemployment weakened? *Reaserch in Economics, Vol 78, Issue 4*.

Hidrayanto, I., Samarina, A., & Stange, I. M. (2019). Is the Phillips curve still alive? Evidence from the euro area. *Economic Latters, Vol 174, issue C,*, str. 149-152.

Hooper, P., Mishkin, F. S., & Sufi, A. (2020). Prospects for inflation in a high pressure economy: Is the Phillips curve dead or is it just hibernating? *Research in Economics, Vol 74(1)*, str. 26-62.

Khan, A. Z. (2014). Quaid-I Azam Muhammad Ali Jinnah Correspondence (1936-1947). *Pakistan Historical Society. Journal of the Pakistan Historical Society, 62*(2), 123.

Lavoie, M. (2023). Conflictual Inflation and the Phillips Curve. *Review of Polotical Economy,* , 1397-1419.

Lojanica, N., & Obradović, S. (2019). Povezanost inflacije, nezaposlenosti i ekonomskog. *Ekonomija socijalizma i tranzicija*, str. 88-105.

Martins, M. M., & Verona, F. (2024). Forecasting Inflation with the New Keynesian Phillips Curve: Frequencies Matter. *Oxford Bulletin of Economics and Statistics, Department of Economics, University of Oxford, vol. 86(4)*, str. 811-832.

Mcleay, M., & Tenreyro, S. (2019). Optimal Inflation and the Identification of the Phillips Curve. *NBER, Macroeconomics Annual, Vol 34*.

Molnar, A., Varga, J., & Csiszárik-Kocsir, A. (2024). Deriving the Classical and New-Keynesian Phillips Curves using Machine Learning Simulations. *Decision Making: Applications in Management and Engineering, 7(1)*, str. 546-567.

National Bank of Serbia. (2015-2024). *Annual Reports.*

Recher, V., Marina, M., & Palić, P. (2017). Analysis of unemployment-inflation nexus in times of crisis: the case of croatia. *Ekonomski pregled, 68(1)*, str. 32-58.

Smith, S. C., Timmermann, A., & Wright, J. H. (2024). Breaks in the Phillips Curve: Evidence From Panel Data. *Journal of Applied Econometrics, Vol 40, Issue 2*, str. 131-148.

Wardhono, A., Nasir, M., Qori'ah, C. G., & Indrawati, Y. (2021). Movement of Inflation and New Keynesian Phillips Curve in ASEAN. *Economies 2021, 9(1), 34*.

Warsame, A. A., Ali, A. O., & Hassan, A. Y. (2022). Macroeconomic Determinants of Unemployment in Somalia: The Case of Okun's Law and the Phillips Curve. *Asian Economic and Financial Review Vol. 12, No. 11*, str. 938-949.