
**EMPIRICAL ANALYSIS OF THE RELATIONSHIP BETWEEN THE
UNEMPLOYMENT AND INFLATION**

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Abstract: Unemployment and inflation are two extremely important macroeconomic indicators, which have great influence on economic stability. Every government strives to achieve low level of unemployment and inflation. However, many empirical studies have shown that there is inverse relationship between unemployment and inflation. High unemployment means higher supply than demand for jobs, and consequently, the employers are not stimulated to increase the wages. Stable and low wages do not further impose any pressure on prices, and inflation remains low. Contrary, low level of unemployment is related with the greater demand than supply of jobs, that will boost the salary higher and finally will increase the production costs as well as the overall demand in the economy. Ultimately, that will cause higher inflation in the economy.

These statements were confirmed by the Phillips researches. The Phillips curve was projected, by which it was possible to predict the rate of unemployment at certain rate of inflation, and vice versa. Though, this curve was exceptionally useful till 70s – 80s of the last century, in the period after, L-shaped Phillip curve held only for explaining short-term relationship, but did not hold for explaining long-term relationship. It means that in the later period inter-relationship between unemployment and inflation was unstable.

Macedonia has faced many challenges in the period right after the independence – enormously high unemployment, hyperinflation and negative rate of GDP. This period is known as “stagflation”. It was exceptionally difficult to improve all these economic indicators, simultaneously. They were inversely related, and it was impossible to improve one indicator, without worsening the other in the same time. Such situation was disproving the existing statements that high unemployment is related with low inflation, and vice versa. Phillip curve in this case, definitely does not hold. Although the situation now is different, it is still very important to determine the inter-relationship between the unemployment and inflation. The truth is that more than 20 years the country does not have any problems with high inflation, but also the fact is that high rate of unemployment is still great concern. Hence, in order to promote suitable government policies, it is important to know the inter-relationship between unemployment and inflation.

With a purpose to determine the mutual influence between two variables, we have conducted an empirical research, using the contemporary econometric software EViews 9.5. The analysis is for the period 1993-2018. The data were collected from National bank of the Republic of Macedonia, State Statistical Office of the Republic of Macedonia and the World Bank database. We have performed the Johansen Co-integration Test, as well as the Granger Causality Test. The results have shown that there is 1 co-integration between variables and that there is not granger causality between the variables. Consequently, the past values of unemployment can not be used for predicting the future values of inflation, and vice versa. Furthermore, the research is evidence that the Phillip curve does not hold for Macedonia and the rate of one variable can not be used for determination of the values of the other variable.

Keywords: unemployment, inflation, co-integration, Granger causality test

INTRODUCTION

One of the main challenges that face the government is how to maintain the optimal balance between the unemployment and the inflation. That is, the government is interested in keeping both indicators as low as possible, potentially both to be single digit rates. However, that is extremely difficult since they are commonly inversely correlated, and an increase in unemployment will probable cause reduction in inflation, and vice versa, at least in short term.

Investigating the inter-relationship between unemployment and inflation is even more important in developing and transition economies. They face serious issues, such as poor economic development, high rate of unemployment, problems with trade balance, high indebtedness, etc.. Very similar is the situation in Macedonia. The country has almost the highest unemployment rate in Europe, it recorded poor economic development, low level of living standard, imbalance between export and import, political instability, etc.. The situation was even worse twenty years ago, in the period after the independence. The country went through the process of transformation, restructuring and privatization. The economy was extremely instable and unfavorable. Hyperinflation, extraordinary high inflation and negative GDP, were only small part of the excessive problems which were present in Macedonia. It was exceptionally difficult to solve all of them simultaneously, since they were inversely related. For the reduction of

inflation, it is necessary to decrease the amount of money in circulation, and consequently that will cause further increase in unemployment. Contrary, the reduction in the unemployment rate seeks spending, investments, which in turn, further increase inflation. So, the government understandable decided to stabilize the inflation first, and later to work on the other problems. Hence, the unemployment rate has increased, and unfortunately it is still far above the acceptable level.

Considering the situation in the country, combating unemployment is still great challenge, and many measures suppose to be introduced in order to improve the condition. Therefore, it is important to discover what consequences might have measures which are intended for reduction of unemployment. Since, short-term increase in inflation is commonly expected, it will be very useful to examine the interrelationship between inflation and unemployment.

That is exactly the main objective of this paper, to discover the influence of unemployment on inflation, and vice versa. In order to get credible results, we have provided data for unemployment and inflation from National Bank of the Republic of Macedonia and State Statistical Office. The data refers to the period 1993-2018. We have used data from the World Bank database, as well. An empirical analysis was conducted, using the contemporary econometric software EViews 9.5. We have performed Johansen Co-integration test, as well as Granger causality test, in order to determine the inter-relationship between the variables.

The paper is organized in three sections. In the first section we will elaborate the previous researches. In the second section will be presented the unemployment and inflation trend in Macedonia, and in the final section, the results from the research will be explained. The paper finishes with the final conclusion, where the inferences will be drawn.

LIERATURE REVIEW

The inter-relationship between unemployment and inflation was firstly introduced in 1958, by Phillips,²⁸ who examined the mutual correlation between two variables in the United Kingdom in the period 1861 - 1957, and found inverse relation between unemployment and inflation. Then he projected the L-shaped Phillips curve, which is still used by the central banks in their short-term projections. According to his findings – the lower the unemployment in an economy is, the higher the rate of inflation will be. However, later in the 70s, in many countries the relation appeared to be unstable. Samuelson and Solow²⁹ were the first researchers who supported the Phillips hypothesis in their paper related to the case in US. They confirm once again the negative relationship between unemployment and inflation.

Phelps (1967)³⁰ and Friedman (1968)³¹ were the first critics of the Phillips hypothesis. They argue that there is no trade-off relationship between unemployment and inflation. In the meantime, Lucas (1976)³² opposed the proposition of the existence of the Phillips curve, stating that there could be a trade-off relationship between unemployment and inflation, but the policy makers have not create a situation where high inflation is paired with low unemployment. He considers that also could be a case where employees would predict inflation and an increase in wages would be possible. In such a case there would be high unemployment and high inflation rate. This is known as the “Lucas critique”.³³

In the 1980s, Phillips hypothesis was slightly neglected by researchers, but still it was used as an important tool by policymakers in many countries. In 1991 Alogoskoufis and Smith³⁴ conducted an empirical study for the USA and the Great Britain supporting “Lucas critique”. Contrary, King and Watson (1994)³⁵ tested the existence of the

²⁸ Phillips, A.W. *The Relation between Unemployment and the Rate of Change of Money Wage Rates in the United Kingdom 1861–1957*. *Economica*, Vol. 25 (1958)

²⁹ Samuelson, P.A. and Solow, R.M. *Analytical aspect of anti-inflation policy*. *American Economic Review*. Vol. 50 No. 2, pp.177–194. (1960)

³⁰ Phelps, E. *Phillips curve, expectation of inflation, and optimal inflation over time*. *Economica*. Vol. 34. pp.254–281. (1967)

³¹ Friedman, M. *The role of monetary policy*. *American Economic Review*. Vol. 58., pp.1–17. (1968)

³² Lucas, R.E. *Econometric policy evaluation: a critique*. *Carnegie-Rochester Conference Series on Public Policy*. Vol. 1. pp.19–46. (1976)

³³ Dritsaki, C. and Dritsaki, M. *Inflation, unemployment and the NAIRU in Greece*. *Procedia Economics and Finance*. Vol. 1. pp.118–127. (2012)

³⁴ Alogoskoufis, G. and Smith, R. *The Phillips curve: the persistence of inflation and the Lucas critique: evidence from exchange-rate regime*. *American Economic Review*. Vol. 81. pp.1254–1275. (1991)

³⁵ King, R.G. and Watson, M.W. *The post-war US Phillips curve: a revisionist econometric history*. *Carnegie-Rochester conference Series on Public Policy*, Vol. 41. pp.157–219. (1994)

Phillips curve using macroeconomic data for the USA. Their findings provided empirical support to the existence of the trade-off relationship between unemployment and inflation over the examined period.

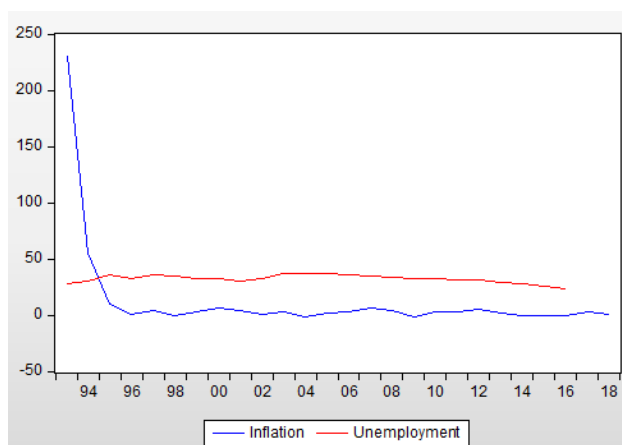
Islam et al. (2003)³⁶ has tested the Phillips hypothesis in the USA taking into account the data from 1950 to 1999. He discovered a weak long-run co-integrating relationship between unemployment and inflation. Reichel (2004)³⁷ conducted co-integration analysis on the data for the industrialized economies and he found trade-off between inflation and unemployment, only in the cases of USA and Japan.

It worth mentioning also the NAIRU theory, also known as “natural rate of unemployment”, elaborated by Phelps in 2006,³⁸. Phelps makes difference between “short-term” Phillip curve and “long-term” Phillip curve. According to the theory, the short-term Phillip curve looks same as Philip curve, but shifts in the long-run as expectations change. This theory argues that in the long-run, only a single rate of unemployment – the natural rate is consistent with a steady rate of inflation. NAIRY theory argues that Phillip curve is vertical, and there is no trade-off between unemployment and inflation.

2. UNEMPLOYMENT AND INFLATION IN THE REPUBLIC OF MACEDONIA

Before we move on elaborating the research results, we will present the data about unemployment and inflation in the Republic of Macedonia, in the period 1993-2018. The data were provided from the National Bank of the Republic of Macedonia, as well as from the State Statistical Office of the Republic of Macedonia and the World Bank Database.

Figure1. Unemployment and Inflation in the Republic of Macedonia in the period 1993-2018



Source: Research calculation

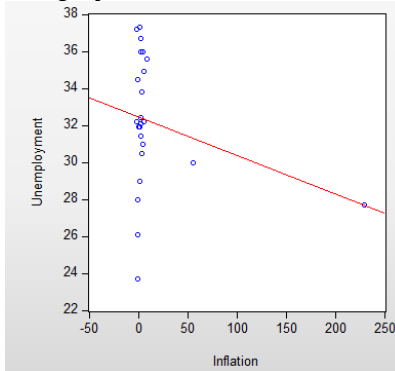
Figure 1 shows the trend in unemployment and inflation in the Republic of Macedonia in the period 1993-2018. We can conclude that both variables share the similar trend, without sharp variability. Only in the first years after independency there was a strong fall in inflation, whilst in the later period inflation trend is very stable. In reference to the unemployment, we can say that in the analyzed period there is only constant slight reduction.

³⁶ Islam, F., Hassan, K., Mustafa, M. and Rahman, M. *The empirics of US Phillips curve: a revisit*, American Business Review. Vol. 20. No. 1. pp.107–112. (2003)

³⁷ Reichel, R. *On the death of the Phillips curve: further evidence*. Cato Journal. Vol. 24. pp.341–348. (2004)

³⁸ Phelps, E. *Analysis of Intertemporal Tradeoffs in Macroeconomic Policy*. The Royal Swedish Academy of Sciences. Stockholm. Sweden. (2006)

Figure 2. Scatter plot unemployment and inflation in the Republic of Macedonia



Source: Research calculations

The presented scatter plot shows that dots on the plot are scattered everywhere, and there is not correlation between unemployment and inflation.

3. RESEARCH RESULTS

In order to get the most reliable results we have conducted an empirical analysis, using the contemporary economic software EViews 9.5. We performed a Johansen Co-integration test, as well as Granger Causality Test. However, in order to use the Granger causality test, first it is necessary to determine whether the variables are stationary. Therefore, first we will conduct unit root test, with the aim to check whether the variables have unit root. That is why we will conduct the Augmented Dickey–Fuller test (ADF). The null hypothesis in ADF test is that there is a unit root, and the alternate hypothesis is that the time series do not have unit root. The ADF unit root test was done first in level form and then in 1st difference. The lag length for ADF test was chosen by using Schwarz’s criterion (SC’s information criterions).

The results from the ADF test indicated that inflation series is non-stationary at its level form, As for the unemployment, the ADT test showed that the variable is non-stationary at its level form, but it achieves stationary at the first difference. We have considered 5% level of significant. In addition, we have also done Phillips-Perron unit root test, and we got the same results. Since, the results from the unit root test are adequate for Granger causality test, we can now go further on the Johansen Co-integration Test and Granger Causality test.

Johansen Co-integration Test

The main purpose of the Johansen Co-integration Test is to discover whether there is a long-run inter-relationship between the variables. In addition, we will present the results from the Johansen co-integration test.

Table.1 Johansen co-integration test for unemployment and inflation

Johansen Cointegration Test				
Date: 02/07/18 Time: 15:20				
Sample (adjusted): 1997 2016				
Included observations: 20 after adjustments				
Trend assumption: Linear deterministic trend				
Series: UNEMPLOYMENT INFLATION				
Lags interval (in first differences): 1 to 3				
Unrestricted Cointegration Rank Test (Trace)				
Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.790436	31.98794	15.49471	0.0001
At most 1	0.036007	0.733429	3.841466	0.3918
Trace test indicates 1 cointegrating eqn(s) at the 0.05 level				
* denotes rejection of the hypothesis at the 0.05 level				
**MacKinnon-Haug-Michelis (1999) p-values				

Source: Research calculations

The results from the Johansen Co-integration test have shown that there is 1 co-integration. It is considered the level of significance of 5%.

Granger Causality Test

As the results from the unit root test are eligible, we can now investigate the inter-relationship between the unemployment and the inflation, using the Granger Causality Test. The null hypothesis is that unemployment does not Granger cause inflation. The alternate hypothesis is that unemployment does Granger cause inflation. As for the impact of inflation on unemployment, the null hypothesis is that inflation does not Granger cause the unemployment. The alternate hypothesis is that the inflation does Granger cause the inflation.

The results from the Granger causality Test are presented in the Table 4. The Akaike Information Criterion (AIK) was used in order to determine the lag lengths, which in this case is 4 legs.

Table 2. Granger Causality Tests Results (4 lags)

Pairwise Granger Causality Tests			
Date: 02/05/18 Time: 15:42			
Sample: 1993 2016			
Lags: 4			
Null Hypothesis:	Obs	F-Statistic	Prob.
INFLATION does not Granger Cause UNEMPLOYMENT	20	2.52907	0.1006
UNEMPLOYMENT does not Granger Cause INFLATION		2.76805	0.0816

Source: Research calculation

The results from the causality analysis are showing the inter-relationship between the unemployment and inflation. The Granger causality test gives information about the impact of one variable on the other and vice versa. From the Table 4 we can conclude that we should accept the null hypothesis in both cases. Hence, the unemployment does not Granger cause inflation on one hand, and on the other hand the inflation does not Granger cause the unemployment. We have considered 5% level of significance, which is usually set as mostly acceptable. Since p value is bigger than the accepted value of significance of 5%, we have accepted the null hypothesis and conclude that the past values of unemployment cannot be used as a credible base for forecasted future values of inflation, and vice versa. From the results of this research, we can draw inference that the Phillips curve does not hold in Macedonian case, and that Phillip curve can not be used for forecasting by policy makers in Macedonia.

CONCLUSION

In order to maintain the macroeconomic stability it is very important to discover the inter-relationship between the unemployment and the inflation. Historically, the first research in this area was conducted by Phillips, who designed the L-shaped Phillips curve. According to Phillips curve an increase in unemployment will lead to decrease in inflation and vice versa. Later, many authors agreed that the Phillip curve holds only in short-term, while in long-run does not hold. Although, many experts deny the validity of Phillip curve in modern economies, still many policy makers use this curve in order to predict future movement, either of unemployment or of inflation.

In order to determine whether the Phillip curve holds in Macedonia, we have performed an empirical analysis in order to discover the inter-relationship between the unemployment and the inflation. We have conducted Johansen Co-integration test, as well as Granger Causality Test.

The results from the research have shown that there is only one co-integration between the variables. The test has also shown that the null hypothesis should be accepted in both cases. Precisely, the analysis showed that past values of unemployment can not be used for predicting future values of inflation, and vice versa, past values of inflation can not be used for predicting future values of unemployment. Therefore, this analysis is evidence that the Phillip curve does not hold in Macedonia.

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