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RISING INTEREST RATES REDUCE INFLATION: AN EMPIRICAL STUDY FOR THE REPUBLIC OF NORTH MACEDONIA

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Abstract
This article aims to help us understand what rising inflation will mean in this low interest rate environment. This paper analyzes the current developments with growing inflation and makes a theoretical and empirical analysis of the interactions between interest rates and inflation in North Macedonia.

In the theoretical part, the review of the literature revealed that some of the researchers established a unidirectional relationship between the inflation and the interest rate, and some a bidirectional relationship. In the empirical analysis, the daily data of the Central Bank od the Republic of North Macedonia for inflation and interest rates for the period 2006:01 – 2022:06 were used.

Granger Causality Test was used to determine the relationship and its direction in the short term through VECM. As a result of the analysis, bilateral causality among variables was determined in the short term. In other words, inflation is a cause of interest rate and interest rate is a cause of inflation. An increase in interest rates reduces inflation. But, the main problem with using interest rates to control inflation are lags, because take time to affect inflation trends. Yet the NBRSM's adherence to its inflation target can only be gauged with backward-looking inflation statistics. But, at this point, no one really knows how high interest rates might need to climb in order to get inflation back down without creating too much additional unemployment.

The findings have practical policy implications for decision makers in the area of macroeconomic planning, particularly in North Macedonia.

Keywords: *Inflation, İnterest rates, Cointegration, Monetary policy.*
JEL Classification: E31, E43, C12, C22

INTRODUCTION

After a long period of relatively low inflation, consumer prices are skyrocketing. The global economy is facing rising prices of primary products on world markets and disruptions in supply chains, which also affect other types of products. These problems have increased production costs in all parts of the world. The war in Ukraine and the West's economic sanctions against Russia have intensified the existing inflation. The inflation is very high and has the potential to continue rising unless policymakers take more aggressive measures. Policymakers face the challenge of stemming inflation without compounding the economic slowdown resulting from the war in Ukraine and related sanctions.

The main task of central banks is to prevent inflation from spiraling out of control - and to bring it back down to the desired pace of around 2%. But I believe this is the most difficult task facing central banks in general.

Prices in North Macedonia, on average, rose by about 7%, in the European Union by about 5.5%, and in the United States, on average, prices rose by about 7.5% (which is the fastest rate of inflation in the United States since 1982). An additional problem and threat for the European Union is now the political crisis (governmental and parliamentary) in Italy.

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According to a Pew Research Center analysis (DeSilver, 2022), inflation rates have doubled in 37 of 44 advanced economies over the past two years. High inflation is a big challenge for everyone.

Since the global financial crisis of 2007-2009, interest rates in Europe have remained at almost zero levels (some even negative), and in the Macedonian economy they have been continuously declining. But the current events caused changes in the situation and the final tightening of the monetary policy by the central banks, which heralded the end of low interest rates. Rising interest rates reduce inflation. Central banks have already started to actively increase interest rates in response to the situation, and they are also announcing a new additional increase in interest rates. The Bank of England, FED, ECB, have already done that.

The Federal Reserve has several main goals regarding the economy: to promote maximum employment, to keep prices stable, and to ensure moderate long-term interest rates. The Fed's main tool for dealing with inflation is interest rates. “The Fed uses interest rates as either a gas pedal or a brake on the economy when needed. With inflation running high, they can raise interest rates and use that to pump the brakes on the economy in an effort to get inflation under control.” said Greg McBride, a chief financial analyst at Bankrate (Reinicke, 2022). To do that, the Fed has signaled it plans to raise interest rates several times this year — perhaps as many as five — starting in March. And faster-than-expected inflation numbers in January suggest it may need to accelerate its overall timetable. However, Sinclair (Reinicke, 2022) alerts that “They have to carefully walk that tightrope”.

The European Central Bank raised interest rates for the first time in more than 11 years, trying to control rising inflation in the Eurozone. The key interest rate has been negative since 2014 in order to encourage banks to borrow money and circulate the money instead of depositing it with the ECB. The ECB has twice increased interest rates by 0.5 percentage points (the last time on 21.07.2022), and is planning a further increase.

The National Bank of North Macedonia continued with the gradual normalization of the monetary policy to maintain medium-term price stability, through a further increase in the basic interest rate (the interest rate on Central Bank bills increased to the level of 2.5% as of July 2022).

However, the fact is that despite the increase, they will remain very low by historical standards and well below the rate of inflation. „This 2022, it is going to be a tough year.“ said Kristalina Georgieva, managing director at International Monetary Fund (Pomeroy, 2022).

The structure of the paper is as follows: section 2 reviews theoretical basics of interest rate and inflation rate relationship. Section 3 discussed about interest rates and inflation. In section 4, the data and methodology are presented. Section 5 devotes on discussion of the empirical results. Finally, Section 6 presents concluding remarks.

LITERATURE REVIEW

Interest rates have played a central role in macroeconomic policy. They have also enjoyed high popularity as policy instruments in developing countries. For instance, high interest rate has been an essential component of many stabilization programs in countries with chronic inflation during the 1980s. One of the basic macroeconomic variables related with interest rate is inflation rate.

Various studies on the relationship between interest rate and inflation have evolved over time in the literature. Some of these studies are theoretically based while some are empirical. The Fisher hypothesis (Fisher, 1930) suggests that inflation is the main determinant of interest

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rates, and as the inflation rate increases by one percent, the interest rate increases by the same amount (Amaefula, 2016). A relationship between inflation and the interest rate has been established using the Fisher effect as a framework (Fama, 1975,1982; Mishkin, 1992).

Based on theoretic issues and empirical studies, there is bidirectional causality relationship between interest rate and inflation rate (Çiğdem, 2019). Of course, some studies have rejected a strong bidirectional relationship between two-mentioned variables (Asgharpur et al., 2007). Brzezina (2001); and Fave and Auray (2002) have confirmed a relationship between interest rate and inflation rate in the long-run.
So, based on these issues, it is expected that a bidirectional causal relationship will exist.

ANALYSIS OF THE CURRENT SITUATION WITH INTEREST RATES AND INFLATION

The volatility of the financial markets remains high. Inflation continues to surprise on the upside. Policymakers face difficulty in predicting supply shocks. At the same time, energy and food shocks appear to be more persistent than previously thought and not just a consequence of the war in Ukraine, as inflation gained momentum before the outbreak of the conflict. Inflation rates for services and non-energy industrial goods also surprised to the upside, and none of the increases in core inflation each month so far this year were forecast.

In the period January - June 2022, the annual inflation rate in North Macedonia is 10%, on average, which is more than projected. The largest part of the domestic inflation is the result of the pressure from the import prices of food and energy, which so far are growing stronger than expected. These pressures quickly spill over to the prices of other products and services and further fuel inflationary expectations (NBRNM, 2022). Core inflation in Macedonia in June reached 12.30% (May 10.2%), and headline inflation 14.50% (May 11.9%). The conditions in the European Union and the United States are moving in the same direction. The core inflation in the European Union in June reached 4.59% (May 4.51%), and the headline inflation 9.60% (May 8.80%). Core inflation in the USA in June reached 5.9% (May 6.0%), and headline inflation reached 9.0% (May 8.50%). This is shown at Fig.1 and indicates that price pressures are expanding and becoming more persistent.

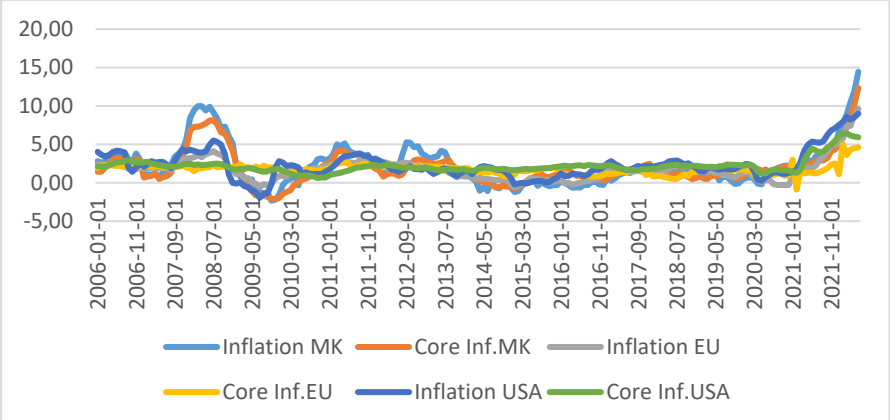

Figure 1. Headline and Core inflation, monthly: RN Macedonia, EU and USA
Source: State Statistical Office of the Republic of North Macedonia, ECB and FED Financial Statistics; Created by the Author

The problem is that any "all-items" CPI will often exaggerate the underlying trend in inflation, usually dominated by extreme changes in global energy and food prices. This can make apparent inflation over the past 12 months dangerously misleading as a guide to future policy for the next 12 months. Core inflation usually captures more persistent components of inflation

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relevant to medium-term trends. Hence, understanding "core inflation" has rarely been so important.

Core inflation is the change in the costs of goods and services, but it does not include those from the food and energy sectors. This measure of inflation excludes these items because their prices are much more volatile. In the Macedonian economy is calculated using the consumer price index (CPI), which is a measure of prices for goods and services. Core inflation is a good indicator of current and future trends in inflation, and hence a viable target for monetary policy. The historically high level of core inflation pointed to increased risks of higher inflation becoming more entrenched and more permanent. Gasmain pressures are also seen to continue to rise, increasing the chances of a stronger and faster pass-through to consumer prices.

DATA AND METHODOLOGY

The basic model of interest rate as a function of inflation rate *(x)* is presented at Eq. (1):

$$y_t=f(x_t) \quad (1)$$

All variables are in percentages; and data have gathered from the State Statistics Office and the National Bank of the Republic of North Macedonia between the period of January 2005 and June 2022. The time span allows us to use 222 observations in our time analysis. For all calculations the statistical software EVIEWS is used. The data are graphically shown at Fig.2:

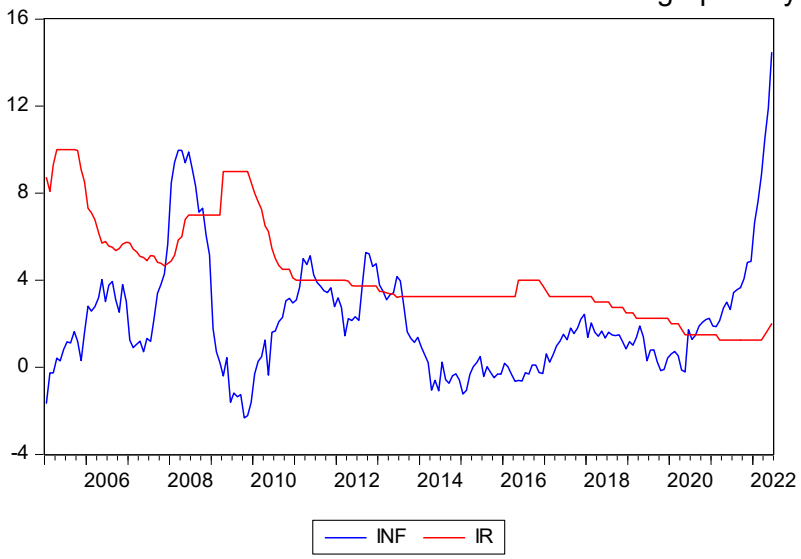

Figure 2. Inflation and Interest rate in Macedonia, 2006:01-2022:06
Source: Created by the Author

Firstly, in order to understand the stationarity (or the order of integration) of considered variables, a standard Unit root test was performed. More specifically, unit root analyses of PP (Phillips - Perron) developed by Phillips and Perron (1988) and ADF (Augmented Dickey - Fuller) developed by Dickey and Fuller (1979, 1981) were used. Equation (2) and equation (3) functionally represent the PP unit root analysis and ADF test, respectively;

$$\Delta y_t = ß+\delta y_t + \sum_{i=1}\emptyset i\ \Delta y_{t-1} + \varepsilon_t \quad (2)$$

$$y_t=\beta_0+\delta_1 y_{t-1}+\varepsilon_t \quad (3)$$

In these equations, the observation number was formulated with T, the distribution of the errorterms with ε_t, the series where the test is applied with y_t and the trend variable with *α, β* and*t*. Hypothesis is as

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H_0 : Series is not stationary (there is a unit root in the series)
H_1 : Series is stationary (there is no unit root in the series)

Secondly, as a result of the unit root analysis, after it was deteced that the variables were stationary at the same level (I_1), Johansen Cointegration test was performed to test whether the series cointegrated in the long term. Following the cointegration detection, Granger Causality Analysis was applied to the series through VECM (Vector Error Correction Model) with an aim to question the causality relationship and direction of the causality in the long term.

The standard Granger causality test is based on the prediction of the two-variable VAR model given at Eq. (4):

$$\Delta y_t = \beta_0 + \sum^{n}_{i=1} \beta_{1i} y_{t-1} + \sum^{n}_{i=1} \beta_{2i} x_{t-1} + \varepsilon_t \quad (4)$$

Engle and Granger (1987) stated that the standard Granger test based on the VAR model would not be acceptable when the series were cointegrated and in this case, the causality relationships between the series needed to be examined with the vector error correction model (VECM). In this case, the VECM is established to explaining the short and long-term causality relationships. The VECM model is specified in the following Eq. (5):

$$\Delta y_t = \beta_0 + \sum^{n}_{i=1} \beta_{1i} y_{t-1} + \sum^{n}_{i=1} \beta_{2i} x_{t-1} + \beta_3 EC_{t-1} + \varepsilon_t \quad (5)$$

where, $y_t$represents the dependent variable, x_t represents the independent variable, *ECt-1* is the error-correction term, and ε_t is the standard error. In the VECM model it is estimated that all variables are endogenous, the impact can be calculated through the selection of dependent and independent variables.

EMPIRICAL RESULTS AND DISCUSSION

In this section, firstly, the unit root analysis results of the variables included in the analysis and then cointegration test results will be discussed. The results of the analysis where the stationariness of the series were tested are given in Table1. According to the ADF and PP unit root results, variables are stationary at I_1.

Table1. Unit root test (PP and ADF): inf, ir

Variable	Phillips Perron Test						
	At level		1st difference		2nd difference		Conclusion
	Adj.t-stat.	p-value	Adj.t-stat.	p-value	Adj.t-stat.	p-value	
Inf	-1.553447	0.5046	-12.62733	0.0000	-54.56348	0.0001	I (1)
Ir	-1.887997	0.3376	-11.42120	0.0000	-39.00874	0.0001	I (1)
	Augmented Dickey - Fuller						
Inf	0.114622	0.9661	-6.196393	0.0000	-4.906303	0.0001	I (1)
Ir	-2.61844	0.0908	-7.025479	0.0000	-12.55855	0.0000	I (1)

*significant at 10% level of significance p<0.10; ** significant at 5% level of significance p<0.05; *** significant at 1% level of significance p<0.01; Decision:Reject the null hypothesis of unit root at 5% level of significance.With the results thus obtained, Johansen's cointegration technique can be implemented and the VECM model can be applied. But before calculating the long-run coefficients of the basic VAR model, it is necessary to determine the optimal

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number of lags. We determine the optimal lag length by minimizing the Schwarz (1978) Bayesian Information Criteria (SC). The lower the SC value, the better the model. In our case, the optimal length of the delay has been calculated and is 3. Then, with Johansen Cointegration test, Table 2, it is stated that the statistical value is smaller than the critical values; the inflation and interest rate series are cointegrated in the long term.

Table 2. Johansen Cointegration test

Variables	Trace	Max-Eigen	Lag
Inf – ir	22.49180***	19.99502***	3

*significant at 10% level of significance p<0.10; ** significant at 5% level of significance p<0.05; *** significant at 1% level of significance p<0.01; Trace represents the Trace Test statistics and Eigenvalue is the Maximal Eigenvalue Test statistics.

Table 3. Granger Causality Test Results through VECM

Hipothesys	Prob	Direction od Causality
Inf is a Granger cause odIr	0.0085***	Inf → Ir
Ir is a Granger cause of Inf	0.0013***	Ir → Inf

**Note: significant at 1% level of significance p<0.01*

Table 3 shows the Granger Causality Test results through the VECM model and the directionof the relationship determined in the short term; accordingly, there is a *bilateral causality* between the variables. It means that inflation is a Granger cause of interest rates and interestrates are a Granger cause of inflation.

CONCLUSION

Global inflation has rebounded from last year's lows faster and sooner than after any previous global recession in the past five decades. At the same time, this is the highest inflation in the recent history of the Macedonian economy. Current developments prompted the idea of examining the relationship between inflation and interest rates through the case of North Macedonia The Granger Causality Test through the VECM model, indicates a bilateral causality between the variables in the Republic of North Macedonia. Interest rates tend to move in the same direction as inflation but with lags, because interest rates are the primary tool used by central banks to manage inflation. In general, higher interest rates are a policy response to rising inflation. And this was the response of policymakers in most countries around the world in response to current developments. But it is important that policy changes take time to affect inflation.

If the high inflation in the Macedonian economy is mainly due to the previously mentioned higher production costs and low inventories, then the Central Bank will have to continue raising interest rates to a large extent, causing commercial banks to tighten lending conditions (because up to this point most of the banks did not respond to the market signals), and thus it will significantly reduce the demand to slow down the pace of inflation. Importantly, the bigger the Central Bank raises rates, the more damaging it will be for the economy. That is the main risk of raising interest rates too quickly. Hence the uncertainty about the degree and pace of monetary policy adjustment needed to restore price stability in the medium term.

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