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The Impact of the Federal Reserve's Interest Rate Hikes on U.S. Inflation Rate

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Abstract:

The Federal Reserve's interest rate hikes have a significant impact on domestic economic activities and monetary policies in the United States. Since March 2022, the Federal Reserve has raised interest rates multiple times to counter domestic inflationary pressures. In this article, data on the U.S. inflation rate and the federal benchmark interest rate from January 2010 to March 2024 were extracted, and an ARIMA model was used for analysis to predict how the U.S. inflation rate will develop under the condition of interest rate hikes. The study found that after the Federal Reserve raised interest rates, the inflation rate in the United States also rose. The reasons for this situation may be due to increased inflation expectations and external factors such as COVID-19. To mitigate risks brought by the rise in inflation, such as asset devaluation, commodity price volatility, and reduced investment returns, investors can adopt strategies like diversifying their investments, closely monitoring the Federal Reserve's interest rate hikes, and avoiding high-leverage investments.

Keywords: Federal Reserve, Inflation, Federal Benchmark Interest Rate, Interest Rate Hike.

1. Introduction

The fluctuations caused by the Federal Reserve's interest rate hikes have led to a series of research studies by scholars both domestically and internationally on its impact on inflation.

In this aspect, Ludger Linnemann has formulated a New Keynesian model that addresses the dynamics of price stickiness within business cycles, with three significant findings: (i) inflation's reaction to higher interest rates is escalating, (ii) the impact on consumer spending is weakening as the ratio of debt to GDP in the long term falls, and (iii) under conditions reflective of many European economies, an uptick in nominal interest rates could counterintuitively result in a higher inflation rate. [1]. Brian Sack, through the establishment of a VAR model, studied the gradual changes in the federal funds rate, whether the gradual changes in the federal funds rate can be explained by the dynamic structure of the economy and the uncertainty the Federal Reserve faces in this structure, assuming that the Federal Reserve's only goal is macroeconomic stability [2]. Ali Anari and James Kolari considered the impact of all interest rates on inflation, constructing a macroeconomic interest rate series for the United States, which took into account the total amount of outstanding debt and the total amount of interest paid by households, businesses, and government sectors. In addition to the time paths of these respective processes during the sample period from 1960 to 2015, they also estimated the short-term and long-term Fisher and Wicksell effects [3]. In their Turkish case study, Nezir Kose and Furkan Emirmahmutoglu identified that a decrease in short-term interest rates by the monetary policy committee can stimulate adjustments in both corporate and personal investment and spending patterns. The consequent decline in real interest rates has the potential to boost real output, which can subsequently lead to an increase in the inflation rate. When the forecasted inflation rate falls short of the target, the committee may opt to lower the policy interest rate. This strategic move can elevate inflation levels and help to realign the inflation rate with the desired target [4]. Samuel Reynard used a monetary variable model to analyze recent changes in inflation volatility and persistence, as well as the flattening of the Phillips curve, and revealed the drawbacks of pursuing a low inflation target without considering the total amount of money [5]. Peter Tillmann has developed a novel empirical technique for evaluating the effects of the cost channel within the monetary policy transmission process on inflationary trends, as delineated by the New Keynesian Phillips curve framework. Under this framework, it is posited that rising interest rates can increase the marginal costs of production. Consequently,

this cost increase can drive up inflation levels [6]. Frederic S. Mishkin has investigated the inconsistency in the occurrence of the strong Fisher effect, which is typically indicated by a robust correlation between inflation rates and interest rates, and has found that it is not a constant phenomenon. Empirical findings do not consistently back the short-term Fisher effect, which would imply a correlation between shifts in expected inflation rates and interest rates. However, there is support for the long-term Fisher effect, indicating that inflation and interest rates are connected through a shared stochastic trend, especially when they are observed to follow a trend [7]. Marc Hayford used an overlapping generations model extended to three periods to demonstrate that, under reasonable assumptions, an unexpected increase in inflation would lead to a decrease in aggregate demand. In addition, this means that the ex ante real interest rate will decrease in response to past unexpected inflation [8].

Existing literature provides various perspectives and methods to analyze the relationship between interest rates and inflation rates, and it has reached a similar conclusion to this study that an increase in interest rates will push up the inflation rate. However, previous scholars have mainly analyzed this from the perspective of the Fisher effect or considered it from the standpoint of constant interest rates, leaving room for further exploration of the impact of interest rate changes on inflation rates.

The purpose of this study is to investigate the impact of Federal Reserve interest rate hikes on the inflation rate in the United States, which holds profound significance for analyzing the U.S. economic situation as inflation rates can reflect its domestic economic conditions, and Federal Reserve interest rate hikes have far-reaching implications for the global economy. Analyzing this can assist government agencies and relevant scholars in viewing Federal Reserve interest rate hikes from a new perspective and understanding the reasons behind changes in inflation rates.

The structure of this paper includes Section 2 for research design, Section 3 for empirical results and analysis, and Section 4 for conclusion.

2. Research Design

2.1 Data Source

This article obtains data through the “FRED website”, identifying the federal benchmark interest rate and the U.S. inflation rate data from January 2010 to March 2024. The Federal Reserve raised interest rates in March 2022, and as of March 2024, the federal funds rate has reached 5.33%. Using the federal benchmark interest rate and the inflation rate as the data source and basis, the article analyzes the impact of the Federal Reserve’s interest rate hikes on the U.S. inflation rate.

2.2 Unit Root Test

The first thing to do is run a unit root test on the model after the first data processing. The existence of a unit root serves as the null hypothesis for the ADF (Augmented Dickey-Fuller) test statistic. It contrasts the linear trend of the time series data with the absolute difference of the data at various time points. The real data and its linear trend will diverge significantly if the time series dataset is non-stationary, which will increase the ADF test statistic. Table 1 shows that the p-values for the log values of all four sets of data are 0, which is less than 0.1, following the execution of the ADF test in Stata. As a result, it is possible to reject the model stability null hypothesis.

Table 1 Weak stationarity test

	t	p
Inflation rate		
Ln value	-7.184	0.0000
1st order difference	-7.310	0.0000
Interest rate		
Ln value	-6.400	0.0000
1st order difference	-6.593	0.0000

2.3 ARIMA Model Setting

ARIMA model, full name Autoregressive Integrated Moving Average Model, is a statistical model widely used in time series analysis and forecasting. It combines three parts: autoregression (AR), differencing (I), and moving average (MA). The construction of the ARIMA model aims to identify patterns in data changes through the analysis of historical data, thereby achieving prediction for the future. The modeling steps of the ARIMA model include: checking the stationarity of the time series data. If the data

is non-stationary, it needs to be transformed into a stationary series through differencing operations.

3. Empirical Results and Analysis:

3.1 Order Determination and Residual Test

The first step in this section of the article is to use the PACF and ACF pairs to arrange the first log-return series; the results are displayed in Figure 1.

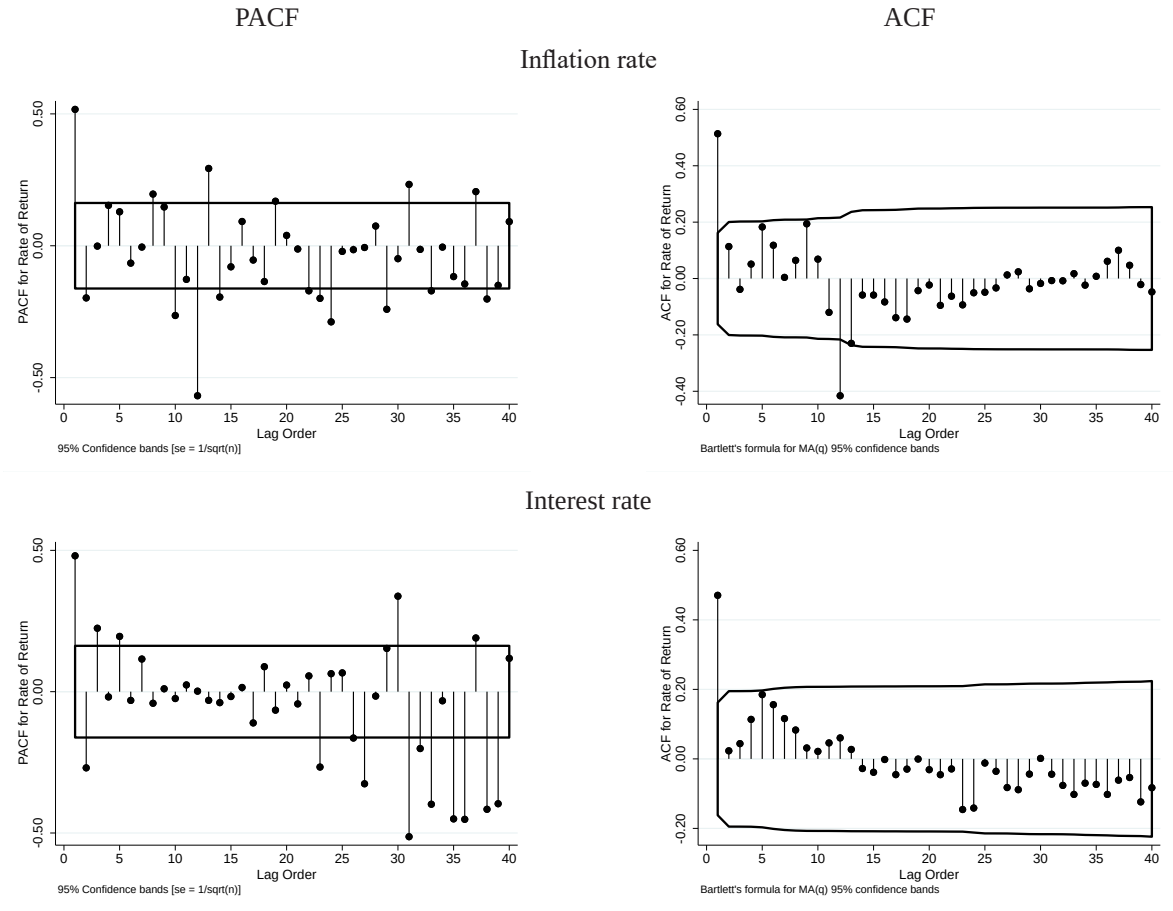

Figure 1 ARMA (p, q) identification

Photo credit: Original

Prior to presenting the findings in Figure 1, the article must arrange the inflation rate's log-return. As per the fixed-order results of the initial two images in the first row of Figure 1, the values of p and q are 10 and 1, respectively, indicating that the first component outside the x-axis is 10. Consequently, AR(P) is 12th order and MA(Q) is 1st order. Subsequently, the article must arrange the second semiconductor's log-return and display the outcomes in Figure 1. The first component outside the x-axis is 5, hence AR(P) is 5th order and MA(P) is 1st order, based on the fixed-order findings of the first two images in the second row of the figure. As a result, the values of p and q are 5 and 1.The residual test comes next after ordering, and the test findings are shown in Table 2

Table 2 Residual test

Model	Portmanteau (Q) statistic	Prob > chi2
Inflation rate -ARIMA(10,1,1)	63.6050	0.0102
Interest rate -ARIMA(5,1,1)	54.5272	0.0626

From the Table 2 it can be seen that these ARIMA models have passed the residual test, that is, the error terms are consistent with an unpredictable white noise sequence.

3.2 Forecast Results and Interpretation

After establishing the model, the ARIMA model forecast results are presented in the Figure 2 and Figure 3, where the blue line represents the actual values of the inflation rate and interest rate, and the orange line represents the model forecast values. The orange line in Figure 3 represents the situation where the Federal Reserve's interest rate remains unchanged, and the orange line in Figure 2 represents the predicted trend of the U.S. inflation rate if the Federal Reserve does not raise interest rates.

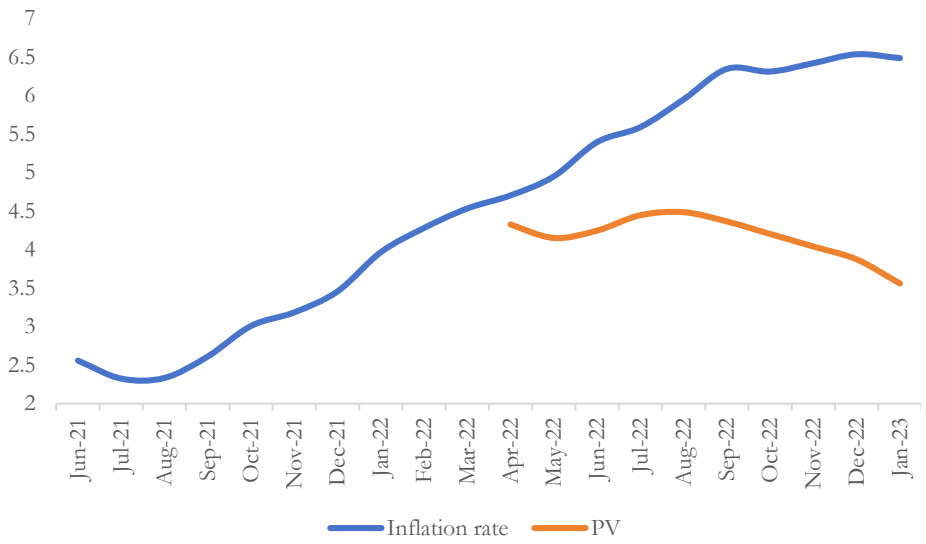

Figure 2 Inflation rate and predicted value

Photo credit: Original

It can be clearly seen from Figure2 that there is a significant deviation between the model's forecast results and the actual values. We can observe that, according to the forecast, after the Federal Reserve raised interest rates in March 2022, the U.S. inflation rate should have shown a downward trend, but this was not the case. There may be several reasons for this. First, policy interest rate shocks had less of an impact on total production during times of more instability. But the greatest impact of uncertainty was felt in the area of inflation control, which was drastically diminished in contrast to more peaceful times [9]. Second, recent events like the Covid-19 pandemic, the Russian invasion of the Ukraine, and various types of disruptions to the global supply chain may have altered the relationship between inflation expectations and inflation, even though the literature suggests that this relationship was relatively weak for a significant portion of the Great Moderation period. Moreover, data suggests that if inflation is high, it may react more forcefully to an increase in expectations [10]. Evidence at the household level partially confirms theoretical expectations that, within a zero lower bound (ZLB) environment, an exogenous boost to households' inflation expectations would encourage them to increase their spending. This rise in consumption, through the mechanisms of macroeconomic general equilibrium, should eventually drive up the inflation rate [11].

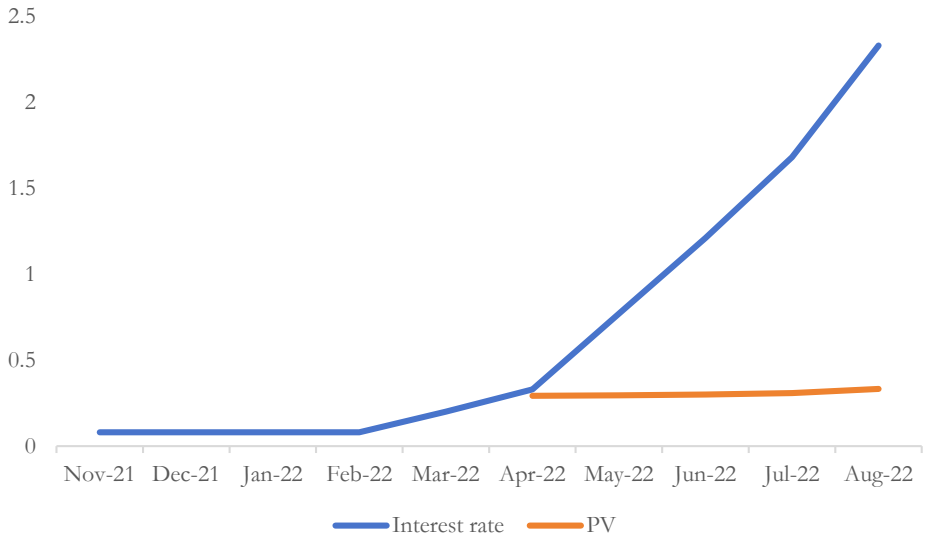

Figure 3 Interest rate and predicted value (%)

Photo credit: Original

4. Conclusion

Like most studies, this article also concludes that high interest rates will lead to an increase in the inflation rate. However, unlike many other studies that choose to start with the Fisher equation, this article uses the ARIMA model for research and analysis, presenting the results more intuitively through charts. As an important participant in the world economy, the United States holds a significant position in the global economic operation. For scholars who are concerned with changes in the domestic economy of the United States, the stability of the U.S. domestic economic operation is quite important. The results of this study can provide them with a new perspective for predicting the development of the U.S. inflation rate.

The purpose of this article is to study the impact of the Federal Reserve's interest rate hikes on the U.S. inflation rate, using the ARIMA model for research and analysis, and drawing a conclusion that the Federal Reserve's interest rate hikes will still push up the U.S. inflation rate. This article indicates that the act of the Federal Reserve raising interest rates does not necessarily achieve its expected goal of reducing inflation and may even lead to a further increase in the inflation rate. Researchers who are concerned with the Federal Reserve's interest rate hikes should maintain a more rational and cautious attitude towards and analysis of this behavior.

References

[1] Linnemann L. Can raising interest rates increase inflation? [J]. Economics Letters, 2005, 87(3).

[2] Sack B. Does the fed act gradually? A VAR analysis[J]. Journal of Monetary Economics, 2000, 46(1).

[3] Anari A, Kolari J. Dynamics of interest and inflation rates[J]. Journal of Empirical Finance, 2016, 39(PartA).

[4] Kose N, Emirmahmutoglu F, Aksoy S. The interest rate–inflation relationship under an inflation targeting regime: The case of Turkey[J]. Journal of Asian Economics, 2012, 23(4).

[5] Reynard S. Maintaining low inflation: Money, interest rates, and policy stance[J]. Journal of Monetary Economics, 2007, 54(5).

[6] Tillmann P. Do interest rates drive inflation dynamics? An analysis of the cost channel of monetary transmission[J]. Journal of Economic Dynamics and Control, 2008, 32(9).

[7] Mishkin F S. Is the Fisher effect for real?: A reexamination of the relationship between inflation and interest rates[J]. Journal of Monetary Economics, 1992, 30(2).

[8] Hayford M. Real interest rates and the distribution effects of unanticipated inflation[J]. Journal of Macroeconomics, 1990, 12(1).

[9] Wilson Luiz Rotatori Corrêa, Lopes L S. Monetary policy transmission, productive activity, and inflation in Brazil: Does uncertainty matter?[J]. The Journal of Economic Asymmetries, 2023, 27(e00285).

[10] Daniel Gründler. Expectations, structural breaks and the recent surge in inflation[J]. Economics Letters, 2023, 233(111394).

[11] Coibion O, Gorodnichenko Y, Kumar S, et. al. Inflation expectations as a policy tool?[J]. Journal of International Economics, 2020, 124(103297).