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# The Causal Relationship between Real Interest Rates and Inflation in Central Asian Countries: A Dumitrescu-Hurlin Panel Data Approach*

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***Abstract***

*This study investigates the causal relationship between real interest rates and inflation in five Central Asian transition economies: Uzbekistan, Kazakhstan, Turkmenistan, Kyrgyzstan, and Tajikistan. While the Fisher Effect traditionally posits a long-run neutrality of real interest rates in response to changes in expected inflation via nominal interest rate adjustments, this study specifically focuses on real interest rates rather than nominal ones. Annual data for the period 2000–2024 were collected from the official databases of the central banks of the respective countries. To explore the direction of causality, the Dumitrescu and Hurlin (2012) Panel Granger Causality test was applied, which allows for cross-sectional dependence and heterogeneity across countries. The empirical findings indicate a unidirectional causality running from inflation to real interest rates. This result implies that inflation significantly shapes interest rate dynamics in these countries, although it does not offer direct validation of the traditional Fisher Hypothesis. The findings contribute to understanding monetary policy behavior in post-socialist economies.*

***Keywords:*** *Real Interest Rate, Central Asia Countries, Inflation, Panel Causality, Dumitrescu-Hurlin, Central Bank Data*

## 1. Introduction

The link between inflation and real interest rates represents a key component in analysing the efficiency of monetary policy, especially within the context of emerging

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economies. The real interest rate serves as a key factor in shaping the expectations of economic agents regarding the future, and in determining whether available resources should be allocated to consumption, saving, or investment. The high and volatile nature of inflation in developing countries necessitates a more careful examination of the relationship between the real interest rate and inflation.

In this context, analysing the causal relationship between the real interest rate and inflation in Central Asian countries such as Uzbekistan, Kazakhstan, Turkmenistan, Kyrgyzstan, and Tajikistan — which are considered to be similar in terms of their macroeconomic structures — is meaningful for evaluating regional monetary policies. After the dissolution of the USSR in the early 1990s, these countries entered a transition process from a centrally planned economy to a market-based economy, and implemented various economic reforms and monetary policies during this period.

For transition economies, the real interest rate serves not merely as a financial metric but also a strategic tool for fostering economic confidence, improving the investment environment, ensuring price stability, and achieving sustainable growth objectives. Therefore, it is of great importance for monetary policymakers to closely monitor developments in real interest rates and to design their policy frameworks accordingly.

This research explores the linkage between real interest rates and inflation across five Central Asian nations based on yearly data spanning from 2000 to 2024. The dataset was sourced from the central banks of the selected countries, and the real interest rates were derived by deducting the inflation rate from the nominal interest rates. The analysis focuses exclusively on real interest rates and inflation indicators, leaving nominal interest rates out of the evaluation. The central purpose of this research is to investigate the relationship between inflation and real interest rates in Central Asian Turkic countries and to assess the implications for the effectiveness of their respective monetary policy strategies.

## 2. Theoretical Framework

### 2.1. Real Interest-Inflation Interaction and Fisher Hypothesis

The interplay between interest rates and inflation has remained a fundamental topic of inquiry in economic research for decades. While interest rates play a decisive role in investment decisions, saving behaviour, and overall economic activity, inflation denotes a continuous upward trend in overall price levels, often driven by monetary expansion, rising costs, and demand conditions (Desroches & Francis, 2007: 12). Adjusted for inflation, the real interest rate captures the genuine return on investment and is a key variable in monetary policy, as it reflects the rate that influences the decisions of individuals and institutions (Kennedy, 2000: 82).

Formulated in 1930 by Irving Fisher and commonly referred to in academic discourse as the "Fisher Effect", this view posits that nominal interest rates respond proportionally to changes in expected inflation, thereby leaving the real interest rate unchanged over time. According to this theory, assuming perfect information and rational expectations in the market, nominal interest rates will increase in direct proportion to inflation, resulting in a stable real interest rate over time (Walsh, 2010: 70). This theoretical relationship can be demonstrated as:

$$\boldsymbol{i} = \boldsymbol{r} + \boldsymbol{\pi^e}$$

Where $\boldsymbol{i}$ represents the nominal interest rate, $\boldsymbol{r}$ is for the real interest rate, and $\boldsymbol{\pi^e}$ the expected rate of inflation.

However, in practice, the empirical validity of this theoretical relationship may be influenced by various structural factors such as financial market depth, the extend of central bank independence and the existence of inflation targeting regimes, the formation of market expectations, and lags in the monetary policy transmission process (Benazic, 2013:85). Particularly in developing countries, the one-to-one adjustment predicted by the Fisher Hypothesis may not hold due to these institutional and structural limitations. As a result, the empirical validity of the hypothesis can vary significantly across different country samples and time periods.

### 2.2. The Relationship Between Real Interest Rate and Inflation From the Neo-Fisher Perspective

The Neo-Fisher Effect emerged as an extension of the traditional Fisher Hypothesis and drew attention to the determining role of central banks interest rate policies on inflation expectations, particularly in low-inflation environments. According to the classical Fisher Hypothesis, since expected inflation and nominal interest rates rise at the same pace, the real interest rate remains unchanged in the long run. However, the Neo-Fisher approach reverses the direction of this causality and argues that permanent increases in nominal interest rates may lead to higher inflation over time. This view was shaped in response to the low interest rate–low inflation spiral observed in advanced economies after the 2008 worldwide economic crisis of 2008, and it presents a critical perspective on traditional monetary policy frameworks (Grosse-Rueschkamp & Rocholl, 2020: 412).

The Neo-Fisher approach has gained more attention under conditions where interest rates approach or fall below zero (zero lower bound, ZLB). In this context, Uribe (2018) argues that central banks may generate inflation by maintaining low nominal interest rates for extended periods. Such interest rate policies are interpreted by the public as a signal of the central bank's intention to raise inflation, and this perception gradually leads to an actual increase in inflation. Similarly, Grosse-Rueschkamp and Rocholl (2020) suggest that keeping interest rates at the zero lower bound over an extended period can generate inflation through the rational expectations mechanism—potentially even more strongly than traditional models predict. Thus, unlike conventional demand-side approaches, Neo-Fisher theory advocates for the management of inflation expectations through interest rate stability.

The Neo-Fisher Hypothesis has been extensively discussed in the literature in terms of both its theoretical foundation and empirical results. While it is argued that increases in interest rates may suppress aggregate demand and cause disinflationary effects in the short term, the Neo-Fisher effect is considered valid only under certain assumptions in the long run. In emerging economies, structural issues such as limited central bank independence, irrational expectations, and shallow financial markets may hinder the functioning of the Neo-Fisher mechanism (Isakova, 2010: 8–9). In this regard, the validity of the Neo-Fisher effect is limited in economies where public confidence in policymakers is weak—as in many post-Soviet countries. Moreover, in cases where inflation expectations are backward-looking (based primarily on historical inflation data), the effectiveness of this mechanism further diminishes. Structural dynamics such as dollarisation, fiscal pressures, and openness to international markets in these countries suggest that the relationship between interest rates and inflation should be addressed through more complex frameworks beyond the Neo-Fisher approach.

### 2.3. Mundell-Tobin Effect and Real Interest Rate Dynamics

In addition to the Fisher and Neo-Fisher approaches, alternative theoretical frameworks that consider macroeconomic dynamics such as money demand, investment decisions, and capital accumulation—particularly in developing economies—hold an important place in the literature when analysing the relationship between interest rates and inflation. One of these alternative approaches, the Mundell-Tobin effect, offers a different perspective on the impact of inflation on real interest rates. This framework, originally formulated by Robert Mundell (1963) and James Tobin (1965), posits that rising inflation can contribute to a decline in real interest rates.

According to the Mundell-Tobin framework, an increase in inflation diminishes the desire to hold real cash balances, as individuals become more inclined to allocate their wealth toward financial or real assets that offer higher returns. In this process, wealth holders prefer to hold less money and redirect their savings toward return-generating investment instruments. As a result, consumption may decline, the propensity to save may increase, and capital accumulation is encouraged (Hassanvand and Nademi, 2018: 222).

Through this mechanism, the expected return on bonds and/or the marginal productivity of capital tends to decline, resulting in a fall in real interest rates. Especially during periods of high inflation, economic agents reduce their money holdings, which results in expanded investment activity. The rise in capital intensity may positively influence productivity. From this standpoint, the Mundell-Tobin effect provides a more dynamic and growth-focused interpretation of the interest rate–inflation relationship, in contrast to the Fisher hypothesis, which posits that a rise in nominal interest rates leads to a corresponding increase in real interest rates (Ravenna & Seppala, 2007: 20)

For developing countries, the validity of this effect depends on structural factors such as the depth of financial markets, the credibility of central banks, and the availability of diverse investment instruments. In economies with weak financial infrastructure and widespread currency substitution, the impact of real interest rates on investment decisions becomes more pronounced. Therefore, the relationship between real interest rates and inflation should be analysed not only through monetary policy tools but also within a broader framework that includes savings and investment dynamics.

## 3. Literature Review

In the economic literature, the causal relationship between inflation and interest rates constitutes a significant area of debate, both theoretically and empirically. While some studies examine how interest rates influence inflation, others focus on the reverse effect—how inflation impacts interest rates. Although the number of studies exploring the causality between these two variables has increased over time, there are still notable gaps, particularly regarding specific regions and groups of countries.

Research addressing the causality in this relationship begins with the theory proposed by Irving Fisher in 1930. According to the Fisher hypothesis, inflation is the primary determinant of nominal interest rates. Fisher's work laid the foundation for numerous studies analysing the interaction between inflation and interest rates. Within this framework, prominent economists such as Keynes, Friedman, Tobin, Mundell, and Feldstein have contributed significantly to the literature (Moroşan & Zubaş, 2015: 149).

Fama (1975) analysed the relationship between interest rates and the efficient market hypothesis in the United States economy using data from 1953 to 1971. In his study, US Treasury bill yields and Consumer Price Index (CPI) data were evaluated through time series analysis. The results of the analysis supported the validity of the Fisher hypothesis in the short term, as the real interest rate offered by Treasury bills was observed to remain constant over the examined period.

Mishkin (1991) tested the validity of the Fisher effect in the US using monthly data from 1964 to 1986. By applying the Engle-Granger cointegration method and ARIMA models, he concluded that the Fisher hypothesis does not hold in the short term, it remains valid in the long term perspective.

Using quarterly data spanning from 1973 to 1989, Strauss and Terrell (1995) conducted an empirical examination of the Fisher theory for Canada, France, Germany, the United Kingdom, Japan, and Italy. Domestic nominal interest rates, domestic inflation rates, and the ex-post real interest rate of the US were used. Johansen and Johansen-Juselius cointegration techniques revealed a long-run relationship in five out of six countries. The results suggest that the US real interest rate may influence the inflation and nominal interest rate dynamics of these countries, indicating the potential international validity of the Fisher hypothesis.

Kandel et al. (1996) examined the relationship between real interest rates and expected inflation in Israel using data from 1984 to 1992. The findings revealed a negative relationship between these variables, contradicting the Fisher hypothesis but supporting the theoretical arguments of Mundell, Tobin, Darby, Feldstein, and Stulz.

Brzoza-Brzezina (2001) investigated the long-run relationship between real interest rates and inflation in the US from 1954 to 1999 using the Johansen cointegration test. The results indicated that the interest rate spread significantly affects inflation in the long term.

Maghyereh and Al-Zoubi (2006) tested the Fisher effect for six developing countries—Argentina, Brazil, Malaysia, Mexico, Korea, and Turkiye—using monthly data for various periods between 1974 and 2003. Using Bierens' (1997) nonparametric cotrending method, they concluded that the Fisher effect holds in these developing economies.

Adegboyega et al. (2013) analyzed the Fisher effect for Nigeria during the post-Structural Adjustment Programme (SAP) period (1986–2011). Using the ARDL cointegration method, they found a negative relationship between interest rates and inflation, inconsistent with the Fisher hypothesis. However, a positive relationship between broad money supply and inflation was observed, and a long-run cointegration among interest rate, money supply, and inflation was established.

Katenova (2013) analysed the Fisher effect for Kazakhstan, Russia, and Kyrgyzstan using quarterly data from 2002 to 2011. ARDL cointegration results confirmed the long-run validity of the Fisher hypothesis in all three countries. However, the different integration levels of treasury bond yields and inflation suggest the limited applicability of the Fisher effect in the short run.

Takayaso Ito (2016) studied the Fisher hypothesis under Sweden's inflation targeting regime between 1993 and 2015. Swap rates were used as a proxy for long-term interest rates. The results confirmed the Fisher effect for 2-, 3-, 4-, 5-, and 7-year maturities, but not for 10-year maturities. The findings were attributed to the credibility of Sweden's long-standing inflation targeting regime, which helped stabilise short- and medium-term interest rates.

Uribe (2017), as part of the new generation of Neo-Fisherian research, applied SVAR analysis using data from the US and Japan (1955–2016). The results indicated that temporary increases in nominal interest rates failed to reduce aggregate demand or raise real interest rates, but instead had deflationary effects. In contrast, permanent and credible interest rate hikes increased real rates and negatively impacted output—findings consistent with the Neo-Fisher effect.

Hassavand and Nademi (2018) explored the relationship between interest rates and inflation in Iran from 1973 to 2015. Using the Time-Varying Parameters (TVP) method and state-space modelling, they analysed both the Fisher effect and its alternative, the

Mundell effect. The model addressed Lucas critique-related concerns by allowing for parameter variability over time.

Telek (2020) tested the Fisher effect for D-8 countries (Turkiye, Egypt, Iran, Malaysia, Pakistan, Indonesia, Bangladesh, and Nigeria) using the CADF-CIPS unit root test, Westerlund and Edgerton (2007) LM Bootstrap cointegration test, and CCE estimation. The results showed that the Fisher effect was valid in most D-8 countries, though not in Nigeria and Malaysia, and only weakly in Iran.

Organ and Gocer (2020) examined the Fisher effect in China using a nonlinear approach. Applying the NARDL model (Shin et al., 2014) to monthly data from 2002M7 to 2018M4, the study found evidence supporting both symmetric and asymmetric partial Fisher effects for bond interest rates.

Kumar and Kausal (2023) tested the validity of both the Fisher and Mundell-Tobin effects in South Asian countries using simple linear regressions for 1990–2022. They rejected the classical Fisher hypothesis, showing that nominal interest rate changes are not proportionally reflected in expected inflation, and that inflation shocks significantly affect real interest rates—thus influencing savings and investment behaviour.

Sugözü and Duyshobay Kızı (2024) analysed 30 Asian countries over the period 2002–2022 to test both the Fisher and Neo-Fisher effects. Using cross-sectional dependence tests, Emirmahmutoğlu-Köse, and Dumitrescu-Hurlin panel causality tests, they concluded that the Neo-Fisher effect better explains the observed dynamics in the region.

In conclusion, there is no single theoretical approach that fully explains the relationship between interest rates and inflation. Especially in transition economies like those in Central Asia, the effectiveness of monetary and interest rate policies plays a crucial role in achieving disinflation and financial stability. The literature highlights a lack of empirical studies focused on this group of countries and underscores the importance of regional-level analyses. In this context, the present study seeks to fill this gap by analysing the causality between real interest rates and inflation in Central Asian countries using the Dumitrescu-Hurlin panel data approach, aiming to contribute to the regional literature.

## 4. Method

In this section of the study, the causality relationship between the real interest rate and the inflation rate is analysed using a panel data set covering five Central Asian countries (Uzbekistan, Kazakhstan, Turkmenistan, Kyrgyzstan, and Tajikistan) and consisting of annual data for the period 2000–2024. The variables included in the study are the real interest rate ($r$) and the inflation rate ($\pi$), and the real interest rate is calculated by taking the difference between the refinancing rate (nominal interest rate) and the inflation rate, based on data from the statistical databases of the Central Banks of the relevant countries.

Due to data limitations, the real interest rate is calculated using the following formula:

$$\boldsymbol{r} = \left(\frac{\boldsymbol{1} + \boldsymbol{i}}{\boldsymbol{1} + \boldsymbol{\pi}} - \boldsymbol{1}\right) * \boldsymbol{100}$$

Here $\boldsymbol{i}$ denotes the nominal interest rate (refinancing rate), $\boldsymbol{\pi}$ denotes the annual inflation rate. The real interest rate obtained by this method reflects the actual level of return that economic agents consider in their decision-making processes.

The relationship between real interest rates and inflation in Central Asian countries is investigated using the panel Granger causality test developed by Dumitrescu and Hurlin (2012). This method can be applied in both balanced and unbalanced panels and is robust to cross-sectional dependence, regardless of whether the number of cross-sections (N) is smaller or larger than the time dimension (T). Moreover, it is a widely preferred method in cross-country comparisons due to its ability to account for structural heterogeneity (Çelik & Ünsur, 2020: 205).

One of the key advantages of this test is its ability to assess the existence of different causal relationships for each cross-sectional unit by allowing heterogeneity across units. Compared to traditional panel Granger causality tests, the Dumitrescu–Hurlin test has a more flexible structure as it does not assume parameter homogeneity and allows estimation coefficients to differ across units. This feature provides an important methodological advantage, particularly in multi-country panel datasets where structural and institutional differences are evident.

The model used in this test is expressed as follows:

$$\mathcal{Y}_{i,t} = \alpha_i + \sum_{k=1}^{K} \Upsilon_{i,k}\, \mathcal{Y}_{i,t-k} + \sum_{k=1}^{K} \beta_{i,k}\, \mathcal{X}_{i,t-k} + \varepsilon_{i,t}$$

Where $\mathcal{Y}_{i,t}$ and $\mathcal{X}_{i,t}$ represent the dependent and independent variables respectively, $\alpha_i$ denotes the individual fixed effects (constant term), $\Upsilon_{i,k}$ and $\beta_{i,k}$ are the coefficients of the lagged dependent and independent variables, respectively and $\varepsilon_{i,t}$ is the error term. The null hypothesis of the Dumitrescu and Hurlin assumes no Granger causality for all cross-sectional units in the panel, i.e. $H_0: \beta_{i,k} = 0 \; \forall i$.

Dumitrescu and Hurlin (2012), while developing this method, calculate individual Granger causality test statistics for each cross-sectional unit in the panel and then average these statistics to obtain a final panel-level test statistic. In this way, more realistic and reliable results can be obtained by accounting for structural differences across countries.

In the next stage of the study, the stationarity properties of the series are examined by first applying a cross-sectional dependence test and then the panel unit root test (CIPS). Following this, the Swamy homogeneity test is conducted to determine whether the coefficient structures of the variables are homogeneous across countries. Finally, the Dumitrescu–Hurlin panel causality test is employed to reveal the direction and presence of causality between real interest rates and inflation rates.

## 5. Empirical Findings

Before proceeding with the analysis of the causal relationship between the real interest rate and inflation in the Central Asian Republics, descriptive statistics for the real interest rate and inflation series used in the study are presented. These statistics are summarised in Table 1.

**Table 1:** Descriptive Statistics of Variables

| Variable | Mean | Median | Max | Min | Standard Deviation | Jarque-Bera Normality Test |
|---|---|---|---|---|---|---|
| Inflation | 9.602 | 8.000 | 38.600 | 0.100 | 6.130 | 213.770 |
| Real Interest Rate | 2.258 | 2.200 | 15.060 | -13.260 | 4.022 | 39.531 |

**0,10, **0,05 and ***0,01 indicate significance levels.*

According to the descriptive statistics presented in the table, the average value of the inflation rate variable is approximately 9.60, with a maximum of 38.60 and a minimum of 0.10. The mean of the real interest rate series is 2.26, while the maximum and minimum values are 15.06 and -13.26, respectively. Furthermore, the results of the Jarque-Bera test, which is used to assess whether the variables follow a normal distribution, are statistically significant at the 1% level. This indicates that the series deviate from normality. However, since the assumption of normal distribution is not a strict requirement for panel data analysis, these results do not compromise the validity of the subsequent analyses. Therefore, the descriptive characteristics of the variables do not pose any limitations for the use of panel data methods.

During the analysis process, the cross-sectional dependence test, the unit root test (CIPS), the homogeneity test (Swamy), lag length selection, and finally the Dumitrescu and Hurlin (2012) panel causality test were applied in accordance with the structural characteristics of the panel data set. This stepwise methodological framework enhances the robustness and reliability of the empirical results by accommodating country-specific structural heterogeneity.

In panel data analysis, the first step involves testing for cross-sectional dependence to evaluate whether observations across different units are correlated. To capture the advantages of different approaches, three alternative tests were employed: the standart LM test creates by Breusch and Pagan (1980), the bias-corrected LM test proposed by Pesaran,Yamagata, and Ullah (2008), and the latest modified LM CD* test introduced by Pesaran (2021).

The Breusch-Pagan LM test is appropriate when the time dimension (T) is significantly larger than the cross-sectional dimension (N). However, it may produce biased results in small samples. To address this issue, the bias-adjusted LM test was developed, offering more reliable outcomes in such cases.

The classical CD test by Pesaran (2004) is widely used when N is large and T is relatively small. Nevertheless, for panel structures where this assumption does not hold—particularly when T is large and N is small—Pesaran (2021) introduced the modified LM CD* test, which provides more accurate results.

Accordingly, considering the panel structure of the study (N=5, T=25), the above-mentioned four tests were applied and the findings on cross-sectional dependence are summarised in Table 2. However, only the findings of the bias-adjusted LM test are included in the table because this test provides the most appropriate and reliable results for the data structure of the study.

**Table 2:** Horizontal Cross Section Dependence Test Results

| Variable Ranking | Test Type | Statistic Value | Probability Value |
|---|---|---|---|
| Inflation→Real interest rate | LM adj | 15.69 | 0.000 |
| Real interest rate → Inflation | LM adj | 10.94 | 0.000 |

**0,10, **0,05 and ***0,01 indicate significance levels.*

According to the results, the bias-adjusted LM test statistics are statistically significant at the 1% significance level ($p < 0.01$). This leads to the rejection of the null hypothesis and confirms the existence of cross-sectional dependence in the panel data set. Therefore, it is appropriate to employ second-generation unit root tests in the panel data analysis.

After testing for cross-sectional dependence, the stationarity characteristics of the variables were subsequently assessed. Given the presence of cross-sectional dependence in the panel data, the stationarity — that is, whether the series are influenced by common shocks — should be assessed using a second-generation unit root test. In this study, Pesaran's (2007) Cross-sectionally Augmented IPS (CIPS) test was employed, and the results are summarized in Table 3.

**Table 3:** Unit Root Test Results

| Variables | Test Statistic (CIPS) | Significance Level | Decision |
|---|---|---|---|
| Inflation rate | -3.39119 | <0.01 | Stationary |
| Real interest rate | -3.45406 | <0.01 | Stationary |

**0,10, **0,05 and ***0,01 indicate significance levels.*

In the CIPS (Cross-sectionally Augmented IPS) test, the null hypothesis ($H_0$) assumes that the series contain a unit root, meaning they are non-stationary. The alternative hypothesis ($H_1$) states that the series are stationary. Based on the results of the analysis, the CIPS test statistics are found to be statistically significant for both the inflation and real interest rate series. Therefore, the null hypothesis is rejected at the 1% significance level, indicating that both series are stationary.

Before proceeding with the causality analysis, it is important to determine whether the long-run coefficients are homogeneous or heterogeneous across the countries in the panel. This determination helps guide the selection of the appropriate causality test method for panel data analysis. In this context, the Swamy (1970) test is employed to examine the homogeneity of the model parameters. The Swamy test evaluates whether the variables in the model—namely the real interest rate and the inflation rate—exhibit the same structure across countries.

As presented in Table 4, the test statistics for both variables are statistically significant at the 1% level. This result leads to the rejection of the null hypothesis ($H_0$: homogeneity), suggesting that the coefficients vary across the panel units. In other words, the variables display a heterogeneous structure among the countries included in the study.

**Table 4:** Homogeneity Test Results

| Variable | Test Statistic | Probability Value |
|---|---|---|
| Real interest rate | 29.37 | 0.000*** |
| Inflation Rate | 39.28 | 0.000*** |

**0,10, **0,05 and ***0,01 indicate significance levels.*

Finally, before applying the Dumitrescu and Hurlin (2012) panel Granger causality test, it is necessary to determine the appropriate lag length for the variables. Accordingly, the lag length selection criteria are presented in Table 5.

**Table 5:** Determination of Lag Length

| Lag Length | J | MBIC | MAIC | MQIC |
|---|---|---|---|---|
| 1 | 15.31997 | -37.26435 | -8.680029 | -20.1403 |
| 2 | 5.00712 | -30.04909 | -10.99288 | -18.63306 |
| 3 | 1.228797 | -16.29931 | -6.771203 | -10.59129 |

When the criteria in Table 5 (MBIC, MAIC, and MQIC) are examined, it is observed that the optimal lag length for the variables in the model is 1. Therefore, the Dumitrescu and Hurlin (2012) panel Granger causality test is conducted based on a model with one lag.

The results of the Dumitrescu and Hurlin (2012) panel Granger causality test between inflation and the real interest rate for the Central Asian countries are presented in Table 6. According to the empirical findings, the null hypothesis ($H_0$), which posits that there is no causality from the real interest rate to inflation, is rejected. Conversely, the null hypothesis stating that there is no causality from inflation to the real interest rate cannot be rejected. This result indicates a unidirectional causality running from the real interest rate to inflation.

**Table 6:** Dumitrescu and Hurlin (2012) Panel Granger Causality Test Results

| Direction of Causality | Statistic Value | Probability Value |
|---|---|---|
| Inflation→Real interest rate | 3.1212 | 0.0018 |
| Real interest rate → Inflation | 1.5583 | 0.1192 |

**0,10, **0,05 and ***0,01 indicate significance levels.*

## 6. Conclusion

The relationship between inflation and interest rates has long been an important topic in monetary economics literature. The direction and nature of this relationship are critically important, especially for the design and implementation of monetary policies. Inflationary pressures arising from money supply have become a structural problem that many countries need to address. In this context, central banks have tended to use interest rates as their main policy instrument.

The Central Asian Republics, which gained independence following the collapse of the Soviet Union, faced significant challenges such as high inflation rates, an underdeveloped financial system, economic instability, and capital shortages during their transition to market economies. In this study, the Dumitrescu and Hurlin (2012) panel Granger causality test was applied to determine the relationship between real interest rates and inflation for the period 2000-2024 in Kazakhstan, Kyrgyzstan, Uzbekistan, Tajikistan, and Turkmenistan—countries considered to share similar economic characteristics.

The analysis results revealed a unidirectional causality running from inflation to real interest rates in the sample countries. This finding contradicts the expected bidirectional relationship suggested by the Fisher hypothesis. It shows that while inflation influences interest rates, real interest rates do not play a determining role in affecting inflation.

As is known, in the absence of money illusion, the main variable affecting spending decisions is the real interest rate rather than the nominal interest rate. Therefore, it is crucial for monetary policymakers to closely monitor the dynamics of real interest rates alongside nominal rates.

The findings suggest that economic activities in the Central Asian Republics are shaped within an inflation-targeting framework, and interest rates are determined accordingly. In this context, policymakers should not disregard inflation dynamics when formulating interest rate policies. However, the limited impact of real interest rates on inflation raises questions about the effectiveness of interest rate policies in maintaining price stability. Therefore, to control inflation, economic decision-makers should develop policy packages that consider both short-term and long-term targets, address domestic and external imbalances, and are tailored to country-specific conditions.

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