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DETERMINANTS OF INFLATION IN TURKEY AMID ECONOMIC AND GEOPOLITICAL TURMOIL

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ABSTRACT

This study aims to investigate the factors influencing inflation in Turkey between 2006:1-2023:11, taking into account the structural changes that occurred during periods of significant economic, political and geopolitical turmoils. For this purpose, we employ the Hacker and Hatemi-J (2006) bootstrap causality test along with the Fourier Toda-Yamamoto bootstrap causality to capture structural changes. Our findings indicate that when structural changes are taken into account, the drivers of inflation are monetary factors such as the money supply and exchange rate. Furthermore, an exogenous factor such as the oil prices is not a determinant of inflation, suggesting that inflation is a domestic factor. Given these findings, the study emphasizes the importance of strong and stable monetary policies in Turkey to control inflation and achieve price stability.

Keywords: *Inflation, Monetary Policy, Oil Prices, Minimum Wage, Fourier Causality Test.*

Jel Codes: *E31, E52, C32.*

1.INTRODUCTION

Emerging economies are particularly susceptible to the adverse impacts of inflation on the economic and social structure, including income inequality, unstable growth, a decline in purchasing power, an increase in borrowing costs, and uncertainties. In this context, the inflation is a significant challenge to be addressed in economies where it is prevalent. The primary goal of the majority of central banks is to uphold and ensure the price stability. Therefore, the recognition of variables that could potentially disturb the price stability holds significant value for central banks in their endeavor to anticipate forthcoming inflation. Consequently, the implementation of appropriate policies will serve to minimise the discrepancies between the targeted and expected of inflation.

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The Global Financial Crisis (GFC), which commenced in 2008, resulted in a contraction in aggregate demand on a worldwide scale. Turkey also experienced the adverse effects of this situation, with the 2009 inflation rate of 6.5%, which was below the targeted 7.5% (CBRT, 2009). Global inflation, which was relatively moderate between the GFC and the onset of the COVID-19 pandemic, reached an alarming level for almost the entire world after COVID-19 (CBRT, 2020). In particular, both the monetary expansions implemented during the pandemic and the increase in production and energy demand towards the end of the pandemic triggered inflation by causing costs to rise, and global inflation started to rise in 2021 (Oskay, 2023). In Turkey, inflation rose from 11.89% in October 2020 to 19.89% in October 2021. During this period, the contribution of the food group to annual inflation increased by 2.03 points to 6.99 points, while the contribution of the energy group increased by 0.75 points to 2.75 points (CBRT, 2021). Although the successful implementation of monetary policies in this period helped keeping global inflation at a moderate level, in February 2022, geopolitical tensions increased with the outbreak of the Russia-Ukraine conflict (RUC), leading to supply constraints and accompanied by a rise in global commodity prices, particularly energy (CBRT, 2023a). Turkey's inflation rose from 19.89% in October 2021 to a record high of 85.51% in October 2022 (CBRT, 2022). While inflation fell to 61.53% in October 2023 (CBRT, 2023b), it remains high.

The existing empirical literature on the causes of inflation places considerable emphasis on the role of endogenous factors (Hałka and Kotłowski, 2017). These factors include economic factors such as money supply (Bello and Saulawa, 2013; Bawa et al., 2016), interest rates (Chaudhry et al., 2015), economic growth (Saungweme, 2021; Ezako, 2023), wages (Ghali, 1999; Agayev, 2012), budget deficits (Mughal, Khan and Aslam, 2011; Ellahi, 2017), unemployment rates (Carandang et al., 2024), and exchange rates (Pahlavani and Rahimi, 2009; Nair, 2014; Yien, Abdullah and Azam, 2017), as well as structural changes such as improvements in institutional quality, democratization, and central bank independence (Inim, Samuel and Prince, 2020; Kamber and Wong, 2020), along with political decisions and institutional changes (Domaç and Yücel, 2005). It should be noted that that global commodity prices such as food (De Gregorio, 2012; Durevall, Loening and Birru, 2013; Bayır and Kutlu, 2019; Peersman, 2022) and energy (Mumtaz and Surico, 2012; Niyimbanira, 2013; Rangasamy, 2017; Ha et al., 2019) may act as external drivers of domestic inflation.

This study offers several important contributions to the existing literature. First, by analysing the inflation dynamics in Turkey over the period 2006:M1-2023:M11, it provides a long-term and up-to-date perspective to the literature in this field. Second, in addition to the Hacker and Hatemi-J (2006) bootstrap causality test, the Fourier Toda-Yamamoto bootstrap causality test, which takes into account structural breaks, aims to overcome the limitations of previous studies in the literature. This method captures the effects of economic, political and geopolitical fluctuations more accurately, adding a more in-depth understanding to the analysis of the determinants of inflation. Finally, the results of the study provide important implications for policymakers and help them develop practical policies. In this respect, the study provides findings that can serve as a guide for the central bank and other economic actors aiming to maintain price stability in Turkey.

The paper is organised in 4 chapters. Section 1 provides information on inflation and the factors causing inflation. Section 2 contains the related literature including national and international empirical studies. Section 3 explains the empirical methods and findings. The last section offers implications and policy prescriptions.

2. LITERATURE REVIEW

The review of the related literature reveals a plethora of empirical studies on the determinants of inflation, employing a range of econometric methods and spanning various time periods for different economies. Although the analyses in the related studies vary in importance, there are many economic factors that can affect inflation at both global (e.g. commodity prices) and domestic (e.g. money supply, exchange rate, interest rate and budget deficit) levels (Barnichon and Peiris, 2008; Durevall and Sjö, 2012; Durevall et al., 2013). Although there are theoretical approaches to the source of inflation, ıt should be emphasized that the variables affecting inflation will differ for each economy. Therefore, although there is a vast literature on this subject, this section summarises national and international empirical studies on the drivers of inflation.

A review of the existing national literature on the causes of inflation reveals that Korkmaz and Çoban (2006) used the Granger causality analysis and found that there is a long-run reciprocal relationship between inflation and minimum wage. Oktayer (2010) used the Johansen cointegration analysis and revealed that budget deficits and money supply have a direct long-term influence on inflation. Abdioğlu (2013) employed the Toda-Yamamoto causality analysis and demonstrate that a bidirectional causality between wage levels and consumer prices. Based on the findings of Jalil, Tariq and Bibi (2014) using the Autoregressive Distributed Lag (ARDL) model, budget deficit, exchange rate, interest rate, public debt stock and per capita income affect inflation positively, while trade openness and money supply affect it negatively. In Sunal and Sezgin Alp (2015), findings from the Granger causality analysis indicate that the causality between nominal minimum wage and inflation is bidirectional. Afsal et al. (2018),employed the Nonlinear ARDL (NARDL) model Their results indicated that reveal that the interest rate exerts a short-run symmetric effect and a long-run asymmetric effect on inflation. On the other hand, no statistically significant finding was obtained on the direction and magnitude of the nexus of budget deficit and exchange rate with inflation. Based on the findings obtained from the Johansen cointegration approach in Demirgil (2019), increases in money supply, oil prices and exchange rate increase inflation, while an increase in the interest rate decreases inflation. In Bayır and Kutlu (2019), the findings from the ARDL model indicate that global commodity prices, income and exchange rate exhibit an upward trend in inflation and there is a long-run interaction. These findings emphasise the importance of global factors in achieving price stability. Yenisu (2019), using

Toda-Yamamoto causality analysis, finds that the drivers of inflation are monetary factors, bank loans, oil prices and budget deficit. Gümüş and Akgüneş (2020) used ARDL and Granger causality methods in their study. Evidence indicate that the long-run relationship between the unemployment rate and the minimum wage change rate with inflation is statistically insignificant, but there is a unidirectional causality from inflation to the minimum wage change rate. According to the findings of Kılavuz and Altınöz (2020) using the ARDL model, interest rate and money supply have a positive long-term effect on inflation, while exchange rate has no effect on inflation. Accordingly, it is determined that inflation in Turkey is more cost-push. Çelik (2021), using Johansen cointegration, Granger causality and Vector Autoregression (VAR) methods, finds that producer price index, money supply and short-term external debt stock have a long-term effect on inflation. Moreover, the causality between inflation and oil prices is bidirectional. Yılmazkuday (2022) applied the Structural VAR (SVAR) method and demonstrated that the factors affecting inflation are negative interest rate shocks, positive exchange rate and oil shocks. Moreover, exchange rate's influence on inflation volatility increases over time. According to the findings of Kolcu (2023) using VAR and ARDL models, exchange rate and interest rate have a positive effect on inflation both in the short and long run. On the other hand, a real money supply change exerts a negative effect on inflation. Demir, Sever and Bayram (2023) used the ARDL model and found that exchange rate, energy price index, money supply and uncertainties have positive short and long-term effects on inflation. Altıntaş and Özbek (2024) analysed the exchange rate and inflation relationship using ARDL and NARDL methods for two different periods, before and after inflation targeting. The findings indicate that during the pre-inflation targeting, post-inflation targeting, and overall period, the exchange rate exerts a positive impact on inflation.

A review of the existing international literature on the causes of inflation reveals that Laryea and Sumaila (2001) used the Vector Error Correction Model (VECM) in their research on Tanzania. The evidence suggests that the effects of monetary factors such as exchange rate and money supply on inflation are more influential. Loungani and Swagel (2001) used a panel VAR model for 53 developing countries and findings demostrate that the inflationary effects of monetary easing and exchange rate changes are more severe in economies with floating exchange rate regimes as opposed to countries with fixed exchange rate regimes. Moreover, oil and non-oil commodity prices have a major effect on inflation in economies with fixed exchange rate regimes. Nassar (2005) analysed the drivers of inflation in Madagascar using VECM. The evidence suggests that national prices, real income, monetary aggregates and interest rates are associated with inflation. In addition, instabilities in the money market have a long-term effect on inflation. Arif and Ali (2012) analysed the drivers of inflation in Bangladesh using VECM. According to the findings, money supply, public expenditure, GDP and imports increase inflation in the long run, while higher public revenues and more exports reduce inflation. It is also found that public expenditures and money supply are the most critical factors on inflation. Using VAR and SVAR methods on Vietnam, Phan (2014) demonstrated that the money supply, policy interest rate, trade partners' price levels and output shocks have a strong impact on inflation, while international oil and rice prices have no effect on inflation. Charnavoki and Dolado (2014) used the Factor-Augmented VAR (FAVAR) model for Canada and indicate that the global demand and commodity price shocks have a adverse effect on inflation. Lim and Sek (2015) employed the panel ARDL approach for 14 high inflation and 14 low inflation countries. According to the findings, in the long-term, government expenditures have a positive effect on inflation whereas money supply has a negative effect in the high inflation countries. On the other hand, import of goods and services have a positive effect on inflation whereas GDP growth has a negative effect in the low inflation countries. The Generalized Method of Moments (GMM) and the Pooled Mean Group (PMG) methods was used by Nguyen (2015) for 9 Asian countries. The results reveal that the money supply, budget deficit and government expenditure are increase the inflation according to both estimation methods. Bane (2018) used the ARDL model for Ethiopia and the results reveal that money supply and real interest rate are the most critical drivers of inflation. Moreover, the structural factors are as important as monetary factors. Deluna, Loanzon and Tatlonghari (2021) analysed the drivers of inflation in the Philippines using the NARDL method. The findings indicate that oil price shocks are the main cause of inflation. It is also indicate that interest rate and demand shocks have an asymmetric long-term effect on inflation whereas the exchange rate has a modest short-term pass-through to inflation and no long-term effect. Ha et al. (2023) examined the drivers of inflation employing the FAVAR model for 55 countries. According to the findings, oil price shocks tend to cause inflation changes in countries with fixed exchange rate regimes, countries without inflation targeting regimes, net energy importers, commodity importers, developed economies and countries with stronger global trade and financial linkages.

A review of the empirical literature reveals that co-integration tests (e.g. ARDL, NARDL, Johansen) are frequently used in the studies. On the other hand, studies using causality analyses are limited in number and traditional causality analyses (e.g. Granger, Toda-Yamamoto) are used in these studies. In this study, a causality analysis using the Fourier approach is applied to a dataset encompassing a period of significant economic, political, and geopolitical changes. This approach allows for the consideration of structural changes, thereby providing insights into the interactions of variables. It is anticipated that the findings of this study will offer an innovative perspective to the existing literature.

3. DATA, METHODOLOGY AND RESULTS

3.1. Data

Our dataset consists of consumer price index (CPI), real effective exchange rate (REER), WTI crude oil price, M2 money supply, unemployment rate and minimum wage variables between 2006:M1 and 2023:M11. CPI is obtained from Federal Reserve Economic Data (FRED), unemployment rate is obtained from TurkStat, West Texas Intermediate (WTI) crude oil price is obtained from the World Bank (WB) Pink Sheet, M2 money supply and real effective exchange rate are obtained from the Central

Bank of the Republic of Turkey (CBRT) and minimum wage is obtained from the Ministry of Labor and Social Security (MLSS) databases. Series are seasonally adjusted using Tramo-Seats and included to model. Summary information of the variables is presented in Table 1.

Table 1. Summary Information of Variables

Variable	Symbol	Source	Unit
Consumer Price Index	lncpi	FRED	2015=100
Real Effective Exchange Rate	lnreer	CBRT	2003=100
WTI Crude Oil Price	lnoil	WB Pink Sheet	$/bbl
M2 Money Supply	lnm2	CBRT	Total
Unemployment Rate	unemp	TurkStat	-
Minimum Wage	lnw	MLSS	-

3.2. Methodology

Based on economic theories and recent research, this study will examine the causal relationship between Turkey's inflation and chosen factors. The causality between the variables will be determined using the Fourier Toda-Yamamoto (FTY) bootstrap causality test that takes into account structural breaks and the Hacker and Hatemi-J (2006) (HHJ) bootstrap causality test that does not take into account structural breaks. Thus, the impact of structural fractures will be seen.

3.2.1. Fourier ADF Stationarity Test

To ensure proper econometric analysis, especially to deal with the spurious regression problem, analysing the stationarity of the series is essential. While traditional stationarity tests like ADF, PP, and KPSS have been used for this purpose, they do not account for structural breaks in the series. However, it is important to note that traditional tests may be less reliable in the presence of numerous structural breaks, especially during times of financial, political, and geopolitical turmoil periods. For this reason, Enders and Lee (2012) proposed the Fourier ADF (FADF) stationarity test that takes structural breaks into account when testing for stationarity. Eq. (1) presents the time-dependent Dickey-Fuller (DF) test function with the Fourier function included:

$$\Delta y_t = \alpha(t) + \delta t + \theta y_{t-1} + \sum_{i=1}^{p} \beta_i \Delta y_{t-i} + u_t \tag{1}$$

Where $\alpha(t)$ is a deterministic function of t, p is the optimal lag, θ and β_i are the coefficients and u_t is the error term. The model includes lagged Δy_t to avoid the autocorrelation problem. When the deterministic term's form is wrongly or unknown specified, testing the null hypothesis $\theta = 0$ becomes challenging. Fourier terms can be incorporated to the deterministic term to deal with this problem (Enders and Lee, 2012). The trigonometric Fourier terms that is added to the DF test is expressed in the Eq. (2):

$$\alpha(t) = \alpha_0 + \sum_{k=1}^{n} \gamma_{1k} \sin\left(\frac{2\pi kt}{T}\right) + \sum_{k=1}^{n} \gamma_{2k} \cos\left(\frac{2\pi kt}{T}\right) \tag{2}$$

Where T is the number of observations, k is the value of Fourier frequencies, t is the trend term and n is the number of Fourier frequencies in the fit. Higher components of n may lead to a reduction of the degrees of freedom. Therefore, the Fourier structure is applied for a single frequency and obtained as in Eq. (3):

$$\alpha(t) = \alpha_0 + \gamma_1 \sin\left(\frac{2\pi kt}{T}\right) + \gamma_2 \cos\left(\frac{2\pi kt}{T}\right) \tag{3}$$

Eq. (1) is substituted into Eq. (3) to obtain the single frequency equation of the FADF stationarity test represented by Eq. (4):

$$\Delta y_t = \alpha_1 + \delta t + \gamma_1 \sin\left(\frac{2\pi kt}{T}\right) + \gamma_2 \cos\left(\frac{2\pi kt}{T}\right) + \sum_{i=1}^{p} \beta_i \Delta y_{t-i} + \theta y_{t-1} + u_t \tag{4}$$

If θ in Eq. (4) equals zero, then the series has a unit root. Accordingly, if the t statistic value exceeds the table value, the null hypothesis is rejected.

3.2.2. Fourier KPSS Stationarity Test

In order to address the shortcomings of traditional stationarity tests that do not account for structural breaks, Becker, Enders and Lee (2006) proposed the Fourier KPSS (FKPSS) stationarity test by adding Fourier functions to the KPSS stationarity test. The FKPSS test is advantageous because it takes into account both sharp and soft breaks. Furthermore, there is no requirement to predetermine the number or date of series' breaks (Becker et al., 2006). The process of analyzing stationarity with the FKPSS test starts with the data creation process in Eq. (5):

$$\begin{aligned} y_t &= X_t'\beta + Z_t'\gamma + r_t + \varepsilon_t \\ r_t &= r_{t-1} + u_t \end{aligned} \tag{5}$$

Where ε_t and u_t represent stationary errors and independent and identically distributed (i.i.d) errors with variance σ_u^2, respectively. The trigonometric term, Z_t, is given in Eq. (6) as suggested by Becker et al. (2006):

$$Z_t = \left[sin\left(\frac{2\pi kt}{T}\right), cos\left(\frac{2\pi kt}{T}\right)\right]' \tag{6}$$

To test the null hypothesis that the series is stationary ($H_0: \sigma_u^2 = 0$), the residuals can be calculated by estimating the level and trend stationarity models in Eq. (7) and Eq. (8):

$$y_t = \alpha_0 + \gamma_1 \sin\left(\frac{2\pi kt}{T}\right) + \gamma_2 \cos\left(\frac{2\pi kt}{T}\right) + e_t \tag{7}$$

$$y_t = \alpha_0 + \beta t + \gamma_1 \sin\left(\frac{2\pi kt}{T}\right) + \gamma_2 \cos\left(\frac{2\pi kt}{T}\right) + e_t \tag{8}$$

t represents the trend in Eq. (8). The FKPSS test statistics can be calculated as in Eq. (9):

$$\tau_{\mu}(k) \ or \ \tau_{\tau}(k) = \frac{1}{T^2}\frac{\sum_{t=1}^{T}\tilde{S}_t(k)^2}{\tilde{\sigma}^2} \tag{9}$$

Where $\tilde{S}_t$ is the sum of the residuals obtained from Eq. (7) and Eq. (8) ($\tilde{S}_t(k) = \sum_{j=1}^{t}\tilde{e_j}$). If nonlinear trends are absent during the data generation process, the standard KPSS stationarity test is deemed to be more dependable compared to the FKPSS stationarity test. Hence, in order to examine the null hypothesis of the absence of nonlinear trend ($H_0: \gamma_1 = \gamma_2 = 0$), Becker et al. (2006) recommended the utilization of the F-statistic test as illustrated in Eq. (10):

$$F_i(k) = \frac{(SSR_0 - SSR_1(k))/2}{SSR_1(k)/(T-q)}, \qquad i = \mu, \tau \tag{10}$$

The Sum of Squares Residuals (SSR) obtained from Eq. (7) and Eq. (8) is denoted as $SSR_1(k)$. The SSR of the regression the null hypothesis holds is denoted as SSR_0 and q represents the number of independent variables. Critical values for the FKPSS stationarity test are listed in Becker et al. (2006).

3.2.3. FTY Bootstrap Causality Test

To overcome the loss of information in the series caused by the Granger (1969) causality test, Toda and Yamamoto (1995) (TY) presented a novel causality test that depends on the Sims' (1980) VAR model. One of the strengths of the TY test is that it can produce accurate results regardless of the level of integration (Wolde-Rufael, 2006). In the TY test, where the level values of the series are taken into account, the optimal lag length is added to the maximum integration order of the series and the model is estimated. The TY test estimated with the VAR ($p + d_{max}$) model is presented in Eq. (11):

$$y_t = \alpha_0 + \beta_1 \ y_{t-1} + \beta_p \ y_{p-1} + \cdots + \beta_{p+d_{max}} \ y_{t-(p+d_{max})} + \varepsilon_t \tag{11}$$

Where y_t, α_0 and ε_t are n-dimensional vectors, β is the parameter matrix, p is the maximum lag length and d_{max} is the maximum degree of integration.

Structural breaks in the series are not taken into account in the TY test. However, if the structural breaks are disregarded in the VAR models, causality test results may be erroneous (Enders and Jones, 2016). Because of this reason, Nazlioglu, Gormus and Soytas (2016) developed the FTY test that takes structural breaks into account by adding Fourier functions to the TY test. There are no assumptions or prior information requirements for the Fourier approximation when it comes to the shifts' date, number, and form. Together with the benefits of the TY procedure, FTY test can handle structural alterations of any kind and magnitude (Nazlioglu et al., 2016). The FTY test, where Fourier functions in Eq. (3) are added to the VAR ($p + d_{max}$) in Eq. (11) model, is presented in Eq. (12):

$$y_t = \alpha_0 + \gamma_1 \sin\left(\frac{2\pi kt}{T}\right) + \gamma_2 \cos\left(\frac{2\pi kt}{T}\right) + \beta_1 \ y_{t-1} + \cdots + \beta_{p+d_{max}} \ y_{t-(p+d_{max})} + \varepsilon_t \tag{12}$$

The FTY test uses the chi-square (χ^2) Wald statistic with p degrees of freedom to test the null hypothesis of no causality ($H_0: \beta_1 = \cdots = \beta_p = 0$) (Nazlıoğlu et al., 2016).

3.2.4. HHJ Bootstrap Causality Test

The HHJ bootstrap causality test is a superior version of the TY test. The main distinguishing factor between the HHJ and TY tests is the use of the bootstrap method in the HHJ test. The bootstrap method is easy to use and produces dependable results, particularly when assumptions are limited (Simon and Bruce, 1991).

Granger causality is examined using the Wald statistic value in the TY test. However, the Wald statistic value is redeveloped as Modified Wald (MWALD) in the HHJ test. The MWALD has an asymptotic χ^2 distribution with degrees of freedom equal to p (Hacker and Hatemi-J, 2006). The MWALD is expressed in Eq. (13):

$$MWALD = (C\hat{\beta})'[C((Z'Z)^{-1} \oplus S_U)C']^{-1}(C\hat{\beta}) \tag{13}$$

Where $\oplus$ is the Kronocker product, C is the $p \times n(1 + n(p + d))$ dimensional matrix, $\hat{\beta}$ is the $(\hat{v}, \hat{A}_1, \dots, \hat{A}_p, \dots, \hat{A}_{p+d})$ matrix, Z is the $t = 1, 2, \dots, T$ denotes the matrix $Z_t = (1, y_t, y_{t-1}, \dots, y_{t-p-d+1})$ and S_U denotes the variance-covariance matrix of the residuals. If the MWALD value exceeds the table critical value, the null hypothesis stating that there is no causality between the series ($H_0 = C\hat{\beta} = 0$) is rejected (Hacker and Hatemi-J, 2006).

3.3. Results

The outcomes of the FADF and FKPSS tests for stationarity are detailed in Table 2. The null hypothesis of non-stationarity for REER and oil prices is rejected in level by the FADF stationarity test, while rejected at difference for other variables. Hence, it is deduced that lnreer and lnoil exhibit stationarity at I(0), whereas the remaining variables show stationarity at I(1). Conversely, according to the findings of the FKPSS stationarity test, the null hypothesis of stationarity is dismissed at level for all variables, but accepted at difference. Consequently, all variables are stationary at I(1).

Table 2. FADF and FKPSS Stationarity Tests Evidence

Tests	**FADF**		**FKPSS**	
Variables	**FADF-Stat**	**k**	**FKPSS-Stat**	**k**
lncpi	4.439	5	0.906*	1
lnreer	-5.236*	1	0.215*	1
lnoil	-4.337*	1	0.283*	1
lnm2	-0.628	1	0.993*	1
unemp	-2.830	2	0.553*	2
lnw	3.272	5	0.733*	1
Δlncpi	-7.246*	1	0.043	1
Δlnreer	-9.759*	1	0.016	1
Δlnoil	-9.967*	5	0.042	5
Δlnm2	-14.225*	1	0.028	1
Δunemp	-7.689*	3	0.114	3
Δlnw	-6.294*	1	0.015	1

Notes: "*" denotes significance level of 5%, ‘k’ denotes frequency value. In the FADF test, the 5% significance values of k for 1,2,3,4 and 5 values are -4.31, -4.01, -3.77, -3.63, -3.31 and -3.24, respectively. In the FKPSS test, the 5% significance values for 1,2,3,4 and 5 values of k are 0.054, 0.132, 0.142, 0.147 and 0.148, respectively.

The findings of the HHJ and FTY assessments subsequent to verifying the stationarity of the variables are demonstrated in Table 3. The HHJ test results suggest a rejection of the null hypothesis of no causality among CPI, REER, oil prices, money supply, unemployment rate, and minimum wage. It is therefore concluded that there is unidirectional causality from the CPI to the REER, from the CPI to the oil price, from the CPI to money supply and from the CPI to the minimum wage, while there is bidirectional causality between the CPI and the unemployment rate.

It is crucial to highlight that the HHJ test does not take structural breaks into account when determining the causality between variables. As per the outcomes of the FTY test, which considers structural breaks, the null hypothesis indicating no causality amid CPI, REER, oil prices, money supply, unemployment rate, and minimum wage is rejected. Accordingly, unidirectional causality is found from the REER to the CPI, from the CPI to oil prices, from the money supply to the CPI and from the CPI to the minimum wage, while no causality is found between the CPI and the unemployment rate.

Table 3. HHJ and FTY Causality Tests Results

HHJ Causality Test Results					
H_0 Hypothesis	**MWALD Values**	**Bootstrap Critical Values**			**$p+d_{max}$**
		%1	**%5**	**%10**	
lncpi ≠> lnreer	15.139*	9.567	6.506	4.701	2+1
lnreer ≠> lncpi	3.927	10.016	6.082	4.925	2+1
lncpi ≠> lnoil	4.996***	8.998	6.183	4.649	2+1
lnoil ≠> lncpi	0.381	10.018	6.534	4.922	2+1
lncpi ≠> lnm2	10.043**	13.886	6.792	4.978	2+1
lnm2 ≠> lncpi	1.844	8.680	5.781	4.514	2+1
lncpi ≠> unemp	15.686*	15.409	7.790	5.041	2+1
unemp ≠> lncpi	9.794**	15.066	7.841	5.411	2+1
lncpi ≠> lnw	9.762**	12.069	6.308	4.525	2+1
lnw ≠> lncpi	1.686	10.049	6.628	4.598	2+1

FTY Causality Test Results			
H_0 Hypothesis	**WALD Values**	**Bootstrap p-value**	**p(k)**
lncpi ≠> lnreer	4.191	0.138	2(1)
lnreer ≠> lncpi	22.475*	0.000	2(1)
lncpi ≠> lnoil	7.884**	0.028	2(1)

lnoil ≠> lncpi	1.758	0.377	2(1)
lncpi ≠> lnm2	1.118	0.560	2(1)
lnm2 ≠> lncpi	39.209*	0.000	2(1)
lncpi ≠> unemp	0.443	0.513	1(1)
unemp ≠> lncpi	0.000	0.994	1(1)
lncpi ≠> lnw	5.539**	0.025	1(1)
lnw ≠> lncpi	0.445	0.505	1(1)

Notes: '≠>' indicates the direction of no causality. "*", "**" and "***" denote the significance of causality at the 1%, 5% and 10% levels, respectively. Lag lengths are determined as 12 based on Nazlıoğlu et al. (2016) and obtained using SIC. The bootstrap value for both tests is 1000.

4. CONCLUSION

This study aims to identify the factors influencing Turkey's inflation by taking into account the major economic, political and geopolitical turmoil in the last 15 years, such as the 2008 GFC, the US-China trade war, the COVID-19, the RUC and Israel's attempt to occupy Palestine. For this purpose, Hacker and Hatemi-J (2006) bootstrap causality test and Fourier Toda-Yamamoto causality test are employed for the period 2006:1-2023:11 to investigate the causes behind inflation in Turkey by taking structural changes into account.

Our study provides important results in several aspects. First, it is found that the determinants of inflation differ when structural changes are considered. Accordingly, the outcomes of the Hacker and Hatemi-J (2006) test without taking structural changes into account indicate that there is unidirectional causality from inflation to exchange rate, minimum wage, oil prices and money supply and bidirectional causality between unemployment and inflation. On the other hand, the outcomes of the Fourier Toda-Yamamoto test, which takes structural changes into account, indicate that there is unidirectional causality from exchange rate and money supply to inflation, and unidirectional causality from inflation to oil prices and minimum wage. These findings from the study are in similarities with previous studies Yenisu (2019), Yilmazkuday (2022) and Demir, Sever and Bayram (2023). Second, it can be stated that a global factor such as oil prices has no effect on Turkey's inflation, that is, inflation in Turkey is a local phenomenon. Finally, Turkey's inflation exhibits a robust relationship with crucial monetary elements such as exchange rate and money supply. Therefore, we can underscoring inflation as a monetary phenomenon.

In light of these findings, it can be posited that a robust monetary policy is the most effective means of maintaining price stability in Turkey. The successful implementation of strong monetary policies is contingent upon the satisfaction of certain conditions. The first requisite is that of central bank independence. In order to achieve this, it is essential that policymakers provide the central bank with an independent atmosphere, protected by law and free from political influences. The second condition is that monetary policies should be transparent and that the central bank should interact with economic agents. This is crucial for guiding the expectations of economic agents and fostering confidence in the market. Finally, the central bank should have an inflation target that takes into account the economic conjuncture and market conditions, and the policies to be implemented should be shaped in the light of science to achieve this target.

While our findings contribute significantly to the existing literature, it is important to acknowledge the limitations of our study. Therefore, we suggest a few aspects for researchers to shed light on future studies. Firstly, this study exemine the inflationary aspect of energy. It is important to consider global food commodity prices, especially considering the fluctuations in food prices during the 2008 GFC, the COVID-19 and the RUC. Secondly, while monetary considerations are the primary focus of this research, it would be beneficial to examine fiscal aspects such as tax revenue, public spending and the budget deficit. Finally, cointegration tests that account for structural changes can be employed to examine the long-term consequences of affecting inflation. Future studies are left to the researchers' interests.

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