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Asymmetric Effectiveness of Monetary and Fiscal Policies: Evidence from Turkey

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This study assesses the asymmetric effectiveness of Turkey's monetary policy and fiscal policy under the inflation targeting regime in the period of 2006-2020. We employed the non-linear autoregressive distributed lag (NARDL) method and Hatemi-J asymmetric causality test with the assistance of the St. Louis equation, which relates the growth in nominal income with the growth in money supply and public expenditures. The NARDL model revealed that an increase in money supply and gross domestic product (GDP) has a positive relationship. On the other hand, a decrease in money supply and government expenditures have no significant relationship with GDP. In addition, Hatemi-J asymmetric causality results showed an asymmetric causality between money supply and GDP. It demonstrates that the money supply in Turkey during the period 2006-2020 is endogenous.

JEL codes: C22, E63, E52

Keywords: St. Louis equation, NARDL, Asymmetric causality

1 Introduction

Economic policies are set to achieve several targets, such as increasing employment, maintaining price stability, and increasing output. Each policy choice and target requires different policy tools. Which policy is more appropriate for which goal and which policy instruments would achieve the targets economically efficiently is the subject of broad debate in the literature on economics. In this regard, economics schools have put forward distinct views. With the effects of the 1929 Great Depression, the thoughts of the Classical School, which rejected state interference, started to be challenged. During this period, many economists argued extensively about which policies were best for the system and could avoid depression.

Ultimately, the Keynesian fiscal policy supporting state interventionism came to the fore (Landreth & Colander, 2002). Keynesian fiscal policy was influential in the US and other Western countries, especially in the 1950s and 60s. However, the inflationary pressure experienced in the 1970s again led to an investigation for a new policy setting. The policy

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stress shifted again to monetary policy and reaffirmed the quantity theory of money (Ekelund Jr. & Hébert, 1997). In this direction, many studies have attempted to assess the effectiveness of monetary and fiscal policies.

The role of monetary and fiscal policy in implementing economic stability policies has been studied for a long time, and there is a broad literature on this topic. In this framework, one of the first econometric studies to compare the impact of monetary policy and fiscal policy was conducted by Friedman & Meiselman (1963). In the study covering the USA data of 1897-1958, monetary variations provided more stable and statistically significant results on national income than autonomous expenditures (McCallum, 1985; Walsh, 2017). The pioneering and seminal study in this area, Andersen & Jordan (1968) utilizes the St. Louis equation, which is expressed in equation (1).

$$\Delta y_t = \alpha + \sum_{i=1}^{p} \beta_i \Delta m_{t-i} + \sum_{i=1}^{p} \gamma_i \Delta g_{t-i} + \sum_{i=1}^{p} \delta_i \Delta y_{t-i} + \varepsilon_t \tag{1}$$

where y_t represents the logarithmic change in nominal income, Δm_t and Δg_t represent the past values of the logarithmic changes in the nominal money supply and public expenditure, respectively. Δy_{t-i} represents the own past values of nominal income (Enders, 2008). Andersen & Jordan (1968) tested the effect of monetary policy on the economy relative to fiscal policy, using the variables of gross national product (GNP), money stock, monetary base, and public expenditures. The results for the US data from 1952 to 1968 identified that monetary policy was efficient in the US economy, whereas fiscal policy was not.

In this study, by utilizing the same methodology, the relative effectiveness of monetary and fiscal policies are evaluated for the 2006-2020 period, during which a full-fledged inflation targeting regime was in place in Turkey. Inflation targeting is a monetary policy strategy (Mishkin, 2000; Svensson, 2010), and is essentially used to attain price stability (Kara & Orak, 2008). Inflation targeting encompasses announcing inflation targets, including the commitment to price stability, an informational strategy using many variables, increasing transparency, and increasing accountability (Mishkin, 2000). However, inflation targeting may be more effective in industrialized countries. In developing countries, on the other hand, it may fail because the requirements for effective inflation targeting cannot be met (Eroğlu et al., 2017; Masson et al., 1997).

After the 2001 crisis, to fight against the inflation that Turkey had been experiencing for many years, switching to an inflation targeting regime was desired. Following the crisis, monetary policy and exchange rate policies were reshaped within the "Transition to a Strong Economy" program. During this period, the Central Bank of the Republic of Turkey (CBRT) switched to the floating exchange rate regime and decided to implement the inflation targeting regime to lower inflation (Akyazı & Ekinci, 2009; Civcir & Akçağlayan, 2010; Kara & Orak, 2008). However, there were no adequate preconditions for implementing full-fledged inflation targeting regime. Therefore, an Implicit Inflation Targeting Regime was implemented between 2002 and 2005. After achieving a sure success in the disinflation process, the CBRT decided that the necessary conditions were met and started implementing a Full-Fledged Inflation Targeting Regime by 2006 (CBRT, 2018).

This study aims to ascertain the relative effectiveness of monetary and fiscal policy under inflation targeting regime. For this purpose, the effects of money supply (a monetary policy tool) and government expenditures (a fiscal policy tool) on economic growth were tested using data between 2006 and 2020. The non-linear autoregressive distributed lag (NARDL) and Hatemi-J asymmetric causality test were used based on the St. Louis equation.

The rest of the paper is organized as follows. The next section presents the related literature. Section 3 provides the data, methodology and econometric model used in the study, Section 4 discusses the empirical findings, and section 5 concludes.

2 Related Literature

Friedman & Schwartz (1963) dealt with the relationship between business cycles and money supply in their classical study. The results revealed that the business cycle is affected by changes in the growth rate of the money supply. This result has encouraged many authors to examine the issue (Thornton, 1993; Walsh, 2017). Again, in the study conducted by Friedman & Meiselman (1963), monetary variables were found to be more efficient in determining national income than fiscal variables. Andersen & Jordan (1968) found that the monetary policy has an essential impact on nominal GNP, whereas the fiscal policy was found to have a minimal but statistically insignificant impact. These findings were inconsistent with the conventional view.

Andersen & Jordan (1968)'s study has caused severe controversy among economists. De Leeuw et al. (1969) criticized the conclusion about fiscal policy by stating that the identification strategy applied led Andersen & Jordan (1968) to this conclusion. By using the same data but neglecting monetary base variables (borrowed reserves or currency or both), they reached different results; both fiscal policy and monetary policy impact the GNP. The results obtained in the study by Andersen & Carlson (1970), which expanded its scope, showed that the fiscal policy was effective but only in the short term.

On the other hand, it was identified that monetary policy had strategic importance in the long term. However, Friedman (1977) expanded the study by extending the original data range. Thus, he stressed that "the St. Louis equation now believes in fiscal policy". Carlson (1978) responded by claiming that the variance of the error term is not constant in Friedman (1977). That is, it has a heteroskedasticity problem. His alternative was to express the variables in rates of change form. His results showed that the evidence did not back up the argument of the St. Louis equation "believing in" fiscal policies.

Darrat (1984) applied the OLS and Granger causality method in a study involving five countries (Brazil, Chile, Mexico, Peru, and Venezuela) and demonstrated that fiscal policy in developed countries is more successful than monetary policy. Batten et al. (1983) conducted an OLS analysis for six countries (Canada, France, Germany, Japan, the United Kingdom, and the United States) and concluded that monetary growth is more effective than fiscal policy in determining GNP growth. Monetary growth has a positive effect on all countries. As for government spending, it is statistically significant only for England and France. Chowdhury (1986) showed for Bangladesh that fiscal policy was more effective than monetary policy on growth from 1972 to 1983.

In a study that tested the effectiveness of fiscal policy in Japan using the VAR method, Kuttner & Posen (2002), concluded that the expansionary fiscal policy had a stimulative effect between 1976 and 1999. Looking at the studies on Nigeria, it has been revealed that the monetary policy is more effective (Ajisafe & Folorunso, 2002; Adefeso & Mobolaji, 2010; Ajayi & Aluko, 2017). On the other hand, Okorie et al. (2017) concluded that fiscal policy in Nigeria is more effective than monetary policy.

Senbet (2011) investigated the relative effectiveness of fiscal and monetary policies on output for the US between 1959 and 2010. A Granger causality test and vector autoregressive (VAR) model were used. The causality test results show two-way causality between monetary policy and both nominal and real output when using the first difference of the effective Federal Funds Rate (FFR). There is one-way causality from monetary policy to real output when using the non-borrowed reserve. As regards the variance decomposition, policy shocks are not statistically significant. However, for real output, monetary policy is statistically significant.

In another study conducted using a panel VAR model for BRICS (Brazil, Russia, India, China, and South Africa) countries representing five developing economies, Jawadi et al. (2016) concluded that monetary contractions resulted in a decline in output in the 1990-2013 period. On the other hand, government spending shocks have strong Keynesian effects, and monetary policies appear to be more accommodating. Using the IS-MP-AS method in their studies covering 1971-2006, Alavi et al. (2016) concluded that both policies significantly affect the Iranian economy. Evans et al. (2018) discussed the relative impact of monetary and fiscal policies for Africa for the period 1995 to 2016. The general method of moments (GMM) results showed that monetary policy has a higher impact than fiscal policy.

Awdeh (2019) examined the relationship between economic growth and monetary policy in Lebanon using a vector error correction model (VECM) from 2002 to 2017. The empirical findings indicate that the monetary instruments used by the Lebanon Central Bank reduced economic growth over the long term. Jithin & Suresh (2020) tested the effectiveness of inflation targeting in India by using an augmented vector autoregression approach (FAVAR) in the years from 2001 to 2016. The findings show that monetary policy effectively explains changes in inflation rather than increasing output.

Conducting an analysis including Turkey, Akyürek et al. (2011) investigated whether the inflation targeting regime is effective in developing countries. The results of a VAR analysis indicated that inflation targeting was adequate for the years between 1999 and 2008. Topçu & Kuloğlu (2012) examined Turkey's economy for the 1998-2010 period by employing OLS and Granger causality tests. Granger causality results showed one-way causality from real GDP to government expenditure and one-way causality from money stock to government expenditure. In the short term, both policies have a positive effect on economic growth. In the long run, only monetary policy has a positive impact. Eroğlu et al. (2017) examined the effectiveness of inflation targeting in Turkey for the period of 1990-2008 and concluded that inflation targeting affects the macroeconomic performance positively, except for the growth rate. According to the results of an ARDL analysis of Özer & Karagöl (2018), fiscal policy has an impact on growth only in the short run, whereas monetary policy is effective in both the short and long run. In the study of Karagöl & Benli (2019) for BRICS-T countries, findings showed that fiscal policy has more impact on GDP than monetary policy.

3 Data and Methodology

3.1 Data

The impacts of M2 money supply[1] and government expenditure on economic growth in Turkey were investigated for the 2006-2020 period using quarterly data. Y is the real GDP (billions constant 2010 US$), M is the money supply (millions), and G is government expenditure. The real GDP, M2 money supply, and government expenditure data were taken from the CBRT Electronic Data Delivery System. All the variables used in the study are expressed in a natural logarithm.

3.2 Methods

3.2.1 Model Specification

The variables were transformed into natural logarithms to effectively assess the explicit impact of money supply (M) and government expenditure (G) on economic growth (Y). The mathematical model is written as follows:

$$LY_t = f\left(LM_t, LG_t\right) \tag{2}$$

By following Friedman & Kuttner (1992), the St. Louis equation in the form of equation (3) is used.

$$\Delta LY_t = \alpha + \sum_{i=1}^{p} \beta_i \Delta LY_{t-i} + \sum_{i=1}^{p} \gamma_i \Delta LM_{t-i} + \sum_{i=1}^{p} \delta_i \Delta LG_{t-i} + \varepsilon_t \tag{3}$$

3.2.2 Unit root testing

The ARDL model applies to stationary variables at the level, the first difference, or a combination of both (Pesaran & Pesaran, 1997). However, this method is not valid if all of the variables analyzed are integrated of order two, i.e. $I(2)$. It is also essential to evaluate the stationarity of variables before progressing to the next stage of study and interpretation. In this analysis, the ADF and KPSS root unit tests were conducted to verify the variables' stationarity (Oryani et al., 2021).

3.2.3 Non-linear ARDL Approach

The co-integration non-linear autoregressive distributed lag (NARDL) is suggested by Pesaran & Shin (1999) and Pesaran et al. (2001) as an asymmetric extension of the linear ARDL model. Shin et al. (2014) developed a flexible dynamic parametric framework to model relationships that exhibit combined long-run and short-run asymmetries. This method analyses the asymmetric effects of LM and LY in Turkey.

[1] M2 is a measure of narrow money stock that includes M1 (currency and coins held by the non-bank public and checkable deposits) plus savings deposits.

Following Shin et al. (2014), consider the following non-linear $ARDL(p,q)$ model which means asymmetric co-integration regression based on:

$$LY_t = \sum_{j=1}^{p} \phi_j LY_{t-j} + \sum_{j=0}^{q} \left(\theta_j^{+\prime} LM_{t-j}^{+} + \theta_j^{-\prime} LM_{t-j}^{-} \right) + \sum_{j=1}^{p} \phi_j LG_{t-j} + \varepsilon_t \tag{4}$$

where LY_t, LM_t and LG_t are $I(1)$ variables and ϕ_j is autoregressive parameter, θ_j^- and θ_j^+ are the asymmetric distributed-lag parameters and $\varepsilon_t \sim \mathcal{N}\left(0,\ \sigma_\varepsilon^2\right)$. LM_t is decomposed as

$$\begin{aligned} LM_t &= LM_0 + LM_t^+ + LM_t^- \\ LM_t^+ &= \sum_{j=1}^{t} \Delta LM_j^+ = \sum_{j=1}^{t} max(\Delta LM_j, 0) \\ LM_t^- &= \sum_{j=1}^{t} \Delta LM_j^- = \sum_{j=1}^{t} min(\Delta LM_j, 0) \end{aligned} \tag{5}$$

where LM_t^+ and LM_t^- are partial sum of positive and negative changes in LM_t.

Considering the functional form of the St. Louis function in (3), the decomposed impact of money supply in (5) can be represented in the NARDL form, as shown in (6).

$$\begin{aligned} \Delta LY_t = \rho LY_{t-1} &+ \theta_j^{+\prime} LM_{t-1}^+ + \theta_j^{-\prime} LM_{t-1}^- + \zeta LG_{t-1} + \\ &\sum_{j=1}^{p-1} \gamma_i \Delta LY_{t-j} + \sum_{j=1}^{p-1} \psi_i \Delta LG_{t-j} + \sum_{j=0}^{q} \varphi_j^+ LM_{t-j}^+ + \sum_{j=0}^{q} \varphi_j^- LM_{t-j}^- + \varepsilon_t \end{aligned} \tag{6}$$

$$\Delta LY_t = \rho \xi_{t-1} + \sum_{j=1}^{p-1} \gamma_i \Delta LY_{t-j} + \sum_{j=1}^{p-1} + \zeta LG_{t-1} + \sum_{j=0}^{q} (\varphi_j^+ LM_{t-j}^+ + \varphi_j^- LM_{t-j}^-) + \varepsilon_t \tag{7}$$

where $\rho = \sum_{j=1}^{p} \phi_j - 1$, $\gamma_i = -\sum_{i=j+1}^{p} \phi_i$ for $j = 1, ..., p-1$, $\theta^+ = \sum_{j=0}^{q} \theta_j^+, \theta^- = \sum_{j=0}^{q} \theta_j^-$, $\varphi_0^+ = \theta_0^+, \varphi_j^+ = -\sum_{i=j+1}^{q} \theta_j^+$ and $\varphi_0^- = \theta_0^-$, $\varphi_j^- = -\sum_{i=j+1}^{q} \theta_j^-$ for $j = 1, ..., q-1$.

We test the long-run relationship between the levels of LY_t, LM_t^+ and LM_t^- $H_0 : \rho = \theta^+ = \theta^- = 0$ by using the F_{PSS} statistics suggested by Pesaran et al. (2001) and Shin et al. (2014). We investigate long-run symmetry $\theta = \theta^+ = \theta^-$ and short-run symmetry that can take $\sum_{i=0}^{q-1} \varphi_j^+ = \sum_{i=0}^{q-1} \varphi_j^-$ using the Wald test. As a result, we can write the error correction model as:

$$\begin{aligned} \Delta LY_t = &\sum_{j=1}^{p-1} \alpha_{1j} \Delta LY_{t-j} + \sum_{j=1}^{p-1} \alpha_{2j} \Delta LM_{t-j} + \sum_{j=1}^{p-1} \alpha_{3j} \Delta LG_{t-j} + \\ &\sum_{j=1}^{q-1} (\alpha_{4j}^{+\prime} \Delta LM_{t-j}^+ + \alpha_{4j}^{-\prime} \Delta LM_{t-j}^-) + \epsilon_t \end{aligned} \tag{8}$$

The cumulative dynamic multiplier effects of LM_t^+ and LM_t^- on LY_t, for $h = 0, 1, 2, ...$ can be evaluated as follows:

$$\ell_h^+ = \sum_{j=0}^{h} \frac{\partial LY_{t+j}}{\partial LM_t^+} = \sum_{j=0}^{h} \lambda_j^+, \tag{9}$$

$$\ell_h^- = \sum_{j=0}^{h} \frac{\partial LY_{t+j}}{\partial LM_t^-} = \sum_{j=0}^{h} \lambda_j^- \tag{10}$$

where as $h \to \infty$, $\ell_h^+ \to \beta^+$ and $\ell_h^- \to \beta^-$, and $\beta^+ = -\theta^+/\rho$ and $\beta^+ = -\theta^-/\rho$ are the asymmetric long-run parameters.

3.2.4 The asymmetric causality test

Co-integration between LM and LY means that there must be a causal relationship. Hatemi-j (2012) suggested that the asymmetric causality test accounts for asymmetries, measuring the combined sums of the independent variable's positive and negative variations.

We are concerned about the causal relationship between the integrated variable GDP and the money supply, which can be expressed as a random walk process (Hatemi-j, 2012).

$$\begin{aligned} LY_t &= LY_{t-1} + \varepsilon_{1i} = LY_0 + \sum_{i=1}^{t} \varepsilon_{1i} \\ LM_t &= LM_{t-1} + \varepsilon_{2i} = LM_0 + \sum_{i=1}^{t} \varepsilon_{2i} \end{aligned} \tag{11}$$

where $t = 1, 2, ..., T$, LY_0 and LM_0 are the initial values and ε_{1i} and ε_{2i} are the white noise disturbance terms. Negative and positive shocks are defined as the following: $\varepsilon_{1i}^- = min(\varepsilon_{1i}, 0)$, $\varepsilon_{2i}^- = min(\varepsilon_{2i}, 0)$, $\varepsilon_{1i}^+ = max(\varepsilon_{1i}, 0)$ and $\varepsilon_{2i}^+ = max(\varepsilon_{2i}, 0)$, respectively. It follows that

$$\begin{aligned} LY_t &= LY_{t-1} + \varepsilon_{1i} = LY_0 + \sum_{i=1}^{t} \varepsilon_{1i}^+ + \sum_{i=1}^{t} \varepsilon_{1i}^- \\ LM_t &= LM_{t-1} + \varepsilon_{2i} = LM_0 + \sum_{i=1}^{t} \varepsilon_{2i}^+ + \sum_{i=1}^{t} \varepsilon_{2i}^- \end{aligned} \tag{12}$$

The negative and positive shocks of money supply and GDP can be defined in a cumulative form as $LY_t^+ = \sum_{i=1}^{t} \varepsilon_{1i}^+$, $LY_t^- = \sum_{i=1}^{t} \varepsilon_{1i}^-$, $LM_t^+ = \sum_{i=1}^{t} \varepsilon_{2i}^+$ and $LM_t^- = \sum_{i=1}^{t} \varepsilon_{2i}^-$. According to Hatemi-j (2012), to examine the asymmetric causality between LY_t and LM_t, VAR model of order p must be estimated: $y_t^+ = \nu + A_1 y_{t-1}^+ + A_2 y_{t-2}^+ + ... + A_p y_{t-p}^+ + u_t^+$ where y_t^+ is a $2x1$ vector of the variables, ν is a $2x1$ vector of intercepts, and u_t^+ is a 21 vector of error terms. The matrix A_r is a $2x2$ matrix of parameters, for lag order $r(r = 1, ..., p)$. The optimal lag order p is selected by the following information criterion for $j = 0, ..., p$ (Hatemi-j, 2003).

$$HJC = ln\left(\left|\hat{\Omega}_j\right|\right) + j\left(\frac{n^2 lnT + 2n^2 ln(lnT)}{2T}\right) \tag{13}$$

where $\hat{\Omega}_j$ is the maximum likelihood estimate of the covariance matrix for the lag order j, n is the number of equations in the VAR model and T is the sample size. The null hypothesis that the k^{th} element of LM_t does not cause the ωth element of LY_t can be tested using a Wald test.

4 Results and Discussion

This section presents our findings as follows. First, unit root test results and then the results of NARDL and causality tests are interpreted. We also present the impact of money growth on economic growth as an additional input to our results. All findings were obtained from R-programming and Gauss.

4.1 Unit Root Test Results

The results of ADF and KPSS unit root tests imply that the first differences of LY, LM, and LG are stationary, see Table A.1. The results indicate that all selected variables are integrated at first order, $I(1)$, fulfilling the assumption of the NARDL approach for examining the non-linear asymmetric and symmetric relationships between variables.

4.2 The NARDL Results

The null hypothesis of no co-integration is rejected because the $F_{PSS} = 17.58$ statistic exceeds the value of the critical bound at the 1% significance level, see Table A.2. The findings of the tests show that LY and the variables of LM and LG have a long-run co-integration relationship.

The Wald test is used to determine if there is an asymmetry between the variables in the long run. The Wald test result is 12.71. So the null hypothesis of equality is rejected as the p-value is less than 0.05. Wald test indicates asymmetry in the long-run impact of money supply on economic growth in Turkey.

The Breusch–Godfrey LM test and the ARCH test were used to analyze the estimated model's serial correlation and heteroscedasticity, respectively. The findings indicated no proof of serial interaction or heteroscedasticity in the predicted models. The findings of the Jarque-Bera test showed that all variables had a normal distribution, Table A.2.

The cumulative sum of the recursive residuals (CUSUM) and their squares (CUSUMQ) were used to confirm that the findings were reliable (Figs. A.1a and A.1b). The parameters are consistent, and the model is stable (at the 5% significance level) as long as the plots of the CUSUM and CUSUMQ are set inside the critical values.

The estimated long-run coefficient of the model that describes the relationship between economic growth, money growth, and government expenditures for Turkey is shown in Table 1. The positive changes in the LM have statistically significant effects on LY. Additionally, negative changes in LM have no significant asymmetrical effects on LY. According to the NARDL estimation results in Table 1, a 1% rise in LM results in a 1.29% increase in LY.

Table 1: Asymmetric ARDL long-term models

Variable	NARDL
LM^+	1.288^{***}
LM^-	-1.632
LG	0.1305

***, ** and * indicate statistical significance at the 1%, 5% and 10% significance level, respectively.

The results of the short-term coefficient derived from the error correction model are shown in Table 2. The error correction term ($ECT(-1)$) is negative and statistically significant at the 1% level. This demonstrates that the analyzed variables in Turkey have a long-term relationship. According to the coefficient calculations, shifts in LY are reversed by 30.8% per year. These findings point to a moderate adjustment process to restore the long-run equilibrium.

Table 2: Asymmetric ARDL models

Variable	NARDL	t-stat
C	5.184***	2.347
D(LY(-1))	−0.261*	−1.954
D(LY(-2))	−0.348***	−3.0350
D(LM^+)	1.262***	3.364
D(LM^+(-1))	−1.395***	−3.274
D(LM^-)	−4.690***	−3.166
D(LM^-(-1))	4.711***	3.786
D(LG)	0.141	1.106
D(LG(-1))	−0.225	−1.456
D(LG(-2))	−0.445***	−3.725
ECT(-1)	−0.308***	−2.311

***, ** and * indicate statistical significance at the 1%, 5% and 10% significance level, respectively. Maximum lags were set to 4 and the optimal lag structure is chosen based on the Akaike information criterion (AIC).

4.3 The Asymmetric Causality Test Results

Table 3 displays the effects of an asymmetric causality tests that looked at the causal relationship between real GDP and money supply. The findings presented in the upper panel of Table 3 suggest that the null hypothesis that a positive GDP shock would not cause positive money supply shocks can be rejected. The results also reveal that Granger

Table 3: The results of the asymmetric causality test

	from LY to LM			
Null hypothesis	Statistics	1%	5%	10%
$LY^+ \nRightarrow LM^+$	16.876**	27.821	16.800	12.834
$LY^+ \nRightarrow LM^-$	1.285	16.399	10.003	7.797
$LY^- \nRightarrow LM^+$	9.525*	20.304	12.457	9.374
$LY^- \nRightarrow LM^-$	5.531	18.715	11.829	8.806
	from LM to LY			
$LM^+ \nRightarrow LY^+$	15.952**	25.156	15.521	11.799
$LM^+ \nRightarrow LY^-$	0.843	21.845	13.410	9.925
$LM^- \nRightarrow LY^+$	12.884**	22.178	12.835	9.850
$LM^- \nRightarrow LY^-$	0.598	16.086	10.007	7.483

***, ** and * indicate statistical significance at the 1%, 5% and 10% significance level, respectively.

causality exists from a negative GDP shock to a positive money supply shock. It is also concluded that a negative shock in money supply Granger causes positive shocks in GDP.

The lower panel of Table 3 displays the results of an asymmetric causality test that looked at the causal relationship between money supply and real GDP shocks. The findings suggest that the null hypothesis that a positive money supply shock would not cause positive money supply shocks can be rejected.

5 Conclusions

In this paper, based on the St. Louis equation, the non-linear autoregressive distributed lag (NARDL) approach and the Hatemi-J asymmetric causality test are used to analyze the asymmetric effectiveness of monetary and fiscal policy in Turkey using the 2006-2020 period during which the Central Bank of the Republic of Turkey (CBRT) was applying the inflation targeting regime.

The bounds test findings have shown that a long-term co-integration relationship between GDP and the variables of money supply and government spending exists. NARDL estimation, as opposed to a decrease in money supply and government expenditure, has revealed that an increase in money supply has a statistically significant impact on GDP. Accordingly, the money supply used as a monetary policy variable has a more significant impact on GDP than government spending used as a fiscal policy variable.

It was found that there is an asymmetric causality between money supply and GDP when the Hatemi-J asymmetric causality results were analyzed. In this regard, the null hypothesis that a positive and negative GDP (money supply) shock would not cause positive money supply (GDP) shocks was rejected.

In this case, the causality from money supply to GDP is in line with the expectations. GDP is the Granger cause of money supply, M2. It shows that the money supply in Turkey during the period 2006-2020 was endogenous. The endogeneity of the money supply affects the definition of money and its uses in the economy. It is also important in terms of the policies and policy tools chosen by the CBRT. The endogenous money supply means that banks, as well as the central bank, are involved in the process of creating money through the credit mechanism. Banks offer loans and contribute to the money creation process. This situation shows that the CBRT should pay attention to financial stability without sacrificing price stability in the inflation targeting regime for macroeconomic stability.

The relative effectiveness of monetary and fiscal policies as economic policy instruments is a matter of debate. In terms of economic stability, monetary policy appears to be more effective than fiscal policy, according to the findings of this study. These policies, however, are not totally independent of each other. Both are key to sustainable and healthy economic growth. Therefore, coordination of monetary and fiscal policies is critical in achieving macroeconomic goals. Policymakers should evaluate these policies within the context of their objectives, considering the current economic and political conditions.

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Appendix: Tables and Figures

Table A.1: ADF and KPSS unit root test results

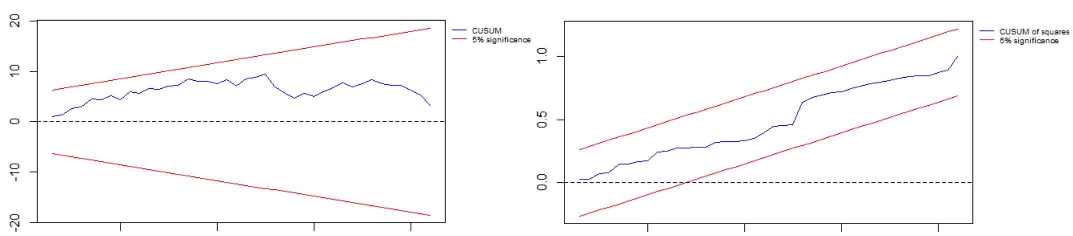
Variable	ADF		KPSS	
	C	$C-T$	C	$C-T$
LY	1.114	-2.811	0.923***	0.257***
ΔLY	0.788*	-4.305**	0.118	0.106
LM	0.232	-2.708	0.928***	0.121**
ΔLM	-9.508***	-9.523***	0.176	0.159
LG	1.700	-0.363	0.9229***	0.225***
ΔLG	-3.382***	-4.014***	0.169	0.128

C: Constant, C-T: Constant & Trend. ***, ** and * indicate statistical significance at the 1%, 5% and 10% significance level, respectively.

Table A.2: Bounds test for co-integration

Significance Level	Critical Value* ($K=2$)	
	$I(0)$	$I(1)$
10%	3.28	4.27
5%	3.98	5.09
1%	5.71	6.98
Diagnostic Test	**Statistic (p-value)**	
	NARDL	
Heteroscedasticity	1.389 (0.708)	
Serial Correlation	11.416 (0.213)	
Normality	0.975 (0.301)	

*The bounds critical values are taken from Pesaran et al. (2001) with unrestricted intercept and no trend.



(a) Cumulative sum of the recursive residuals

(b) Cumulative sum of the recursive residuals of square

Figure A.1: CUSUM and CUSUMQ