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Article

# Simulating the effect of inflation targeting on money supply and inflation in Iraq

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**Abstract:** Inflation targeting, as one of the most important monetary policy frameworks, has been Inflation targeting has been widely adopted by many countries in recent decades with the aims of stabilizing the general price level, controlling liquidity growth, and enhancing the credibility of monetary policy. However, the effectiveness of this framework in oil-dependent economies with institutional constraints, such as Iraq, remains a subject of debate. The main objective of this study is therefore to simulate and examine the impact of inflation targeting on money supply and the inflation rate in the Iraqi economy. To achieve this goal, annual time-series data for the Iraqi economy covering the period 1975–2024 were employed. The dynamic relationships among inflation targeting, money supply, and the inflation rate were analyzed using a vector autoregression (VAR) model. Prior to estimation, the stationarity of the variables was assessed using the Augmented Dickey–Fuller test. The optimal lag length was selected on the basis of information criteria. Impulse response functions and forecast error variance decomposition were then applied to evaluate the dynamic effects of inflation-targeting shocks. The results of the impulse response functions indicate that shocks arising from inflation targeting do not exert a significant or stable effect on money supply; the response of this variable remains limited, short-lived, and unstable. In contrast, the impact of inflation targeting on the inflation rate emerges with a time lag and contributes to a gradual reduction in inflationary fluctuations over longer horizons, although the magnitude of this effect is relatively modest. Variance decomposition analysis corroborates these findings: the contribution of inflation targeting to explaining fluctuations in money supply remains negligible across all time horizons, while its contribution to explaining changes in the inflation rate increases gradually. Nevertheless, the bulk of inflation fluctuations continues to be driven by endogenous inflation shocks and other structural factors specific to the Iraqi economy. Overall, the results suggest that, under Iraq's current institutional and structural conditions, inflation targeting has not yet functioned as an effective nominal anchor for liquidity control, although it may contribute modestly to dampening inflationary fluctuations in the long run. These findings underscore the need to strengthen central bank independence, reduce fiscal dominance, develop monetary policy instruments, improve monetary transmission channels, and enhance coordination between monetary and fiscal policies in order to increase the effectiveness of inflation targeting in Iraq.
**Keywords:** inflation targeting, money supply, inflation, monetary policy, VAR model, Iraq

## 1. Introduction

Among the macroeconomic variables and indicators used in comparing and evaluating the economic performance of countries, inflation is of considerable importance alongside economic growth. Unemployment, income distribution, health capital, education, welfare, and economic growth are among the variables that are directly and indirectly related to inflation. Hence, identifying the effective factors and estimating their contribution to the creation and increase of inflation has always been of interest to economists. The idea of inflation being monetary has never been as challenging as the "neutrality of money" and its various dimensions have been considered in the approaches of different schools. In this regard, Friedman and his followers, by adding adaptive expectations and the short-term concept to Fisher's quantity theory of money and combining them with the short-term Phillips curve (Keynesian approach), presented the accelerationist inflation theory, according to which an increase in the volume of money has

real and nominal (inflationary) effects in the short term and only inflationary effects in the long term (similar to the classical approach). In the 1960s and 1970s, new monetarists, following Lucas, using the rational expectations perspective, showed that even in the short run, anticipated monetary policies had no real effects and that changes in the money supply only caused changes in inflation. In contrast to the above approach, which assumed that monetary policies were exogenous, Kydland and Prescott showed that monetary policies were endogenous and dependent on the inflation rate.

In the mid-1970s, Swanson and Woodford showed that the lack of central bank independence led to discretionary monetary policy choices and implementation, resulting in "time inconsistencies" and high inflation. In the late 1980s and early 1990s, Taylor published a paper comparing the effects of a controlled monetary policy with a discretionary monetary policy. Taylor showed that a controlled monetary policy led to low inflation. Taylor's monetary rule, which was essentially a function of the central bank's response to the output gap and the inflation gap, was developed by some New Keynesian economists such as Walsh, Galli, Clarida, and Gertler. In its developed and New Keynesian version, the monetary rule is derived from the optimization (minimization) of a welfare loss function for the monetary authority subject to constraints, and the inflation gap in the target function is actually the deviation of the current inflation rate from the target inflation rate.

In terms of implementation, it is instructive to study the experience of inflation targeting in successful and advanced countries. In the last few decades, inflation targeting has become a standard operating procedure for most central banks to control inflation. Before the introduction of the inflation targeting framework, central banks were more focused on targeting macro-monetary variables (such as the monetary base or liquidity). However, empirical studies have shown that this type of targeting can be highly biased in achieving the target inflation rate.

Therefore, in recent decades, due to the existence of an inflationary environment that was itself caused by economic and non-economic factors (including oil shocks), many central banks expressed concerns about the potential effects of changes in the value of national currencies on inflation. Therefore, countries such as Australia, Canada and the United Kingdom have used inflation targeting systems to deal with these threats, as this system is believed to work well in reducing inflation (Svensson, 1997). Inflation targeting (IT) has been increasingly accepted by policymakers as a monetary policy strategy to limit real inflation in the medium and long term. Under an inflation targeting system, the central bank publicly announces the target inflation rate and then uses various monetary policy tools to close the gap between actual and target inflation. One of the notable features of this monetary policy strategy is that no country has reversed its policies after adopting it (Ardakani et al., 2018).

Low and stable inflation is a necessary (but not sufficient) condition for macroeconomic stability, increasing economic growth and people's welfare. Therefore, since the 1990s, many countries have pursued their policies within the framework of inflation targeting in such a way as to achieve low and stable inflation. In contrast, only a handful of countries (including Iraq) currently have double-digit inflation. An examination of the effect of inflation targeting on average inflation in inflation-targeting countries shows that average inflation in these countries has decreased significantly after the implementation of inflation targeting policies (Jafari Samimi & Hanjari, 2009).

Since the early 1990s, inflation targeting has attracted the attention of policymakers and economists as a framework for monetary policy. New Zealand in 1990 and Canada in 1991 were the first countries to introduce inflation targets to help deflation. The positive experience of these countries led to the adoption of this framework by other countries, such as the United Kingdom in 1992, Sweden, Finland and Australia in 1993, and Spain in 1995. Thereafter, inflation targeting has increasingly been recognized as an appropriate framework for monetary policy and has been widely accepted by policymakers in various countries; as of March 2010, 25 countries around the world have used this framework to guide their monetary policy (Bernanke et al., 1999).

Given that, in addition to industrialized countries, many developing and emerging market countries have chosen the inflation targeting framework for their monetary policy, all of which have the common goal of reducing inflation and, consequently, improving economic conditions, it is necessary to evaluate the performance of inflation targeting empirically, because the choice of a framework for monetary policy is very important for an economy. If this

framework really improves macroeconomic variables, then other countries should also move in this direction; on the other hand, if inflation targeting does not have a particular advantage compared to other nominal anchors, then countries that have chosen this framework should not rely only on the results of this policy framework and take other measures to increase inflation reduction, economic growth, reduce volatility, and so on. The better this framework and its effects are known, the more confident both the targeting countries and the countries that want to implement this framework in the future will be in implementing this policy and will achieve greater success. On the other hand, the inflation targeting policy will be presented as a successful economic policy.

Studies show that there is no consensus among economists regarding the effects and results of implementing inflation targeting. Based on empirical studies, economists such as Bernanke and Woodford (2005), Caballero and Krishnamurthy (2005), and Mishkin (2003, 2000) and Sims (2005) believe that developing countries have not achieved the expected results from implementing inflation targeting due to the lack of efficient institutions and macroeconomic instability, and they do not achieve good results. The second group, such as Creel and Hubert (2015), Bernanke et al. (1999) and Svensson (1997) They emphasize that inflation targeting will improve monetary policies and the macroeconomic situation. The third group states that the adoption of inflation targeting will lead to a decrease in inflation. They believe that the activities of the central bank are a determining factor in inflation changes (Romer, 2006). In fact, the emphasis here is on the independence and transparency of the central bank. Experience shows that the short-term loss of the relationship between inflation and unemployment, as a result of the implementation of inflation targeting, can be reduced by the credibility of the policy and the policymaker. Credibility is also a category that is achieved by the independence and transparency of the central bank's performance (i. e., revealing policy changes and being accountable and explaining their causes). Because transparency leads to a decrease in uncertainty about inflation forecasts and, as a result, an increase in the probability of its compliance with the targeted inflation (Dargahi, 2002). Given the importance of this issue, this study examines the effect of inflation targeting on the volume of money and inflation in Iraq.

## 2. Theoretical foundations of the research

Inflation targeting has emerged as one of the most important frameworks for macroeconomic management since the late twentieth century. By focusing on the stabilization of the inflation rate through monetary policy instruments, this approach aims to promote economic stability and support long-term growth.

Inflation targeting is a monetary policy framework in which the central bank formally and publicly announces a specific numerical target or range for the inflation rate over a defined time horizon and employs its policy instruments—primarily the policy interest rate—to guide expectations and macroeconomic variables toward that target. The key elements of this framework include: an explicit announcement of the target (either a point target or a band), a clearly defined targeting horizon (short-or medium-term), a high degree of transparency and regular reporting (typically through inflation reports or monetary policy reports), and central bank independence coupled with accountability for results.

In practice, two main variants of the framework exist. Strict inflation targeting focuses primarily on stabilizing inflation, while flexible inflation targeting also takes into account the short-term stability of output and employment.

Inflation targeting is more than a simple public announcement of an inflation objective. It comprises several essential components:

1. Priority of inflation control: The central bank must assign primary importance to inflation stabilization in the conduct of monetary policy. Other objectives—such as output, employment, or the exchange rate—are typically assigned secondary or zero weight. While this prioritization can help reduce inflation volatility, it may involve trade-offs with other macroeconomic goals (Bernanke et al., 1999).
2. Transparency and communication: Beyond announcing the inflation target, the central bank should publicly disclose relevant details of its policy strategy, including inflation forecasts, the expected time horizon for

achieving the target, and any secondary objectives. Greater transparency enhances the predictability of monetary policy and reduces uncertainty in financial markets.

Accountability: The central bank must be held accountable for meeting the announced inflation target. Failure to achieve the target within the specified horizon may result in formal explanations to the public or the government and, in extreme cases, consequences for the responsible officials. This accountability mechanism strengthens the credibility of the central bank. According to Bernanke et al. (1999), the use of a nominal anchor is one of the most important features of inflation targeting. A nominal anchor helps the central bank mitigate the time-inconsistency problem identified by Kydland and Prescott (1977) and Barro and Gordon (1983). This problem arises when monetary authorities may pursue policies that generate higher long-run inflation in order to achieve short-term objectives, such as higher economic growth or employment. By committing to a specific inflation target, a nominal anchor constrains the central bank from pursuing such short-term goals and renders monetary policy more predictable. In the absence of a nominal anchor, shifts in public expectations can destabilize the economy; thus, the nominal anchor serves as a key instrument for maintaining macroeconomic stability.

For inflation targeting to be implemented successfully, several basic prerequisites must be fulfilled:

1. Central bank independence: Independence ensures that monetary policy is conducted free from political pressures, such as the government's desire to maintain high employment for electoral purposes. Friedman (2002) emphasizes that independence implies that the central bank prioritizes inflation over real outcomes (such as output or employment). In countries with a high systemic dependence on seigniorage revenues (i. e., money creation to finance government spending), particularly developing economies, central bank independence is often difficult to achieve, as the government may compel the central bank to set an inflation target consistent with seigniorage needs rather than price stability (Agénor, 2000).
2. Sound fiscal position: Persistent large fiscal deficits tend to generate inflationary pressures over the long run. Therefore, a strong fiscal position is essential for the credibility and success of inflation targeting. In oil-dependent economies such as Iraq, where oil revenues are highly volatile, effective management of fiscal deficits is critical to containing inflationary pressures.
3. Sound financial system: A resilient financial system is necessary to maintain inflation close to the target. In the event of a financial crisis, controlling inflation becomes costly and difficult. This prerequisite is particularly important in Iraq, where the financial system continues to face challenges such as weak infrastructure.

## *2.1 Rules versus Discretion in Inflation Targeting*

One of the traditional debates in monetary policy concerns the choice between "rules" and "discretion." Some argue that inflation targeting should be implemented as a strict policy rule, under which the central bank focuses exclusively on inflation and assigns little or no weight to other variables such as output or the exchange rate. This approach can enhance the central bank's credibility, as the period required to bring inflation down to the target is typically shorter. Once the public gains confidence in the central bank's ability to control inflation, credibility rises and greater scope is created for pursuing secondary objectives. However, an exclusive focus on inflation may generate undesirable economic instability in the face of supply-side shocks (for example, sharp increases in oil prices) (Bernanke et al., 1999).

In contrast, Bernanke et al. (1999) suggest that inflation targeting is best viewed as a form of "constrained discretion." Under this approach, the economy is conceptualized as a ship guided by a nominal anchor: the anchor allows the ship to sail within a defined range in the short run while preventing it from drifting into undesirable zones over the longer term. Constrained discretion enables the central bank to adjust policy in response to economic shocks while utilizing all available information.

## *2.2 Benefits of Announcing Monetary Policy*

The public announcement of monetary policy under an inflation-targeting regime offers several advantages:

1. Reduction of uncertainty: Clear communication of inflation forecasts and the time horizon for achieving the target reduces uncertainty in financial markets. Lower uncertainty improves the formation of expectations and supports more stable investment decisions.
2. Support for private-sector investment: As the main engine of growth in many economies, the private sector benefits from greater predictability of monetary policy. Reduced uncertainty facilitates better investment planning and decision-making.
3. Insulation from political pressures: In the period preceding elections, governments may pressure the central bank to adopt expansionary policies aimed at boosting short-term growth. Central bank independence combined with transparent public announcements of policy helps to resist such pressures.

## *2.3 Inflation Targeting and Supply-Side Shocks*

Inflation targeting can also be effective in dealing with supply-side shocks, such as oil price shocks, which are common in oil-rich economies like Iraq. In such situations, the economy often experiences significant fluctuations. The central bank can respond to these shocks by adjusting monetary policy in the short run. When the central bank operates under a framework of constrained discretion, it can signal to the public that the shock is temporary and will not undermine the long-term objectives of monetary policy. This signalling is effective, however, only if the central bank already possesses sufficient credibility.

## *2.4 Implementing Inflation Targeting*

Implementing monetary policy within an inflation-targeting (IT) framework involves several practical issues and challenges that affect the effectiveness of the strategy. One of the central challenges is striking an appropriate balance between transparency and flexibility.

Transparency involves the public announcement of key elements of monetary policy, including the inflation target, inflation forecasts, and the time horizon for achieving the target. Greater transparency helps reduce uncertainty in financial markets, particularly for the private sector, which is the main engine of economic growth in many economies. Lower uncertainty can improve investment decisions and help anchor inflation expectations.

Flexibility, by contrast, refers to the central bank's ability to adjust short-term policy instruments—such as interest rates or the money supply—in response to economic shocks (for example, oil shocks in resource-rich economies such as Iraq). This flexibility enables the central bank to pursue its long-term monetary policy objectives at the lowest possible cost to the economy.

Balancing these two requirements is not straightforward. Excessive transparency—if it involves disclosing policy intentions in excessive detail—may constrain the central bank's room for manoeuvre in unexpected circumstances. Conversely, frequent discretionary interventions without adequate communication can undermine the central bank's credibility and destabilize public expectations, leading to greater economic volatility. Therefore, the central bank must carefully determine the appropriate degree of transparency and flexibility in order both to preserve credibility and to retain the capacity to respond effectively to shocks.

## *2.5 Inflation Targeting Models*

Inflation targeting emerged as a monetary policy strategy in response to two major challenges faced by many economies: exchange-rate crises and instability in money demand (Svensson, 1998). Under this strategy, inflation is assigned primary importance as the objective of monetary policy, while other goals—such as output or unemployment—receive lower priority. Countries have adopted inflation targeting largely because of the difficulties associated with exchange-rate crises, which threaten overall economic stability, and with unstable money demand, which renders the relationship between the money supply and inflation unpredictable (Svensson, 1998). By prioritizing inflation, the strategy seeks to achieve price stability and reduce macroeconomic uncertainty.

According to Svensson (1998), inflation targeting is characterized by three key features:

1. An explicit quantitative inflation targets the central bank announces a specific numerical target, either as a point target (for example, 2 percent) or as a range (for example, 1.5–2.5 percent per year). Although the precise target varies across countries, it typically lies in the range of 1.5 to 2.5 percent.
2. Inflation-forecast targeting Inflation targeting employs an operational approach known as inflation-forecast targeting. In this approach, the conditional inflation forecast serves as the intermediate target variable. The central bank adjusts its monetary instruments (primarily the policy interest rate) so as to bring the inflation forecast into line with the announced inflation target.
3. High transparency and accountability The framework requires a high degree of transparency in the communication of monetary policy and clear accountability of the central bank for the achievement of the inflation target. Transparency helps reduce uncertainty and facilitates the management of inflation expectations.

Effective implementation of inflation targeting requires a forward-looking approach. This is necessary because of the lags inherent in the monetary policy transmission mechanism and the imperfect control that the central bank exercises over inflation. Changes in policy instruments may take several months or even years to affect inflation fully. Consequently, the central bank must adjust its instruments on the basis of conditional inflation forecasts that incorporate all relevant information, including current economic data, potential shocks, and market expectations. Unlike strategies that rely on a single intermediate target (such as money-supply growth), inflation targeting makes use of all available information in a comprehensive manner (Svensson, 1998).

Inflation-targeting models generate an endogenous reaction function in which the monetary policy instrument (for example, the interest rate) is determined as a function of relevant information. In much of the earlier literature, targeting was often associated with a restrictive information constraint, under which the policy instrument depended only on the gap between an intermediate target variable and its target value. Under inflation targeting, by contrast, the central bank uses all relevant information to align the intermediate target (the inflation forecast) with the ultimate inflation target.

Inflation targeting is commonly divided into two main types:

Strict Inflation Targeting Strict Inflation Targeting In this approach, the central bank focuses exclusively on controlling inflation and attaches little or no weight to other economic variables, such as output or the exchange rate. While this strategy can be effective under conditions of relative economic stability, it may generate undesirable instability in the face of large supply-side shocks (for example, oil price shocks).

Flexible Inflation Targeting Under flexible inflation targeting, the central bank takes into account other macroeconomic variables—such as output, interest rates, and the exchange rate—in addition to inflation. This greater flexibility allows the central bank to respond more effectively to economic shocks and thereby reduce social and economic costs, including higher unemployment or lower growth.

When the economy is hit by a shock, the central bank should first assess the impact of the shock on the intermediate target variable (the inflation forecast) and then adjust policy accordingly. Economic shocks can be classified into two broad categories:

- Aggregate demand shocks: These shocks, such as an increase in consumer demand or investment, can usually be managed effectively through conventional monetary instruments (for example, by raising interest rates).
- Aggregate supply shocks: Unexpected supply shocks, such as a sharp rise in oil prices, pose a greater challenge. In such cases, the central bank may need to adjust the inflation target temporarily and communicate this adjustment transparently to the public in order to preserve credibility and maintain confidence in the policy framework.

The Effects of Inflation Targeting in the New Classical Framework

New classical theory offers several insights into the impact of inflation targeting on key macroeconomic variables:

- Inflation: By managing rational expectations and sending credible policy signals, inflation targeting can contribute to a reduction in inflation. In the Iraqi economy, which is subject to high inflation driven by external shocks (such as oil-price volatility) and domestic instability, the establishment of central-bank credibility can help stabilize inflation expectations and ease price pressures.
- Economic growth: In the short run, tight monetary policy (for example, a reduction in the money supply) may lead to a temporary slowdown or recession, consistent with the predictions of new classical theory. Such costs can be particularly high in transition economies such as Iraq that suffer from weak infrastructure. In the long run, however, the stabilization of inflation can strengthen investor confidence and support more sustainable growth.
- Money supply: New classical theory does not focus directly on controlling the money supply. Instead, it emphasizes that credible monetary policy can lower inflationary expectations, thereby reducing the need for large and abrupt adjustments in the money supply. In Iraq, where the money supply is heavily influenced by fluctuations in oil revenues, effective management of expectations can contribute to greater monetary stability.

Iraq's economy—characterized by heavy dependence on oil revenues, political instability, and various rigidities (including wage stickiness)—presents a challenging environment for the successful implementation of inflation targeting. New classical theory suggests that building central-bank credibility and anchoring inflation expectations can help reduce inflation. For example, the clear announcement of an inflation target and consistent adherence to it through transparent monetary policy can strengthen public confidence. At the same time, the presence of backward-looking expectations and structural rigidities in the Iraqi economy may limit the effectiveness of this approach.

Overall, new classical theory, with its emphasis on market-clearing equilibrium and rational expectations, provides a useful analytical framework for understanding inflation dynamics and the design of inflation-targeting regimes. The theory highlights the importance of expectation management and policy credibility in reducing inflation, while also recognizing that economic rigidities and backward-looking expectations can complicate the process. In the specific context of Iraq, which faces both external and domestic shocks as well as significant structural rigidities, the application of this framework requires careful attention to these constraints and a rigorous simulation of the effects of monetary policy.

## 3. Empirical Evidence

Ogrokhina and Rodriguez (2024) examined the relationship between inflation targeting and capital flows in selected developing countries over the period 2000–2023 using a panel-data model. Their results indicate that inflation targeting reduces the pro-cyclicality of capital flows in developing economies. Specifically, inflation-targeting countries received approximately 40 percent more capital inflows during recessions than non-targeting countries. This effect was driven primarily by other private investment liabilities.

Garcia and Cross (2024) investigated the impact of monetary policy on income inequality and the role of inflation targeting in this relationship for the G7 countries over the period 1974–2019, employing structural vector autoregressive models. Their findings show that contractionary monetary policy shocks increase income inequality in the G7 economies. However, controlling for the adoption of inflation targeting reduces the size of this effect in Japan and the United Kingdom and completely eliminates it in Canada and the United States. These results suggest that inflation targeting can mitigate the inequality-increasing effects of unexpected monetary contractions. In contrast, the evidence for the euro-area countries (France, Germany, and Italy) is more mixed.

Guo and Lim (2024) analyzed the contribution of inflation targeting to price stability using survival analysis and quarterly data from 1980: Q1 to 2022: Q4. The results show that the duration of high-inflation episodes declined significantly after the adoption of inflation targeting. Moreover, in inflation-targeting countries, the periods during which inflation remained below the lower bound of the target range were shorter than those during which it remained above the upper bound. These findings indicate that inflation-targeting regimes play an important role in promoting price stability, even in the context of the inflation surge observed after the COVID-19 outbreak in 2020.

McCloud (2024) examined the impact of inflation targeting on household consumption in both developed and developing countries over the period 1995–2020, employing various treatment-effect methods. The results reveal heterogeneous effects on household consumption levels in approximately two-thirds of the inflation-targeting sample. This heterogeneity depends on the government's willingness to comply with the institutional preconditions for inflation targeting and, on the countries', fiscal positions. In developing countries, the central bank's tendency to limit exchange-rate fluctuations also contributes to the observed heterogeneity. Economic uncertainties—measured by the level of inflation, inflation volatility, and output-growth volatility—emerge as important transmission channels in developing countries, while financial development and savings are relevant channels in both developed and developing economies.

Hutchison and Noy (2010) studied the adoption of inflation targeting as a monetary-policy strategy in emerging-market economies using panel data for the period 1990–2008. Their results indicate that the inflation-targeting frameworks chosen in these countries often differed substantially from the monetary-policy regimes that preceded them.

Brito and Bystedt (2010) investigated the effect of inflation targeting on inflation volatility using a random-effects panel model for the period 1980–2009. Their findings suggest that once inflation volatility is taken into account, the apparent benefits of inflation targeting largely disappear; in some periods, inflation targeting was associated with very low inflation accompanied by recession.

Mookerjee et al. (2015) examined the impact of inflation and inflation volatility on monetary policy and economic growth in Southern African countries using panel data and a random-effects model. Their results show that inflation volatility had a positive effect on economic growth in these countries and that monetary policy contributed to greater price stability and economic growth after 2000.

Canarella and Miller (2017) analyzed inflation targeting as a framework for inflation control using panel data and fixed-effects estimation. They found that inflation targeting successfully reduced inflation in industrialized and developed countries but was less effectively implemented in developing economies. Global economic factors also played an important role in the decline of inflation in advanced economies.

Martínez-García, Coulter, and Grossman (2021) provide evidence that inflation targeting has been more effective than alternative monetary-policy frameworks in stabilizing public inflation expectations in emerging economies. Their study highlights that structural changes in the economy—including a reduced sensitivity of inflation to resource gaps and the inflationary pressures associated with globalization—have contributed significantly to the decline in inflation.

Batini and Laxton (2007) examined inflation targeting in 42 non-industrialized countries over the period 1985–2005, of which 13 had adopted inflation targeting and 29 had not (including 22 emerging economies). Four key variables were considered: the inflation rate, inflation volatility, output-growth volatility, and output-gap volatility. Using a cross-sectional difference-in-differences approach similar to that of Ball and Sheridan (2005), the authors compared the average change in these variables before and after the adoption of inflation targeting while controlling for common time effects. Robustness checks were performed across seven alternative specifications. In all cases, the effect of inflation targeting on the inflation rate was negative and statistically significant: countries that adopted inflation targeting experienced an average reduction in inflation of 4 to 5 percentage points larger than that observed in non-targeting countries.

Gonçalves and Salles (2008) studied 36 non-industrialized countries over the same period (1985–2005), comprising 13 inflation-targeting and 23 non-targeting economies. Focusing on the inflation rate and changes in economic growth, and employing a difference-in-differences design, they found a negative and significant effect of inflation targeting on inflation, with an average reduction of approximately 2.5 percentage points. However, a positive intercept in the estimated inflation equation—implying rising average inflation across the sample—contrasts with the broader global disinflation trend and raises some questions about the robustness of the findings.

Lin and Ye (2009) examined 52 non-industrialized countries over 1985–2005 (13 inflation-targeting and 39 non-targeting countries), focusing on the inflation rate and inflation persistence. Unlike the previous studies, they employed propensity-score matching to address the endogeneity of the decision to adopt inflation targeting. Robustness checks included the exclusion of observations with very high inflation (above 40 percent). In all specifications, the effect of inflation targeting on inflation was negative and significant, with an average reduction of approximately 3 percentage points. These results confirm that inflation targeting can produce substantial reductions in inflation in non-industrialized economies.

## 4. Research Model and Variables

In this section, the effect of inflation targeting on key macroeconomic variables is examined empirically. Drawing on the theoretical foundations of monetary policy and the empirical findings of previous studies (Bernanke and Mishkin, 1997; Mishkin, 2000; Svensson, 1997, 2010; Walsh, 2009; Ball and Sheridan, 2004; Batini and Laxton, 2007; Gonçalves and Salles, 2008), a vector autoregression (VAR) framework is employed. The choice of this approach is motivated by the fact that, under an inflation-targeting regime, the relationships among monetary and real variables are inherently dynamic, endogenous, and interactive. Monetary policy not only influences inflation, liquidity, and economic growth but is itself affected by developments in these variables. The VAR model permits the simultaneous analysis of these interactions and the transmission of policy shocks without imposing strong theoretical restrictions.

In line with the research objectives, three separate but related VAR systems are considered. Model (4-1) examines the effect of inflation targeting on the volume of liquidity; Model (4-2) focuses on the effect of inflation targeting on the inflation rate; and Model (4-3) analyzes the effect of inflation targeting on economic growth. This separation facilitates a more precise investigation of the transmission channels of inflation-targeting policy and allows differences in the responses of monetary and real variables to policy shocks to be identified.

In the first model, although direct control of the money supply is typically replaced by the adjustment of policy instruments under inflation targeting, liquidity remains one of the principal channels of monetary-policy transmission. Accordingly, the liquidity variable is treated as the dependent variable and Model (4-1) is specified as:

$$\log(M)_t = c_1 + c_2 \cdot \mathrm{INFTARGET}_t + c_3 \cdot \mathrm{INF}_t + c_4 \cdot \mathrm{GDPG}_t + \varepsilon_{1t} \quad (4\text{-}1)$$

where denotes the logarithm of the volume of liquidity (or the liquidity-to-GDP ratio), is the inflation-targeting indicator (an implicit inflation target extracted from the long-term inflation trend), is the realized inflation rate, and is the rate of economic growth. Deviations of inflation from the target are expected to influence the path of liquidity growth through the monetary-policy reaction function.

In the second model, the inflation rate is entered as the dependent variable in order to assess the effectiveness of inflation targeting in achieving price stability. According to the theoretical literature, the announcement and systematic pursuit of an inflation target can affect inflation dynamics by anchoring expectations and eliciting a consistent policy response. Model (4-2) is therefore specified as:

$$\mathrm{INF}_t = c_1 + c_2 \cdot \mathrm{INFTARGET}_t + c_3 \cdot \log(M)_t + c_4 \cdot \mathrm{GDPG}_t + \varepsilon_{2t} \quad (4\text{-}2)$$

This specification allows the direct effect of the inflation-targeting variable on the inflation rate to be tested while explicitly incorporating the role of liquidity as a fundamental determinant of inflation.

Both models are estimated within a multivariate VAR system in which all variables are treated as endogenous. This approach enables the computation of impulse-response functions and forecast-error variance decompositions, thereby providing a detailed analysis of the short-and medium-term dynamics linking inflation targeting, liquidity, inflation, and economic growth.

To examine the interrelationships among the variables of interest, a VAR model in matrix form is employed. In the VAR framework, each variable depends on its own lags as well as the lags of the other variables. The vector of endogenous variables is defined as:

$$\boldsymbol{Y}_t = \begin{bmatrix} \text{INFTARGET}_t \\ \log(M)_t \\ \text{INF}_t \\ \text{GDPG}_t \end{bmatrix}$$

The general form of a VAR($p$) model is:

$$\boldsymbol{Y}_t = \boldsymbol{A}_0 + \boldsymbol{A}_1\boldsymbol{Y}_{t-1} + \boldsymbol{A}_2\boldsymbol{Y}_{t-2} + \cdots + \boldsymbol{A}_p\boldsymbol{Y}_{t-p} + \boldsymbol{\varepsilon}_t$$

where $\boldsymbol{A}_0$is the vector of intercept terms, $\boldsymbol{A}_i(i = 1,2, \dots, p)$ are $4 \times 4$coefficient matrices, and $\boldsymbol{\varepsilon}_t$is the vector of disturbance terms:

$$\boldsymbol{A}_0 = \begin{bmatrix} c_1 \\ c_2 \\ c_3 \\ c_4 \end{bmatrix},\ \boldsymbol{\varepsilon}_t = \begin{bmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \\ \varepsilon_{3t} \\ \varepsilon_{4t} \end{bmatrix}$$

The disturbance terms satisfy the usual assumptions:

$$\mathbb{E}(\boldsymbol{\varepsilon}_t) = \boldsymbol{0},\ \mathbb{E}(\boldsymbol{\varepsilon}_t\boldsymbol{\varepsilon}_t') = \boldsymbol{\Sigma},\ \mathbb{E}(\boldsymbol{\varepsilon}_t\boldsymbol{\varepsilon}_s') = \boldsymbol{0} \text{ for } t \neq s.$$

For greater clarity, the VAR($p$) system can be written equation by equation as:

$\text{INFTARGET}_t = c_1 + \Sigma_{i=1}^{p} (a_{11_i}\ \text{INFTARGET}_{t-i} + a_{12_i}\ \text{LOG(M)}_{t-i} + a_{13_i}\ \text{INF}_{t-i} + a_{14_i}\ \text{GDPG}_{t-i}) + \varepsilon_{1t}$

$\text{LOG(M)}_t = c_2 + \Sigma_{i=1}^{p} (a_{21_i}\ \text{INFTARGET}_{t-i} + a_{22_i}\ \text{LOG(M)}_{t-i} + a_{23_i}\ \text{INF}_{t-i} + a_{24_i}\ \text{GDPG}_{t-i}) + \varepsilon_{2t}$

$\text{INF}_t = c_3 + \Sigma_{i=1}^{p} (a_{31_i}\ \text{INFTARGET}_{t-i} + a_{32_i}\ \text{LOG(M)}_{t-i} + a_{33_i}\ \text{INF}_{t-i} + a_{34_i}\ \text{GDPG}_{t-i}) + \varepsilon_{3t}$

$\text{GDPG}_t = c_4 + \Sigma_{i=1}^{p} (a_{41_i}\ \text{INFTARGET}_{t-i} + a_{42_i}\ \text{LOG(M)}_{t-i} + a_{43_i}\ \text{INF}_{t-i} + a_{44_i}\ \text{GDPG}_{t-i}) + \varepsilon_{4t}$

The primary focus of the analysis is the identification of the effects of inflation-targeting shocks on the paths of liquidity, inflation, and economic growth. After estimation of the VAR, impulse-response functions and forecast-error variance decompositions are employed to determine the magnitude, timing, and persistence of the responses of $\log(M)$, INF, and GDPGto shocks in INFTARGET. The variables used in the empirical analysis are described and discussed in the following subsection

## *4.1. Review of the variables studied in the research*

represents the inflation-targeting variable. In this study, the construction of this variable requires careful consideration of the institutional context of the Iraqi economy. Unlike countries whose central banks formally announce a specific numerical inflation target (for example, 2 percent or 4 percent), the Central Bank of Iraq does not operate under an explicit inflation-targeting regime. Policy documents and official statements typically emphasize

general objectives such as "price stability" and "inflation control" without specifying a precise numerical target. Under these circumstances, the empirical monetary-policy literature recommends the use of an implicit (or operational) inflation target—that is, a target inferred from the observed behaviour of prices rather than from an official announcement by the policymaker (Clarida et al., 1999; Mishkin & Schmidt-Hebbel, 2007).

The theoretical rationale for this approach is that, even in the absence of a formal target, the central bank implicitly seeks to keep inflation close to a stable long-run path or level. This long-run path can be interpreted as trend inflation or an implicit inflation target. To extract this stable component, it is preferable to work with the price level rather than with the inflation rate itself, because the price level tends to evolve more smoothly and is less sensitive to short-term fluctuations and temporary shocks—especially in an economy such as Iraq, which has experienced severe price shocks and episodes of hyperinflation.

The consumer price index (CPI) is therefore used as the underlying price series. Let denote the consumer price index in year. The natural logarithm of the price index is defined as:

$$p_t = \ln(\mathrm{CPI}_t).$$

Annual realized inflation is then calculated as the logarithmic difference of the price index:

$$\pi_t = 100 \times (p_t - p_{t-1}),$$

where $\pi_t$is the actual inflation rate observed in year $t$. This logarithmic definition is the standard measure of inflation in the macroeconomic and monetary-policy literature.

To obtain the implicit inflation target, the trend component of the logarithm of the price index is extracted using the Hodrick–Prescott (HP) filter, one of the most widely used methods for decomposing a time series into trend and cyclical components. The HP filter selects the trend $p_t^*$that minimizes the following objective function:

$$\min_{\{p_t^*\}} \sum_{t=1}^{T} (p_t - p_t^*)^2 + \lambda \sum_{t=2}^{T-1} [(p_{t+1}^* - p_t^*) - (p_t^* - p_{t-1}^*)]^2.$$

Here, $p_t^*$is the trend component of the logarithm of the CPI and $\lambda$is the smoothing parameter that governs the degree of smoothness of the trend. For annual data, the conventional value $\lambda = 100$is employed, consistent with the recommendations of Hodrick and Prescott (1997) and Ravn and Uhlig (2002).

Once the trend series $p_t^*$has been obtained, the implicit inflation target is defined as the growth rate of this trend:

$$\pi_t^* = 100 \times (p_t^* - p_{t-1}^*).$$

The variable $\pi_t^*$thus represents the implicit inflation target in year $t$. It corresponds to the long-run, sustainable rate of inflation that would prevail if the economy moved exactly along the price-level trend and can be regarded as the operational counterpart of an officially announced inflation target in countries that lack such an announcement. The concepts of trend inflation and implicit inflation targets occupy a central place in the analysis of monetary policy and monetary rules (Clarida et al., 1999; Woodford, 2003).

To measure the success of monetary policy in achieving the implicit target, the inflation gap (or deviation of inflation from the target) is defined as:

$$\mathrm{GAP}_t = \pi_t - \pi_t^*.$$

A positive value of $\mathrm{GAP}_t$ indicates that realized inflation exceeds the implicit target and signals the presence of inflationary pressures that may call for a contractionary policy response. Conversely, a negative value indicates that inflation lies below the target and may leave room for a more expansionary stance. The inflation gap is the principal indicator used to analyse the behaviour of inflation targeting and the orientation of monetary policy.

In addition to the signed gap, the absolute magnitude of the deviation is calculated to capture the size of the departure from the target irrespective of its direction:

$$\mathrm{DEV}_t = \mid \mathrm{GAP}_t \mid .$$

Within loss-function frameworks commonly employed in the monetary-policy literature, deviations from the target typically enter the policymaker's loss function in squared form. Accordingly, an inflation-loss index is defined as:

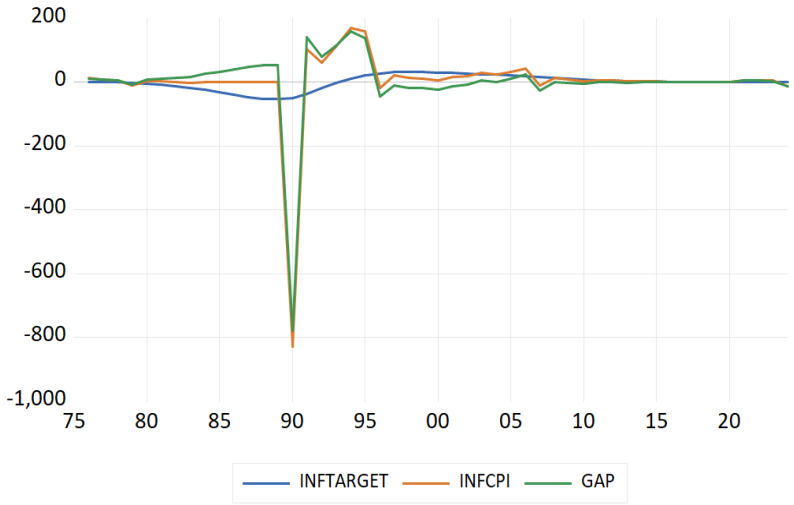
$$\mathrm{LOSS}_t = (\mathrm{GAP}_t)^2 .$$

This quadratic specification is consistent with the theoretical literature, which treats larger deviations from the target as generating disproportionately greater losses for the policymaker (Svensson, 1997; Woodford, 2003).

Finally, the variables $\pi_t^*$, $\mathrm{GAP}_t$, and $\mathrm{DEV}_t$ are employed as operational proxies for inflation targeting in the subsequent time-series analysis. Given that the Iraqi economy has experienced severe structural shocks—including war, sanctions, and hyperinflation—in certain periods, the empirical analysis concentrates primarily on intervals in which monetary policy exhibited at least minimal operational coherence. Within this framework, the use of an implicit-target-based inflation gap permits a coherent examination of the effects of inflation targeting on inflation, economic growth, and monetary variables, and is theoretically and empirically well-founded.

On the basis of the foregoing definitions, the series for inflation targeting, actual inflation, and the observed inflation gap are plotted below.

**Chart 4.1. - Trend of target inflation, actual inflation and their differences in Iraq during the research period**



The presented chart shows the dynamics of three key variables related to inflation targeting in the Iraqi economy over the period under review. These variables include realized inflation (INF CPI), the implicit inflation target extracted from the trend component of the consumer price index, and the inflation target of (INF TARGET) and the inflation gap as the difference between actual inflation and the implicit target (GAP). Examining these three variables simultaneously allows for the analysis of inflation behavior, the degree of deviation from the long-run price path, and the implicit function of monetary policy.

In the early part of the period under review, from the mid-1970s to the late 1980s, actual inflation has had relatively limited fluctuations, generally at or near single-digit levels. During the same period, the implicit inflation target, derived from the growth of the logarithm of the CPI, has followed a smooth, stable, and low-volatility path. The closeness of actual inflation to the implicit inflation target in these years causes the inflation gap (GAP) to fluctuate around small values close to zero. This pattern suggests that, although there was no formal inflation targeting framework in Iraq, the general price level followed a relatively predictable long-term path during this period, and price shocks were mostly limited and temporary in nature.

Entering 1990, the behavioral pattern of all three variables changes abruptly and sharply. The chart clearly shows a very large negative jump in the inflation gap and a sharp divergence of realized inflation from the implicit inflation target. In this year and the years immediately following, actual inflation experiences very sharp and unusual fluctuations, while the implicit inflation target – calculated on the basis of the long-term trend in prices – responds only intermittently and gradually. This behavior is fully consistent with the logic of deriving the inflation target from the price trend; because the inflation target should not be shifted mechanically and simultaneously with severe short-term shocks. The inflation gap during this period reached very large positive and negative values, indicating an unprecedented deviation of inflation from the long-term price path. This phenomenon cannot be interpreted as a failure of monetary policy in the conventional framework, but rather should be seen as a reflection of a deep structural failure in the foundations of Iraq's macroeconomic and monetary system. The year 1990 coincided with Iraq's invasion of Kuwait, the start of the Persian Gulf War, the imposition of extensive international sanctions, and the collapse of a significant part of the country's productive and institutional capacity. These developments caused severe disruption in the financial system, reduced confidence in the national currency, severe restrictions on foreign exchange resources, and ultimately a period of hyperinflation and uncontrollable price fluctuations in the early 1990s. From an econometric perspective, the year 1990 and the period after it can be considered as a structural break in the process of producing inflation and the price level in Iraq. The existence of such a break means that the parameters governing the behavior of inflation and even the transmission mechanism of monetary policy were different before and after this period. For this reason, it is observed that the inflation gap in these years takes on very large values and outliers that, if taken into account without the necessary considerations, can severely distort econometric estimates.

After gradually passing through the hyperinflationary period, especially since the early 2000s and especially after 2004, the chart shows that all three variables are gradually entering a more stable phase. Realized inflation has decreased significantly and is at lower and less volatile levels. The implicit inflation target, as a trend component, also converges towards lower values, and the inflation gap fluctuates around zero. This gradual convergence of actual inflation and the implicit target can be seen as a sign of the relative return of monetary and price stability and increased coherence of economic policies in the period after institutional restructuring. Overall, this chart clearly shows that the implicit inflation target variable extracted from the logarithm of the CPI trend is able to distinguish between transient fluctuations and sustained changes in inflation. The inflation gap, as a descriptive indicator, also reveals periods of relative stability and periods of severe instability. However, the existence of a deep structural failure around 1990 requires that in subsequent empirical analyses, either the main focus be on the periods after this failure (for example, after 2004), or dummy variables and structural failure tests be used to control for the effects of these unconventional shocks. These considerations are a necessary condition for obtaining reliable results in examining the effect of inflation targeting on economic growth and monetary variables in the Iraqi economy.

INF represents the inflation rate of Iraq during the period under review. Since the 2000s, there has been growing interest in examining the effects of inflation targeting (IT) on macroeconomic performance, leading to mixed results

and conclusions about the effectiveness of this policy framework. This is particularly evident in empirical research focused on emerging market economies (EMEs), as these countries constitute a heterogeneous group with their own institutional and macroeconomic characteristics.

Inflation targeting is a monetary policy regime in which price stability is the primary objective of monetary policy, and this objective is accompanied by explicit quantitative targets for the medium-term inflation rate. Moreover, in such a framework, the central bank is known for its high degree of transparency and accountability. Accordingly, the announcement of explicit and numerical inflation targets is said to play a key role in stabilizing and anchoring the inflation expectations of financial market participants and economic agents (in general). From this perspective, if an inflation targeting regime is valid, it affects the process of inflation expectation formation by reducing the backward-looking component and making expectations more forward-looking. As a result, well-anchored inflation expectations can lead to a fundamental change in inflation dynamics, such that this change is accompanied by a reduction or even elimination of inflation inertia.

Naturally, a large part of the empirical literature has been devoted to testing these claimed and desirable effects of inflation targeting on inflation expectations and inflation persistence. In this context, many studies use survey data on inflation expectations of firms, households or professional forecasters, which are generally available only for OECD countries. In addition, some studies use data extracted from the bond market. In terms of methodological tools, in addition to the OLS regression framework, a number of articles use a variety of time series analysis models; from structural failure tests and various autoregressive models to GARCH and fractional convergence (fractional integration). In the following, the literature related to this topic is reviewed. Huh (1996) and Lane and Van Den Heuvel (1998) are early examples of studies that examine the behavior of inflation expectations after the adoption of inflation targeting in the United Kingdom. Both papers cover similar time periods (from the mid-1970s to the mid-1990s), use similar econometric techniques, namely the vector autoregression (VAR) model, and reach the same conclusion: inflation expectations have declined after the adoption of inflation targeting. Also within the VAR framework, Schmidt-Hebbel and Werner (2002) provide evidence of the favorable effects of inflation targeting on inflation expectations in Brazil, Chile, and Mexico, Demertzis et al. (2010) show that inflation targeting has significantly helped to anchor inflation expectations in seven advanced economies, and Corbo et al. (2001) reach similar results for a sample of 26 countries. Neumann and von Hagen (2002) conduct an event study of monetary policy in nine advanced economies and compare the effects of the 1978 and 1998 oil shocks and show that long-term interest rates, as a proxy for inflation expectations, increased in both targeting and non-targeting countries, but the increase was smaller in targeting countries; thus, they conclude that targeting countries have achieved greater gains in the credibility of monetary policy. Johnson (2003) also shows that the announcement of inflation targets in five advanced economies during 1984–1998 led to a reduction in inflation expectations. Gillitzer and Simon (2015) also show that inflation expectations in Australia were better anchored in the second phase of inflation targeting.

Gürkaynak et al. (2007) take an alternative approach to measuring the effects of inflation targeting on long-term inflation expectations, based on daily bond yields in Canada, Chile, and the United States. Specifically, they compare the behavior of long-term nominal and indexed bond yields in response to major economic events and confirm the positive effects of inflation targeting. Similarly, Gürkaynak et al. (2010) estimate the zero-coupon yield curve separately for nominal interest rates and real interest rates (for inflation-indexed bonds) in the United States, the United Kingdom, and Sweden. They then calculate implied forward interest rates and obtain "inflation compensation " as the difference between nominal and real forward rates over a ten-year horizon. Next, they regress inflation compensation on the surprise components of major economic and financial data releases and conclude that while long-term inflation expectations in the United States respond strongly to domestic economic news, long-term inflation expectations in the United Kingdom and Sweden generally do not respond significantly to either domestic or foreign news, suggesting that inflation expectations in these two target countries are strongly anchored. Using the same approach, De Pooter et al. (2014) show that inflation expectations are well anchored in Brazil, Chile, and Mexico. Using Treasury yield data, Suh and Kim (2021) also confirm these findings for a mixed sample of advanced and emerging economies, providing evidence that the anchoring effect may be even stronger in emerging economies.

Based on a sample of 15 countries, Ehrmann (2015) shows that inflation expectations are better anchored in targeting countries than in non-targeting countries. As a result, policy rates in targeting countries need less drastic adjustments to respond to changes in inflation and are therefore less likely to encounter the "zero lower bound" constraint. He also examines the success of inflation targeting in anchoring inflation expectations under different conditions: when inflation is at a normal level, when inflation is persistently high, and when inflation is persistently low. His finding suggests that the role of inflation targeting in anchoring expectations is weakened when inflation is persistently low; That is, inflation expectations become more dependent on laggard inflation, the dispersion of individuals' inflation forecasts increases, and inflation expectations are adjusted downward when actual inflation is lower than expected, but do not react significantly when actual inflation is higher than expected. In more recent research, Ehrmann (2021) examines the performance of different types of inflation targets (range, point, and point with tolerance bands) and concludes that no one type of inflation target is clearly superior to another in anchoring inflation expectations.

However, the empirical literature is not unanimous on the positive effects of inflation targeting on inflation expectations. Among the early studies, Freeman and Willis (1995) assess the effectiveness of inflation targeting in the early target countries (the United Kingdom, Canada, New Zealand, and Sweden) and provide mixed evidence that inflation targets may have reduced inflation expectations in only two of the four countries studied. Similarly, Debelle (1996) shows that inflation targeting has reduced inflation expectations in New Zealand, but the evidence for Canada is weak. Johnson (2002) analyses eleven developed countries and shows that inflation expectations fell immediately after the adoption of inflation targeting in New Zealand and Sweden, the effect is smaller and lagged in Canada and Australia, and virtually disappears in the United Kingdom. Furthermore, he finds that neither the volatility of expected inflation nor the mean absolute forecast error has decreased after the announcement of inflation targets. Levin et al. (2004) provide evidence that inflation targeting in industrial countries may be effective in anchoring long-term inflation expectations, but this result does not hold for short-and medium-term inflation expectations. They also conclude, using an event study approach for five emerging economies, that short-term and long-term inflation expectations in these countries have not changed significantly after the introduction of inflation targeting. Davis and Presno (2014) use the VAR method to examine inflation expectations for a sample of 36 developing and advanced economies. For the former, they show that inflation expectations are less responsive to inflation and oil price shocks in the period after inflation targeting, thus providing evidence for the anchoring effect of inflation targeting; But for advanced economies, weaker results are obtained. Similar results are found in Capistrán and Ramos-Francia (2010) also examine the effect of inflation targeting on the dispersion of inflation expectations of professional forecasters in a 25-country panel and show that, after controlling for global inflation trends, deflationary periods, country-specific effects, and the level and variance of inflation, inflation targeting leads to lower long-term inflation expectations. However, the full beneficial effect is only apparent after three years of inflation targeting adoption, and the anchoring effect is observed only in developing countries, not in advanced economies.

Another body of research casts doubt on the effectiveness of inflation targeting in anchoring inflation expectations. For example, Almeida and Goodhart (1998) argue, based on simple descriptive data for OECD countries, that the announcement of inflation targets has had no effect on inflation expectations, and that inflation expectations have remained either the same as before or even higher than the announced inflation targets. Castelnuovo et al. (2003) use survey data on long-term inflation expectations for 15 advanced economies to show that inflation expectations are well anchored in almost all countries, regardless of whether the country has been an inflation targeter or not; that is, the announcement of explicit, numerical inflation targets does not matter for inflation expectations. This result is indicated by the low and generally decreasing volatility of expectations, as well as the low and decreasing correlation between revisions of short-and long-term inflation expectations. Ball and Sheridan (2004) examine the inflation performance of 20 OECD countries and show that inflation expectations behave similarly in targeting and non-targeting countries. Cecchetti and Hakkio (2010) and Willard (2012) also show that inflation targeting in OECD countries does not lead to a reduction in inflation expectations. Angeriz and Arestis (2007a) and Crowe (2010) report similar evidence for mixed samples including emerging economies, while Filardo and Genberg (2009) reach similar results for targeting countries in Asia. Furthermore, Broz and Plouffe (2010) show, based on microdata for 10,090

firms from 81 countries, that exchange-rate pegs are effective in reducing private sector concerns about inflation expectations, but inflation targets and central bank independence do not. In a more recent study, Bundick and Smith (2018) compare the behavior of inflation expectations in the United States and Japan using an event study approach based on stock market data. They find that, unlike the American experience, leading inflation compensation indicators in Japan respond to news about current inflation after the introduction of inflation targeting, suggesting a lack of strong anchoring of inflation expectations.

Another related branch of empirical literature examines the effects of inflation targeting on inflation persistence, and the evidence is equally conflicting. Here too, some studies show that adopting inflation targeting has led to a failure in the behavior of the inflation process; some provide mixed evidence; and others clearly reject the desired effect of inflation targeting. For example, in the first group, Levin et al. (2004) provide evidence that targeting countries in advanced economies have lower inflation persistence than non-targeting countries. Kuttner and Posen (2001) compare the effects of hard exchange rate pegs, central bank independence, and inflation targeting and conclude that inflation targeting is the only policy regime that reduces inflation persistence. Kočenda and Varga (2018) compare the effects of inflation targeting and exchange rate targeting on inflation sustainability in 68 countries and show that both explicit and implicit inflation targeting are beneficial in reducing inflation sustainability. Baxa et al. (2014) and Bratsiotis et al. (2015) provide evidence for advanced economies that inflation persistence is strongly reduced or even eliminated after the introduction of inflation targeting, while Pétursson (2004) and Phiri (2016) find similar results for 29 targeting countries and 46 African countries, respectively. Finally, the beneficial effect of inflation targeting has also been confirmed in several country-specific studies, including the United Kingdom (Kontonikas, 2004), Mexico (Chiquiar et al., 2010), South Africa (Gupta et al., 2017) and Turkey (Çiçek and Akar, 2013).

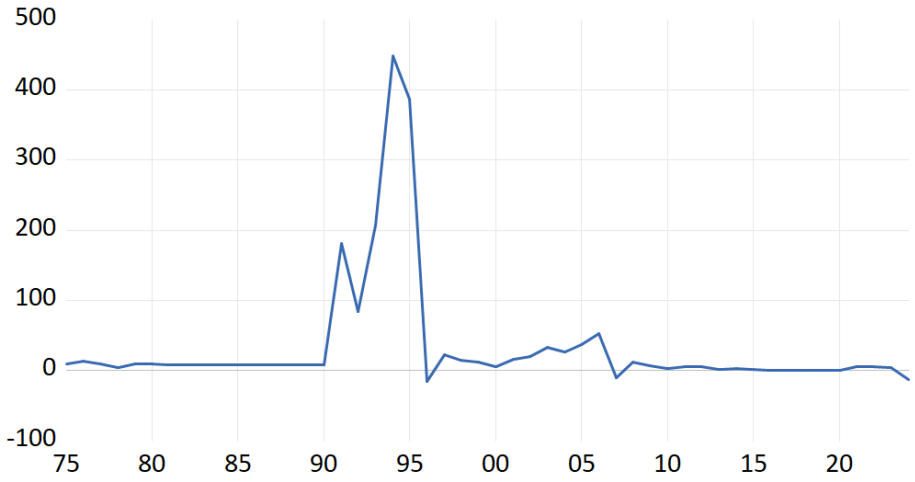
In contrast, Kuttner and Posen (1999) show that inflation sustainability in New Zealand and the United Kingdom has decreased after the adoption of inflation targeting, but inflation targeting has had no effect in Canada. Benati (2008) examines inflation sustainability in five advanced economies under different monetary regimes and shows that although inflation sustainability has decreased after inflation targeting, inflation under other nominal anchors is also very little sustainable; therefore, inflation targeting cannot be considered superior to other monetary regimes. Canarella and Miller (2016; 2017a) examine inflation sustainability in OECD countries and show that inflation sustainability has decreased after the adoption of inflation targeting in only half of the sample. In this regard, they report large asymmetries and differences in inflation sustainability across the sample countries. They also provide mixed evidence on inflation sustainability after the global crisis; That is, in some countries, stability has increased and in others it has not. In another study, Canarella and Miller (2017b) show that inflation targeting countries among industrialized countries share a common trend of stability with Germany and the United States and thus respond to inflation shocks in a similar way. In other words, industrialized countries experience their inflation dynamics in line with the global downward trend, but this is not true for developing countries, where inflation targeting actually leads to less stability. Similarly, Yigit (2010) shows that inflation stability in the post-inflation targeting period has decreased in only three of eight advanced economies, while Davis and Presno (2014) show that inflation targeting is useful in reducing inflation inertia in developing countries but not in advanced economies. Vega and Winkelried (2005) provide evidence using a large sample of 91 countries that inflation targeting reduces inflation persistence in advanced and developing economies, but the effect is both small and fades very quickly, lasting only one season. Gerlach and Tillmann (2012) show that inflation targeting reduces inflation persistence in the Asia-Pacific region, but no such effect is observed among non-Asian targeting countries. In a study of inflation dynamics in three Central and Eastern European (CEE) economies, Baxa et al. (2015) conclude that inflation targeting does not automatically change the dynamics of the inflation process; that is, its effects depend on how inflation targeting is implemented, including whether it is accompanied by exchange rate-related targets.

Findings from a number of studies also challenge the proposition that inflation targeting is effective in reducing inflation persistence. For example, Siklos (1999) and Levin and Piger (2004) show that inflation targeting does not reduce inflation persistence in advanced economies. Ball and Sheridan (2004), Gadea and Mayoral (2006) and Willard

(2012) also reach similar results for OECD countries, while Hossain (2014) confirms these findings for Australia. Edwards (2007), Siklos (2008) and Filardo and Genberg (2009) report similar evidence using mixed samples of advanced and emerging economies. Similarly, Arsić et al. (2022) find that inflation targeting has no effect on inflation sustainability in a sample of 26 emerging economies. Siregar and Goo (2010) also confirm the ineffectiveness of inflation targeting in Indonesia and Thailand, while Kaseeram and Contogiannis (2011) show that inflation targeting has not been successful in reducing inflation inertia in South Africa.

Therefore, it can be concluded that the empirical evidence in this area has not been able to convincingly demonstrate that inflation targeting alone is an effective tool for stabilizing inflation expectations and reducing inflation persistence. In this context, it is difficult to claim the definitive superiority of inflation targeting over other nominal anchors. Moreover, even in cases where inflation targeting has been successful in stabilizing inflation expectations, its effect appears with a significant lag (up to several years), indicating that the desired effects of inflation targeting depend to a large extent on the credibility of monetary policy. Therefore, this study examines the impact of inflation targeting on inflation in Iraq in order to determine the impact of this monetary policy on inflation as one of the macroeconomic indicators that has not been examined so far. Figure 4.2 shows the trend of this variable over the period under review.

Chart 4.2. Inflation rate trend during the period under review




This chart shows the long-term trend of Iraq's inflation rate over a long time horizon, and it clearly illustrates the volatile, shock-driven, and structural nature of inflation in this country. The analysis of this trend can be done periodically, focusing on key turning points.

In the early period (mid-1970s to late 1980s), inflation fluctuated at a relatively low and stable level. At this point, although the Iraqi economy faced structural constraints and dependence on oil revenues, it had not yet been exposed to severe monetary, fiscal, and institutional shocks. Inflation during this period was largely driven by government spending, oil revenues, and price controls, and its fluctuations were limited. This relatively calm behavior reflects the dominant role of real factors and the absence of severe monetary instability during this period.

The main turning point of the chart begins in the early 1990s, when inflation experienced a very sharp and unprecedented jump. This inflationary jump is a direct reflection of a series of simultaneous political, economic, and institutional shocks. The Gulf War, widespread international sanctions, the collapse of domestic production capacity, disruption of the financial and banking system, and most importantly, the financing of the government budget deficit through money creation, caused very high inflation and even pseudo-hyperinflation. The peak of inflation during this period shows that monetary policy has effectively lost its independence and has come under complete financial

domination. At this point, the inflation rate is not the result of a regular response of monetary policy, but a direct consequence of structural shocks and the collapse of the policy framework.

After this critical period, from the mid-1990s onwards, we have witnessed a sharp and sudden decline in the inflation rate. This decline in inflation can be attributed to institutional changes, limited monetary and fiscal reforms, a relative easing of sanctions, and a gradual return to economic capacity. However, inflation behavior at this point remains unstable and subject to significant fluctuations. The existence of periodic spikes and dips in the late 1990s and early 2000s indicates that the process of containing inflation was not sustainable and based on a coherent policy framework, and the economy remains vulnerable to domestic and external shocks.

In the following period, especially from the mid-2000s onwards, the inflation trend enters a new phase, accompanied by a decrease in the level and range of fluctuations. Inflation rates in this period mainly fluctuate around lower values and there are no very sharp jumps. This development can be attributed to the relative improvement in macro stability, increased oil revenues, greater use of indirect monetary policy tools, and the central bank's efforts to control liquidity and manage inflation expectations. However, there are still periodic fluctuations, mainly related to exchange rate shocks, oil price changes, political uncertainties, and security developments.

In the final years of the graph, inflation tends to be very low and even negative. This behavior can reflect a combination of weak aggregate demand, intermittent recessions, negative external shocks, and sometimes contractionary policies or fiscal constraints. A sharp decline in inflation at this point does not necessarily mean lasting stability, but can be a sign of the fragility of the economy and its sensitivity to external developments.

Overall, this chart shows that inflation in Iraq has been influenced by structural shocks, financial dominance, institutional instability, and political-economic developments rather than by a regular and predictable monetary policy process. The very large jump in the early 1990s has created a deep structural break in the path of inflation that should be taken into account in econometric analyses. This feature well justifies the importance of using approaches such as VAR, instantaneous response functions, and even, if necessary, including structural breaks or livestock variables in modeling the effect of inflation targeting on inflation, liquidity, and economic growth.

GGDP It represents the rate of economic growth in Iraq at constant prices during the period under review. In practice, inflation targeting (IT) is usually implemented in a “flexible” manner, and central banks do not behave in an “inflationary” manner within this framework; in the sense that although price stability remains the dominant and long-term objective of monetary policy, central banks often pursue some other short-term objectives as well and try to react to and neutralize the effects of shocks that occasionally affect the economy. For this reason, proponents of inflation targeting argue that this framework is close to optimal monetary policy because it controls inflation on the one hand and, on the other hand, simultaneously tries to minimize output fluctuations. Despite the theoretical appeal of these arguments, as empirical findings show, the empirical validity of these claims remains a matter of debate and controversy, and no single verdict can be issued regarding the definitive effect of inflation targeting on output growth and its volatility.

In the pioneering empirical literature on the macroeconomic effects of inflation targeting in OECD countries, Ball and Sheridan (2004) show that this policy regime has no significant effect on either average output growth or output volatility. In other words, according to their results, both inflation-targeting and non-targeting countries have experienced improved economic performance over the period under review, and this improvement cannot be attributed solely to inflation targeting. Ball (2010), working with a roughly similar sample, also reaches similar conclusions. A number of other studies using different econometric methods, including VAR (Laubach and Posen, 1997; Mishkin and Posen, 1997), cointegration (Lee, 1999), and propensity scoring (Walsh, 2009), also provide evidence that inflation targeting in advanced economies has no significant effect on output performance. In this regard, Lane and Van Den Heuvel (1998) reach a similar conclusion by examining the British experience. Nadal-De Simone (2001) also estimates the conditional output variance in 12 advanced economies using state-space models with time-varying parameters and reaches heterogeneous results: for Canada, output variance is higher in the period after inflation

targeting; for Australia and New Zealand, inflation targeting leads to a reduction in output volatility; And in Singapore and Korea, the production variance does not change significantly.

In contrast, some empirical studies provide evidence of the beneficial effects of inflation targeting on output performance in advanced economies. For example, Choi et al. (2003) show that inflation targeting in New Zealand is associated with reduced growth volatility. Dotsey (2006) also concludes, based on a simple comparison of descriptive statistics for a set of advanced economies, that inflation targeting can provide some benefits in increasing output and reducing its volatility. Parkin (2014) also reports that inflation targeting is more effective than central bank independence (CBI) in improving output growth and reducing growth volatility. In more recent research, Ryczkowski and Ręklewski (2021) confirm the beneficial effects of inflation targeting on output growth using different panel data models for 27 OECD countries.

However, even studies using mixed samples of advanced and emerging economies have failed to provide consistent evidence on this issue. For example, Corbo et al. (2001) show that in the 1980s and 1990s, inflation-targeting countries were able to reduce the impact of inflation shocks on output volatility through anchored expectations. Hu (2006) provides evidence that inflation targeting is associated with higher output growth and lower growth volatility, and Barnebeck Andersen et al. (2015) also confirm the better performance of inflation targeting countries in terms of output growth. In contrast, Pétursson (2004) finds mixed results on the effect of inflation targeting on economic growth, while Naqvi and Rizvo (2009) conclude that inflation targeting has no significant effect on either output growth or growth volatility.

Moreover, a number of studies have suggested that the effects of inflation targeting on output may differ between advanced and emerging economies. In this regard, Roger's (2010) descriptive comparison of inflation targeting and non-targeting countries shows that only low-income inflation targeting countries have experienced improved growth, while in high-income countries, targeters have not seen significant changes in macroeconomic performance. Mollick et al. (2011) also examine the effects of inflation targeting on output growth in the "globalization years" of 1986–2004 and find that in industrialized countries, both "soft" and full inflation targeting have a positive effect on long-run growth, but in emerging economies only full targeting has a positive effect on growth, a result that probably reflects the lower credibility of soft inflation targeting in these countries. Abo-Zaid and Tuzemen (2012) show that inflation targeting increases growth rates in both developed and developing countries, but reduces growth volatility only in the latter group. Fratzscher et al. (2020) also report that inflation targeting improves output growth in a subsample of OECD countries, but no such effect is observed in non-OECD countries.

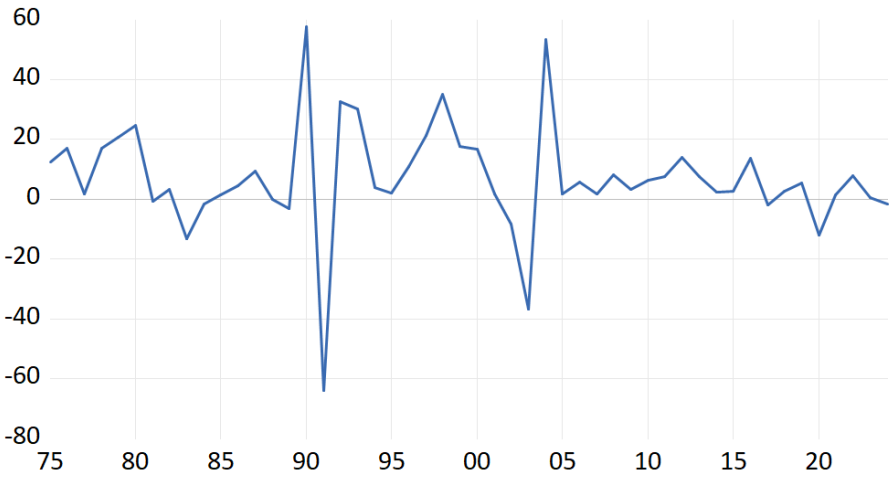
Batini and Laxton (2007) are among the first studies to examine the macroeconomic effects of inflation targeting in emerging economies. They do not provide clear and conclusive results on the effects on real output, as they show that inflation targeting reduces output gap volatility, but this effect is not statistically significant. However, they interpret this finding positively and conclude that inflation targeting does not have at least some adverse effects on output in emerging economies. Gonçalves and Salles (2008) support this view by using a similar methodology and show that inflation targeting leads to a reduction in output volatility in these economies. The IMF (2006) also argues, based on some descriptive statistics for a sample of 42 emerging economies, that targeting countries have better macroeconomic performance in terms of output volatility. Roger (2009) extends the IMF (2006) comparisons and shows that among low-income countries, target countries experienced lower growth volatility than non-target countries during the 1990s and 2000s. However, these results should be interpreted with caution, as these two studies do not provide formal econometric evidence.

In contrast, some studies suggest that inflation targeting is not without costs in emerging economies. Brito and Bystedt (2010) provide evidence that inflation targeting can have an adverse effect on output growth, while its effect on output volatility is not significant; although they themselves emphasize that their results are very sensitive to the econometric method and lack sufficient robustness. Amira et al. (2013) also use a framework GMM but report the opposite result: inflation targeting in emerging economies boosts economic growth, although it is also associated with greater growth volatility. Other studies on emerging economies also generally provide mixed findings. For example,

Gemayel et al. (2011) do not reach consistent results on the effect of inflation targeting on GDP growth and growth volatility using different methods, and Ayres et al. (2014) also show that the effect of inflation targeting on growth is not statistically significant. Ouyang and Rajan (2016) conclude, in their review of the experience of developing countries, that inflation targeting has no effect on growth in the entire sample, but leads to lower growth in a subsample of Asian countries. Thornton (2016) does not find a significant relationship between inflation targeting and growth volatility by reviewing the study of Gonçalves and Salles (2008) and controlling for three additional factors. Chevapatrakul and Paez-Farrell (2018) also reach the same conclusion using quantile regressions. Duong (2021) uses a difference-in-differences approach to show that inflation targeting has no effect on output growth. Arsić et al. (2022) also report that inflation targeting has no effect on GDP growth, although it may be effective in reducing output volatility.

Accordingly, the empirical literature on the effects of inflation targeting on output and its volatility is highly contradictory and difficult to draw a uniform conclusion. In particular, the existing literature has failed to provide convincing evidence that inflation targeting by itself can increase output growth. However, the existing empirical evidence is also insufficient to claim that inflation targeting is necessarily detrimental to output performance. Therefore, the final conclusion depends largely on the researcher's interpretation of these findings: proponents of inflation targeting usually emphasize that this framework can maintain price stability without harming output, while critics conclude that inflation targeting should not be considered a "cost-free" monetary strategy. The chart below shows the trend of this variable during the period under review.

**Chart 4-3-Economic growth trend in Iraq**




This chart shows the trend of Iraq's economic growth over a long period, clearly illustrating the volatile, shock-prone, and discontinuous nature of output growth in this economy. The analysis of this trend can be presented at several distinct time points.

In the early period, from the mid-1970s to the mid-1980s, Iraq's economic growth was mostly positive and relatively high, although it fluctuated significantly. This behavior can be attributed to increasing oil revenues, expanding public investment, and an active role for the government in the economy. However, even at this point, economic growth was not consistently stable, and its fluctuations reflected the economy's strong dependence on exogenous factors, particularly oil prices and government spending.

The main turning point of the graph is observed in the early 1990s, where economic growth faced a very sharp decline. The unprecedented decline in growth during this period is a direct reflection of the Persian Gulf War, the widespread destruction of economic infrastructure, international sanctions, and the collapse of foreign trade. This severe negative shock fundamentally disrupted the productive structure of the economy and caused economic growth

to enter deep negative territory in the short term. The sharp positive jumps after this decline also indicate a very low base effect of production and a temporary recovery of some of the lost capacities, rather than a sign of a sustainable recovery.

In the intermediate period, from the mid-1990s to the early 2000s, economic growth experienced sharp fluctuations. Large positive surges and significant negative declines were observed intermittently, indicating the absence of a stable and predictable growth path. At this point, the Iraqi economy continued to be affected by sanctions restrictions, political instability, and institutional weakness, and economic growth was more subject to short-term shocks and sudden changes in oil production and government spending.

Since the mid-2000s, the range of fluctuations in economic growth has been relatively reduced. Although economic growth is still not completely stable, there have been fewer sharp drops and jumps, and growth has been fluctuating around relatively low and positive values. This development can be attributed to the relative improvement in security conditions, increased oil revenues, gradual reconstruction of infrastructure, and expansion of economic activities. However, the economy's heavy dependence on the oil sector and external shocks continue to prevent the formation of a stable and balanced growth trend.

In the final years of the period under review, economic growth again shows signs of weakening and volatility, and in some years tends to be close to zero or negative. This behavior can be caused by negative external shocks, oil price fluctuations, government fiscal constraints, and weak private sector investment. At this point, economic growth is more a response to short-term developments and cross-sectional shocks than to long-term stabilization policies.

Overall, this graph shows that Iraq's economic growth during the period under review has been largely shock-driven and unstable, lacking a stable and smooth trend. This feature highlights the importance of simultaneously examining monetary, inflation, and liquidity policy in a dynamic framework such as the VAR model. In particular, the response of economic growth to inflationary and monetary shocks can vary depending on the time period, institutional conditions, and the magnitude of the shocks. Therefore, the analysis of the instantaneous response functions in the empirical chapter makes it possible to determine under what conditions the inflation targeting policy has been able to reduce the fluctuations of economic growth and at what points its effect has been limited or neutral.

M represents the volume of money to GDP. In the macroeconomic literature and in international empirical studies, the Broad Money index (% of GDP) is conventionally used as a proxy for the volume of money. Broad Money usually includes hard money plus It is quasi-money (banknotes and coins in the hands of individuals, sight and time deposits, and other liquid deposits). When expressed as a percentage of GDP, this variable reflects, in addition to the nominal size of liquidity, the monetary depth of the economy and the role of the financial sector in financing economic activities. For this reason, the use of Broad Money (% of GDP) in monetary policy analyses, especially in countries where data are available, is More precisely, money is not available, it is quite common. In the new monetary policy frameworks, inflation targeting (IT) is usually based on a central bank response rule rather than direct monetary targeting; that is, the central bank attempts to steer realized inflation towards the inflation target by adjusting policy instruments (mainly the policy interest rate or its equivalent). In such a regime, unlike the classical monetarist approach that directly controlled and targeted money growth, the volume of liquidity becomes more "endogenous"; that is, money supply and liquidity growth are determined mainly in interaction with money demand, bank credit, interest rates, output, and financial sector behavior (Woodford, 2003; Mishkin, 2000). However, IT does not diminish the importance of money, but rather changes its role from an "intermediate target" to a "transmission channel and information variable"; Because changes in liquidity affect both aggregate demand and prices, they can also contain information about future inflationary pressures and financial conditions. (Clarida et al., 1999; Bernanke & Mishkin, 1997).

Theoretically, the relationship between IT and liquidity can be explained in two main ways. The first way is the "policy response and demand control" way. In a Taylor-type monetary policy rule, the central bank adjusts the interest rate in response to the inflation gap and the output gap. A simple representation of this rule is as follows:

$$i_t = r^* + \pi_t + \varphi(\pi_t - \pi_t^*) + \gamma(y_t - y_t^*)$$

In this relation, $i_t$ is the policy interest rate, $r^*$ is the equilibrium real interest rate, $\pi_t$ is the realized inflation, $\pi_t^*$ is the inflation target, and $(y_t - y_t^*)$ is the output gap. When inflation is above the target, that is, $(\pi_t - \pi_t^*) > 0$, the central bank increases $i_t$ adopts a contractionary policy. An increase in interest rates raises the cost of financing, reduces demand for credit and borrowing, slows down the growth of banks' balance sheets, and as a result, liquidity growth (M) also decreases. Conversely, when inflation is below target or the economy is in recession, a decrease in interest rates can strengthen credit and liquidity growth. Therefore, in IT, the "inflation gap" and the "severity of deviation from the target" of policy decisions are expected to lead to changes in liquidity growth. (Clarida et al., 1999; Svensson, 1997; Woodford, 2003).

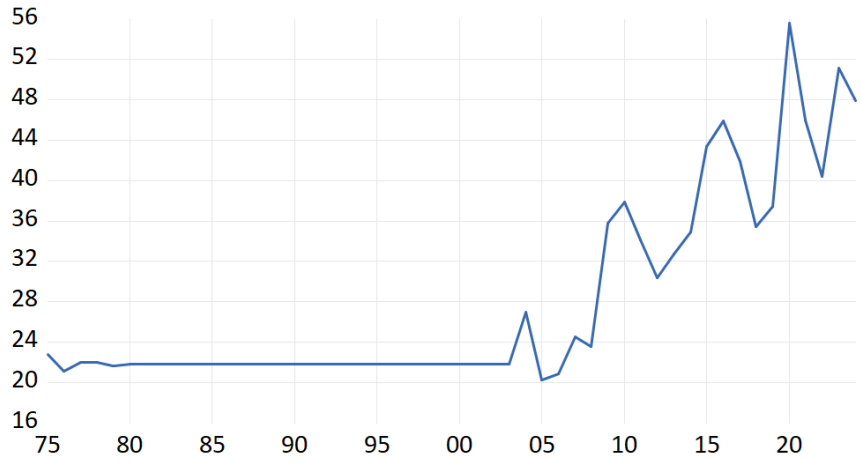
The second path is the “price stability and anchoring of expectations” path. One of the main claims of IT is that it anchors inflation expectations and reduces inflation uncertainty by being transparent and committed to price stability. Reducing uncertainty and increasing the credibility of monetary policy usually leads to a lower inflation premium in interest rates, an improved horizon for investment decisions, and more stable financial conditions. This can make credit cycles and liquidity growth less volatile and less “volatile.” In other words, even if the central bank does not directly target money growth, successful implementation of IT can, by reducing uncertainty and improving expectations, make bank lending behavior and bank money creation more regular; as a result, both the level of liquidity and its volatility may become more predictable than under weaker policy regimes. (Mishkin, 2000; Bernanke et al., 1999).

This relationship can also be supported by the money demand framework. If a money demand function is considered as follows:

$$m_t - p_t = \alpha + \beta\, y_t - \delta\, i_t + u_t$$

where $m_t$ is the logarithm of the money supply (or liquidity), $p_t$ is the logarithm of the price level, $y_t$ is real output, and $i_t$ is the interest rate, then it becomes clear that monetary policy is carried out through $i_t$ can affect the demand for money and thus the growth of liquidity. In the IT regime, because $i_t$ is adjusted in response to the inflation gap, in effect the inflation gap indirectly affects the liquidity path through the interest rate channel. Figure 4-4 shows the trend of this variable during the period under review in Iraq.

**Chart 4-4-Trend in money supply to GDP**




The presented chart shows the trend of Iraq's liquidity to GDP ratio over a long-term period and well reflects the structural transformation of the country's monetary and financial system.

In the first period, from the mid-1970s to the early 2000s, the ratio of broad money to GDP fluctuated at a relatively constant and low level (around 20 to 22 percent). This behavior reflects the shallowness of Iraq's financial and monetary system during this period. At this point, the role of the banking system in financing economic activities was limited and most economic interactions were conducted outside the framework of a developed financial system. Also, government controls, institutional constraints, and political and economic shocks have caused liquidity growth to not keep pace with production growth. Since the early 2000s, especially after 2003, a significant structural change has been observed in the trajectory of this indicator. The ratio of broad money to GDP increases significantly, from around 22 percent to over 30 percent and then to over 40 percent in subsequent years. This increase can be attributed to a number of factors: the expansion of banking activities, increased oil revenues and foreign exchange inflows, growth in government spending, the relative development of monetary instruments, and the increasing role of the banking system in the circulation of financial resources. During this period, monetary policy focuses more on liquidity management and financial stability, and liquidity plays a more prominent role in macroeconomic dynamics.

In subsequent years, especially since the 2010s, the liquidity-to-GDP ratio has remained high, but with significant fluctuations. Intermittent jumps in this indicator, especially in years that have been faced with oil shocks, political instability, or economic recession, indicate that the increase in this ratio is not necessarily due to real liquidity growth, but in many cases also reflects a decrease or sharp fluctuation in GDP. In other words, in conditions of recession or output decline, even a modest increase in liquidity can lead to a sharp increase in the liquidity-to-GDP ratio.

In the final years of the period under review, the ratio of Broad Money to GDP approaches very high levels. This situation may indicate an increasing dependence of the economy on liquidity, an expanding role of the government and the banking system in financing, and at the same time the weakness of the real sector of the economy in effectively absorbing monetary resources. Such a situation is often interpreted in macroeconomic literature as a sign of an imbalance between the monetary and real sectors of the economy and can lead to inflationary pressures or financial instability if not properly managed.

In general, the trend of Broad Money (% of GDP) in Iraq shows that the country's economy has moved from a shallow and limited monetary system to a monetary system with higher liquidity; however, this development has been accompanied by severe output fluctuations and structural shocks and does not necessarily mean improved monetary policy efficiency or increased sustainable economic growth. From this perspective, examining the effect of inflation targeting on the path of liquidity and its interaction with inflation and economic growth, as is done in the VAR model of this study, is of particular importance. This analysis can show whether the inflation targeting policy has been able to guide liquidity growth in the direction of price stability and sustainable growth.

## *4.2 Descriptive statistics of research variables*

In this part of the research, the descriptive statistics of the model variables are examined.

**Table 4-1-Descriptive statistics of model variables**

| Money volume to GDP | The difference between the targeted and actual inflation rate | Economic growth rate | Inflation rate | Inflation targeting | |
|---|---|---|---|---|---|
| **28.09811** | **0.570383** | **6.825137** | **34.55867** | **-0.153773** | **Mean** |
| **21.79707** | **1.284833** | **3.854532** | **8.093394** | **0.868021** | **Median** |
| **55.59928** | **158.4929** | **57.81783** | **448.5000** | **31.56340** | **Maximum** |
| **20.24657** | **-778.6816** | **-64.04711** | **-16.11733** | **-54.10914** | **Minimum** |

| | | | | | |
|---|---|---|---|---|---|
| **9.758768** | **121.3614** | **18.64196** | **89.57265** | **22.94870** | **Std. Dev.** |
| **1.256904** | **-5.436269** | **-0.515268** | **3.577113** | **-0.802193** | **Skewness** |
| **3.297947** | **36.30482** | **7.439661** | **15.27909** | **3.067334** | **Kurtosis** |
| | | | | | |
| **13.08301** | **2505.989** | **42.41072** | **412.3329** | **5.264616** | **Jarque-Bera** |
| **0.001442** | **0.000000** | **0.000000** | **0.000000** | **0.071912** | **Probability** |
| | | | | | |
| **1376.808** | **27.94876** | **334.4317** | **1693.375** | **-7.534890** | **Sum** |
| **4571.210** | **706971.9** | **16681.10** | **385116.4** | **25278.85** | **Sum Sq. Dev.** |
| | | | | | |
| **49** | **49** | **49** | **49** | **49** | **Observations** |

Table 4-1 reports descriptive statistics for five key macroeconomic variables of Iraq, including the ratio of money to gross domestic product (Broad Money/GDP), the difference between actual and targeted inflation (inflation gap), the economic growth rate, the inflation rate, and the inflation targeting variable over the period 1975 to 2024. These statistics provide a clear picture of the volatile, shock-driven, and heterogeneous nature of the Iraqi economy during the period under review.

The money-to-GDP ratio, with an average of about 28 percent and a median of about 22 percent, suggests that the Iraqi economy has had relatively limited monetary depth for most of the period under review. However, the maximum value of this ratio (over 55 percent) along with the minimum of about 20 percent suggests that at some points, especially in recent years or during periods of output recession, the monetary sector has become significantly larger than the real sector of the economy. The relatively high standard deviation and positive skewness indicate that there have been sharp and asymmetric increases in liquidity relative to output, a situation that is usually associated with financial dominance, unbalanced credit growth, and weak absorptive capacity of the real sector of the economy.

The difference between actual and targeted inflation has a positive but small mean, while its range of variation is very wide; it has fluctuated from very negative values (around-779) to very positive values (more than 158). This feature shows that the gap between actual and targeted inflation has not been stable and controllable in most periods, and the Iraqi economy has repeatedly encountered severe deviations from inflation targets. Very large standard deviation, severe negative skewness, and very high kurtosis all indicate the presence of extreme inflation shocks and abnormal behavior of this variable. The strong rejection of normality (based on the Jarek-Bara test) reinforces the point that monetary policy in Iraq has often faced structural shocks and abnormal conditions.

As for the economic growth rate, the average growth rate of about 6.8 percent may seem favorable at first glance, but its very wide range of variations (from negative growth of more than 64 percent to positive growth of nearly 58 percent) suggests that this average has been largely the result of sharp jumps and drops, rather than the result of a steady growth trend. The high standard deviation and high skewness indicate that Iraq's economic growth has been strongly affected by exogenous shocks such as war, sanctions, oil price fluctuations, and political instability. The negative skewness also indicates that sharp drops in economic growth have played a more prominent role than positive jumps.

The inflation rate is one of the most volatile variables in the table. The relatively high average inflation and very large standard deviation, together with a very severe maximum inflation (over 448 percent), indicate that the Iraqi economy has experienced periods of high inflation and even quasi-hyperinflation. The strong positive skewness and very large elongation indicate that the inflation distribution is highly asymmetric and that the occurrence of large inflationary shocks has shaped the behavior of this variable. The categorical rejection of the normality of inflation also

emphasizes that analyzing inflation in Iraq without taking into account structural failures and severe shocks will present a misleading picture.

Finally, the inflation targeting variable (defined implicitly or derived from the inflation trend) has a mean close to zero, but its range of fluctuation is very wide. This feature indicates that the inflation targeting framework in Iraq has been accompanied by significant instability and changes in practice and has not followed a smooth and predictable path. The negative skewness and relatively high elongation indicate that at some points, very low or even negative inflation targets have been set in conditions where actual inflation has been extremely high; a situation that can lead to weakening the credibility of monetary policy and increasing the gap between targets and outcomes.

Overall, the descriptive statistics of these five variables provide a coherent picture of the Iraqi economy as a shock-driven, unstable economy with a serious mismatch between the monetary and real sectors. The sharp fluctuations in inflation and economic growth, the asymmetric behavior of liquidity, and the large deviations from inflation targets all indicate that monetary policy in this country has been dominated by structural shocks and institutional constraints for many periods. From this perspective, the use of a dynamic framework such as the VAR model to examine the interaction of inflation targeting with liquidity, inflation, and economic growth is fully justified, because only in such a framework can the mutual reactions, lagged effects, and the role of large shocks be analyzed simultaneously and realistically.

### *4.3 Investigating the stability of research variables*

In this part of the study, the stationarity of the variables used is examined. As mentioned in the previous sections, the empirical framework of this study is based on vector autoregression (VAR) models. The use of these models requires that the statistical properties of the time series be examined before estimating the model, because the stationarity or non-stationarity of the variables plays a decisive role in choosing the appropriate form of the model and interpreting the results. If all the variables used are stationary, a VAR model can be used at the variable level. However, if the variables are non-stationary, using VAR at the level can lead to spurious regression, and in this case, VAR based on the difference of variables is usually used. However, although difference ensures the stationarity of the series, it simultaneously removes information related to long-term relationships between variables and can reduce the efficiency of estimates, especially in small samples. Therefore, careful examination of the stationarity of variables is a fundamental prerequisite for valid estimation of VAR models.

In addition to the stationarity of variables, determining the optimal number of lags in VAR models is also of particular importance. As the number of lags increases, the number of estimable parameters increases exponentially and the degrees of freedom of the system decreases, which can affect the accuracy and stability of the results. On the other hand, choosing lags that are smaller than necessary may also cause important system dynamics to be ignored and autocorrelation to appear in the disturbance terms. Therefore, choosing the optimal number of lags is one of the key steps in the VAR model estimation process, which will be discussed later in the chapter.

In general, a time series is considered stationary if its mean and variance are constant over time and the covariance between the variable values in two different time periods depends only on the time interval between them, not on the actual time of the covariance calculation. If these conditions are not met, the time series is non-stationary and shocks to it will have persistent effects. There are various methods and tests to examine the stationarity of time series, including the examination of the autocorrelation function, the correlation graph, and unit root tests.

In this study, in order to ensure the robustness of the results, the stationarity of the variables is examined using unit root tests. Specifically, the generalized Dickey-Fuller (ADF) test is used to examine the presence of a unit root in the variables. This test is one of the most common and widely used tests in time series analysis and allows for the inclusion of the width from the origin and the trend in the test equation. The results of the generalized Dickey-Fuller test for the research variables are reported in the relevant table and, based on it, the stationarity or non-stationarity of each variable is evaluated. These results provide the basis for making decisions about the final form of the VAR model and how the variables are entered into the model in the later sections of the chapter.

Table 4-2-Results of the generalized Dickey-Fuller unit root test

| Variable | Dickey-Fuller statistic | Critical value at the 1 % level | Critical value at the 5 % level | Critical value at the 10 % level | |
|---|---|---|---|---|---|
| **Inflation targeting** | **-2.973723** | **-3.626784** | **-2.145842** | **-2.611531** | **No width from origin and trend** |
| **Economic growth** | **-4.479588** | **-4.252879** | **-3.248490** | **-3.207094** | **With width from origin** |
| **Liquidity volume** | **-3.140318** | **-3.689194** | **-2.971853** | **-2.625121** | **With width from origin and trend** |
| **Inflation rate** | **-3.245427** | **-3.679322** | **-2.967767** | **-2.622989** | **No width from the origin** |

Table 4-2 presents the results of the generalized Dickey-Fuller (ADF) unit root test for the main research variables. The purpose of this test is to examine the presence or absence of a unit root in the time series and determine their stationarity before estimating the VAR model. As can be seen, for each variable, the specifications of the test equation (presence or absence of the width from the origin and the trend) have been selected in accordance with the behavior of the time series.

The results for the inflation targeting variable show that the calculated Dickey-Fuller statistic is-2.97. This value is smaller in absolute value than the critical value at the 1 percent level, but larger than the critical value at the 5 percent level (-2.14) and the 10 percent level (-2.61). Therefore, the null hypothesis of the existence of a unit root is rejected at the 5 and 10 percent confidence levels, but cannot be rejected at the 1 percent level. Accordingly, it can be concluded that the inflation targeting variable is stationary at the conventional 5 percent confidence level and its fluctuations occur around a fixed mean. This result shows that the inflation targeting index extracted from the long-term inflation trend has a more stable and smoother behavior than the realized inflation.

In the case of economic growth rate, the Dickey-Fuller statistic is-4.48, calculated by taking the width from the origin into account. This value is larger in absolute value than all critical values at the 1, 5, and 10 percent levels. As a result, the null hypothesis of the existence of a unit root is categorically rejected and the economic growth rate is stationary at the 1 percent confidence level. This finding indicates that although Iraq's economic growth has experienced severe fluctuations, these fluctuations are transitory in nature and the shocks to economic growth have not left permanent and stable effects on its level.

The test results for the liquidity volume (taking into account the width from the origin and the trend) indicate that the Dickey-Fuller statistic is equal to-3.14. This value is larger in absolute value than the critical value at the 5 percent (-2.97) and 10 percent (-2.62) levels, but smaller than the critical value at the 1 percent level (-3.68). Therefore, the null hypothesis of the existence of a unit root at the 5 percent level is rejected and it can be concluded that the liquidity volume is stationary at this level of confidence. The stationary nature of liquidity indicates that despite significant fluctuations in some periods, the growth of liquidity relative to GDP has tended to return to an equilibrium path in the long run.

Regarding the inflation rate, the test ADF The zero-root test was performed and the calculated statistic is-3.25. This value is greater in absolute value than the critical values at the 5 and 10 percent levels, but smaller than the critical value at the 1 percent level. Thus, the null hypothesis of the existence of a unit root at the 5 percent level is rejected and the inflation rate is considered stationary at this level. This result indicates that although the Iraqi economy has experienced periods of very high inflation, in the long run, inflation has tended to return to its equilibrium level and inflationary shocks have not been completely permanent.

In summary, the results of the generalized Dickey-Fuller test show that all variables used in the study are stationary at the conventional confidence level of 5%. This finding, on the one hand, indicates the absence of spurious regression in the relationships between variables, and on the other hand, justifies the use of the VAR model at the variable level. Therefore, given the stationary nature of the variables, we can continue the study by estimating the VAR model and analyzing the short-term and medium-term dynamics between inflation targeting, liquidity, inflation, and economic growth.

## *4.4 Estimation of the research model*

In this section, the lagged vector autoregressive model VAR(1) is introduced as the main estimation framework. Given the endogenous nature of the research variables, namely the money supply to GDP ratio (M2), the economic growth rate (GGDP), the inflation rate (INF), and the inflation targeting index (INFTARGET), it is assumed that each of these variables is affected not only by its own past values, but also by the past values of other variables in the system. As a result, the VAR(1) model allows the identification of the mutual dynamics and the transmission path of shocks in a multi-equation system without imposing strict theoretical constraints. In this framework, all variables are assumed to be endogenous and the model is estimated in the form of a system of equations.

The VAR(1) system of equations used in this study is defined as follows:

$$M2t = \alpha\ 0 + \alpha\ 1\ M2t{-}1 + \alpha\ 2\ GGDPt{-}1 + \alpha\ 3\ INFt{-}1 + \alpha\ 4\ INFTARGETt{-}1 + \varepsilon t$$

$$GGDPt = \alpha\ 0 + \alpha 1\ M2t{-}1 + \alpha\ 2\ GGDPt{-}1 + \alpha\ 3\ INFt{-}1 + \alpha\ 4\ INFTARGETt{-}1 + \varepsilon t$$

$$INFt = \alpha 0 + \alpha 1\ M2t{-}1 + \alpha 2\ GGDPt{-}1 + \alpha 3\ INFt{-}1 + \alpha 4\ INFTARGETt{-}1 + \varepsilon t$$

$$INFTARGETt = \alpha 0 + \alpha 1\ M2t{-}1 + \alpha 2\ GGDPt{-}1 + \alpha 3\ INFt{-}1 + \alpha 4\ INFTARGETt{-}1 + \varepsilon t$$

In the above relations, t represents the year, $\alpha$ i The constant term of each equation, $\alpha$ ij Interval coefficients of system variables and $\varepsilon$it The disturbance terms are random. The logic of the modeling is that monetary and real economic dynamics in Iraq are shaped simultaneously and interactively. For example, changes in liquidity can both be affected by and affect inflation and economic growth, while changes in the inflation targeting index can also affect inflation and liquidity and ultimately economic growth through monetary policy. For this reason, the analysis in the form of a VAR system rather than a single equation allows for a more detailed examination of the mutual interactions.

For a more concise and accurate presentation, the VAR(1) model can be written in matrix language as follows. First, the vector of endogenous variables is defined:

$$Yt = [M2\ t\ GGDP\ t\ INF\ t\ INFTARGET\ t]$$

As a result, the VAR(1) model can be expressed in the following matrix form:

$$Yt = A0 + A1\ Yt{-}1 + \varepsilon t$$

where A 0 Vector of constants, A 1 Interval coefficient matrix and $\varepsilon$t The vector of sentences is disruptive.

In this structure, each element of the A1 matrix shows the effect of a unit change in the corresponding variable in period t−1 on the equation variable in period t. In the VAR model, since the variables on the right side include the lags of endogenous variables, the parameter estimation is performed by the ordinary least squares method for each equation; because in the standard VAR conditions, the lags of the variables are not correlated with the disturbance terms and the OLS estimation is consistent. In the rest of the chapter, after estimating the model, its stability and adequacy are examined through diagnostic tests (such as the stability of the roots and the autocorrelation of the residuals), and then to analyze the effects of inflation targeting policy on liquidity, inflation and economic growth, instantaneous response functions and variance decomposition of the forecast error will be used.

**4-4-1-Determining the optimal Lags**

According to Sims' idea, in the VAR model, determining the appropriate variables to be present in the system and determining the number of interruptions is of great importance. Sometimes the degree of freedom limit determines the number of interruptions. However, in situations where the number of observations is large, determining the optimal number of interruptions is essential. Due to the large number of parameters in the VAR model, the optimal interruption should be determined based on the principle of economy. In cases where the number of observations is limited, a large number should not be chosen in selecting the optimal interruption of the vector autocorrelation model (because due to the limited number of observations, many degrees of freedom will be lost). Therefore, in this model under consideration, we first put the maximum order. In selecting the optimal order, care should be taken to select the largest order so that the disturbance components of the equations do not become correlated as much as possible and the estimated parameters do not lose too many degrees of freedom. For Determining the number of these optimal breaks can be done using criteria such as: Akaike Information Criterion, Schwartz Information Criterion, Hannan Information Criterion Quine and the maximum likelihood ratio were used. Statistics Hey Each of the criteria mentioned is given in Table (4-3). Because in most studies, the likelihood ratio (LR) criterion is used for Optimal interval determination is also used in this study. Based on This criterion determines the optimal interval for explanatory variables for modeling.

Table 4-3-Determining the optimal number of interruptions

| **Interruption** | **LogL** | **Trueness ratio criterion** | **Final prediction error** | **Acacia** | **Schwartz** | **Hanan Quinn** |
|---|---|---|---|---|---|---|
| 0 | -884.6895 | NA | 1.42e+11 | 37.02873 | 37.18466 | 37.08766 |
| 1 | -740.5698 | 258.2146* | 6.83e+08* | 31.69041* | 32.47007* | 31.98504* |

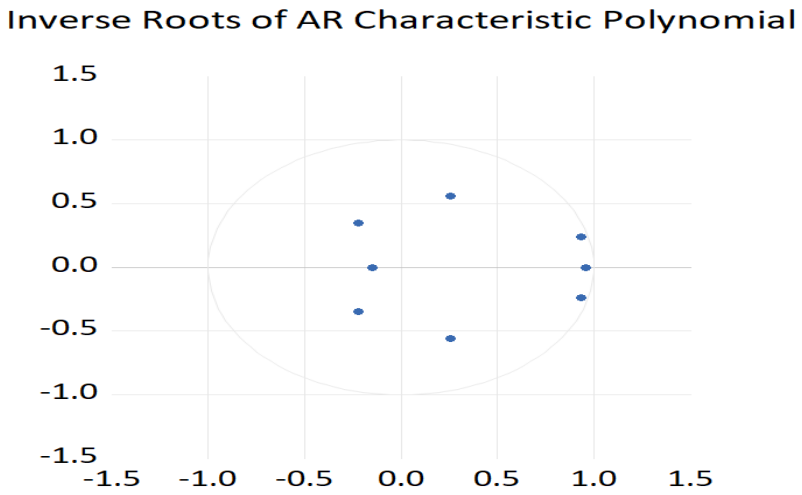
Table 4-3 reports the results of determining the optimal number of lags for the VAR model based on several statistical criteria. Selecting the optimal lag is one of the fundamental steps in estimating VAR models. Autoregression is vector, because the number of intervals It directly affects the dynamics of the model, the number of estimable parameters, and the degrees of freedom of the system. Choosing a lag that is too small can lead to incorrect model characterization and residuals. Autocorrelation in the sentences leads to distortion, while choosing excessive lags also reduces the efficiency of estimation, especially in small samples, by increasing the number of parameters. The results obtained show that the selection of the optimal number of lags for the VAR model is carried out consistently by all statistical criteria. Comparison of the values of the likelihood function and the likelihood ratio test indicates that adding a lag to the model provides a significant improvement in the fit and better reflects the important dynamics of the system. Also, the final prediction error criteria, Akaike, Schwartz and Hannan-Quinn have all selected lag one as the optimal lag. Since these criteria simultaneously consider the accuracy of the fit and the simplicity of the model, their minimization at lag one indicates the appropriateness of this choice for the sample under study.

Overall, the results of the table confirm that the VAR model with one lag provides the best balance between explaining the dynamics of the variables and preserving the degree of freedom. Accordingly, in the remainder of the study, the VAR(1) model is used as the final model to analyze the effect of inflation targeting on liquidity, inflation, and economic growth in Iraq.

**4-4-2-Model stability test**

Another test used to test the stability of the model is the AR polynomial inverse root test. According to this test, a vector autoregressive equation is stable when the absolute value of all roots is less than one, or in other words, all roots lie inside a circle of unit radius. If the estimated VAR system is not stable and stable, then results such as instantaneous impulse response will certainly not be reliable. In this study, the AR polynomial inverse root diagram is also used to examine the stationarity of the estimated VAR system. The results obtained according to the diagram show that the absolute value of all inverse roots is less than one, and therefore the estimated VAR system is stable.

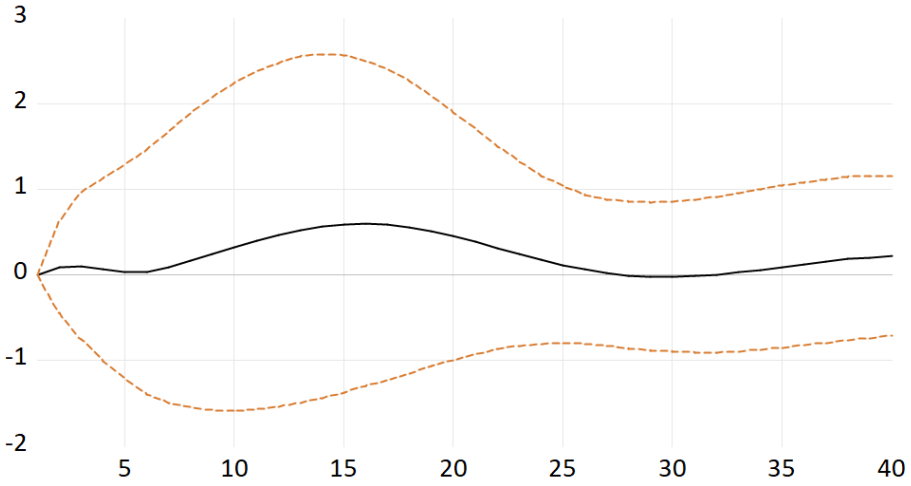
Figure 4-5-Inverse root of a certain polynomial AR




The main criterion for stability in VAR models is that all inverse roots of the characteristic polynomial lie inside the unit circle. As can be seen in the diagram, all points corresponding to inverse roots lie completely inside the unit circle, and no roots lie outside or on the boundary of the unit circle. From a macroeconomic perspective, this result suggests that the estimated dynamic system is stable and that shocks to the model variables — whether monetary shocks, inflation shocks, or shocks related to inflation targeting — have temporary effects and are amortized in the long run. In other words, the response of variables such as the volume of liquidity, the inflation rate, and economic growth to a policy or structural shock does not remain explosive or permanent and returns to its equilibrium path after a few periods.

Model stability is particularly important because it is a necessary condition for valid interpretation of the results of dynamic analyses, including instantaneous response functions and variance decomposition of forecast error. In the absence of stability, the results of these analyses can be misleading; but given that all roots are located inside the unit circle, we can be confident that the dynamic responses of the system to inflation targeting shocks and other variables are economically meaningful and reliable. In the context of the Iraqi economy, this result shows that although the economy has faced severe shocks in different periods — such as political instability, oil shocks, or inflationary spikes — the dynamic relationships between monetary policy, inflation, liquidity, and economic growth in the estimated model are such that the economy tends to return to an equilibrium path. Therefore, it can be concluded that the VAR(1) framework used has the necessary stability and provides a suitable basis for examining the effects of inflation targeting on Iraq's macroeconomic variables.

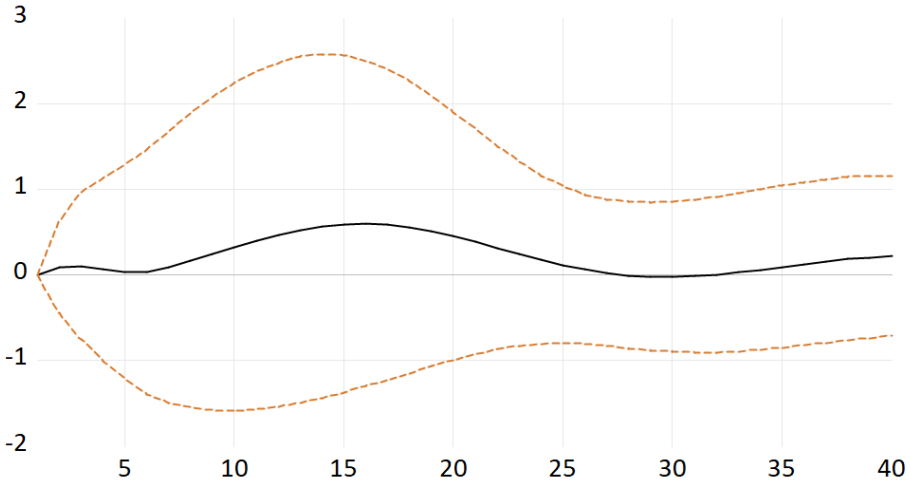
**4-4-3-Instantaneous reaction functions (impact and response)**




One application of the VAR model, which was used by Sims (1980) and others, is to examine the response of the model variables to shocks in each of the variables. In this case, and are functions of the current and lagged methods and are called reaction functions. In other words, these functions show the path of the system dynamics in response to the shocks.

After identifying and estimating the relevant model in the previous sections of the research, the next step is to examine the mutual and dynamic relationships between the model variables. In this section, the effects of shocks from the model's explanatory variables on inflation targeting in Iraq are analyzed and examined. In order to identify structural shocks and calculate instantaneous response functions, the Cholesky decomposition method has been used. This method is based on a recursive structure in which the order of variables implies that variables placed at higher levels can affect subsequent variables in the same time period, while not receiving immediate effects from them. Thus, shocks correlated with shocks It becomes orthogonal and allows for analysis of system dynamics.

Figure 4-6-Dynamic response of money supply to inflation targeting shocks

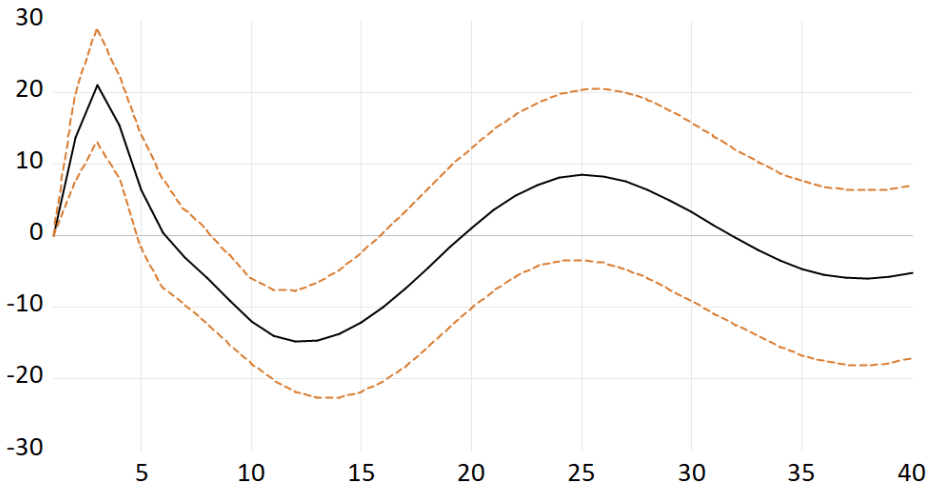



shows the instantaneous response function of the money supply (M2) to a positive shock in inflation targeting (INFTARGET) within the VAR(1) model. The solid line is the estimated response of M2 and the dashed lines represent the confidence bounds.

As can be seen, in the initial periods after the inflation targeting shock, the response of the money supply is very limited and close to zero. This behavior indicates that the announcement or change in the direction of inflation targeting does not lead to an immediate adjustment of the liquidity supply in the short run. From an institutional perspective, this result is consistent with the reality of the Iraqi economy, because the instruments of monetary policy and its transmission mechanism, especially in the short run, are subject to interruptions and limitations, and the monetary policymaker usually uses gradual adjustments. In the medium term (around 10 to 20 periods), the M2 response becomes positive and mild and peaks. This pattern suggests that an inflation targeting shock — which can be interpreted as a tightening or redefinition of the inflation path — is gradually accompanied by a controlled expansion of liquidity. From a theoretical perspective, this could reflect an attempt by the policymaker to reduce the real costs of anti-inflationary policy on the real sector of the economy, especially in an economy where growth and employment are highly dependent on liquidity conditions. At longer horizons, the response of the money supply declines and again tends towards zero. This behavior suggests that the effect of the inflation targeting shock on liquidity is not permanent and that monetary policy returns to a more stable path after a period of adjustment. This result is consistent with the stability of the VAR model and the amortization of shocks in the long run, and suggests that inflation targeting, at least in its implicit framework in Iraq, does not lead to permanent changes in liquidity growth.

Importantly, at most time horizons, the confidence bounds include zero. This suggests that the effect of inflation targeting on money supply is statistically weak or inconclusive. In other words, although the sign of the reaction is positive in the medium term, there is no strong evidence of effective and meaningful liquidity control through inflation targeting. This finding is consistent with the literature on developing countries, which suggests that inflation targeting without high institutional independence and efficient monetary instruments does not necessarily lead to monetary growth containment. Overall, this instantaneous response function shows that inflation targeting in Iraq has a limited, lagged, and unstable effect on the money supply. From a policy perspective, this result suggests that inflation targeting alone is not a powerful tool for controlling liquidity and that its success requires strengthening monetary discipline, improving monetary policy transmission channels, and coordination with fiscal policy.

Figure 4-7-Dynamic response of inflation rate to inflation targeting shocks




shows the instantaneous response function of the inflation rate (INF) to a positive shock in inflation targeting (INFTARGET) in the framework of the VAR(1) model and with Cholesky identification. The solid line is the estimated inflation response and the dashed lines are They display confidence limits.

In the short run (the initial periods after the shock), the inflation rate shows a positive and relatively strong response. This initial response suggests that the inflation targeting shock — which can be interpreted as an increase in the tolerable level of inflation or a weakening of monetary policy tightening — initially leads to an increase in

actual inflation. From an economic perspective, this result is consistent with the expectations channel; that is, economic agents quickly adjust their inflation expectations upon observing a change in the direction of inflation targeting, and this adjustment in expectations leads to an increase in realized inflation.

Over the medium-term horizon (roughly periods 8 to 15), the inflation response turns negative and falls below its equilibrium level. This behavior indicates that monetary policy has entered an adjustment phase. In other words, after an initial increase in inflation, the monetary policymaker is likely to use control tools to prevent inflationary pressures from intensifying or to allow the temporary effects of the initial shock to wear off. This pattern is consistent with the theoretical view that inflation targeting — even implicitly — can lead to inflation containment in the medium term, although with a time lag.

In the subsequent periods and the long-term horizon, the inflation response becomes positive again and then gradually decreases and tends towards zero. This back-and-forth oscillation shows that the effect of the inflation targeting shock on the inflation rate is not stable and uniform and that the economy returns to its equilibrium path after several periods of adjustment. This result is consistent with the stability of the VAR system and the amortization of shocks in the long run and indicates that inflation targeting in the Iraqi economy does not lead to a permanent change in the inflation level.

Importantly, although the inflation response is quantitatively significant at some horizons, the confidence bounds include zero for a significant portion of the periods. This suggests that the effect of inflation targeting on the inflation rate is not statistically robust and stable, and that the transmission power of this policy is limited. This result is consistent with the institutional characteristics of the Iraqi economy, such as the weakness of the formal inflation targeting framework, the dominance of fiscal policy, and exogenous oil shocks.

Overall, this instantaneous response function shows that the inflation targeting shock in Iraq causes short-term and medium-term fluctuations in the inflation rate, but its effect is amortized in the long run and does not lead to a sustainable change in inflation. From a policy perspective, this finding suggests that inflation targeting, in the absence of monetary and fiscal discipline and a strong institutional framework, will not be an effective tool alone to sustainably control inflation and will play a more adaptive and reactive role than a decisive nominal anchor.

**4-4-4-Analysis of variance**

In order to more accurately analyze the dynamics of the vector autoregressive model and examine the relative importance of shocks to each of the system variables, the variance analysis of forecast error method is used. This method is one of the important tools in the analysis of VAR models and is a suitable complement to instantaneous response functions. Analysis of variance shows how much of the variance in the forecast error of an endogenous variable is due to shocks to the variable itself and how much is due to shocks to other variables in the model over different time horizons. In other words, this method determines to what extent changes in a variable over time are influenced by its own innovations and to what extent by innovations in other variables.

From an analytical perspective, variance analysis allows us to assess the relative importance of variables in explaining fluctuations in the variable of interest. This section examines whether fluctuations in the inflation rate or economic growth over short and long horizons are mainly due to inflation targeting shocks or are affected by changes in the volume of liquidity and other macroeconomic variables. Thus, variance analysis helps us to better understand the channels of monetary policy transmission and the extent to which inflation targeting affects macroeconomic variables.

In general, variance analysis, along with instantaneous response functions — sometimes referred to as a form of “shock accounting” —are complementary tools for examining the dynamic relationships among economic variables. While instantaneous response functions show the path and direction of the effect of a shock over time, variance analysis focuses on the relative contribution of each shock to explaining the fluctuations of the variables. Using these two tools together provides a more comprehensive picture of the dynamic structure of the VAR model

and the interaction between inflation targeting policy, the volume of liquidity, inflation, and economic growth in the Iraqi economy.

Table 4-4-Analysis of variance of inflation targeting, inflation rate and money supply

| | | Inflation rate variance analysis and inflation rate targeting | | Analysis of the variance of the money supply and inflation targeting | |
|---|---|---|---|---|---|
| **Period** | **SE** | **INF** | **INFTARGET** | **M2** | **INFTARGET** |
| **1** | **4.908126** | **93.62445** | **0.000000** | **100.0000** | **0.000000** |
| | | **(7.95177)** | **(0.00000)** | **(0.00000)** | **(0.00000)** |
| **2** | **6.300087** | **81.44489** | **5.696871** | **98.95438** | **0.021255** |
| | | **(8.26101)** | **(3.24818)** | **(4.90277)** | **(0.28489)** |
| **3** | **7.398381** | **74.50324** | **14.15652** | **98.45613** | **0.035685** |
| | | **(7.36845)** | **(5.04148)** | **(6.51674)** | **(0.57013)** |
| **4** | **8.257983** | **74.01343** | **15.52380** | **98.19205** | **0.035028** |
| | | **(7.37834)** | **(4.70937)** | **(7.12680)** | **(0.90315)** |
| **5** | **8.971457** | **73.85133** | **15.64985** | **98.05527** | **0.030959** |
| | | **(7.63879)** | **(4.53664)** | **(7.64483)** | **(1.25817)** |
| **6** | **9.570563** | **73.69810** | **15.61942** | **98.03429** | **0.028759** |
| | | **(7.81614)** | **(4.50654)** | **(7.88387)** | **(1.58480)** |
| **7** | **10.08293** | **73.46560** | **15.67569** | **98.00328** | **0.034051** |
| | | **(7.91285)** | **(4.55231)** | **(8.03161)** | **(1.92182)** |
| **8** | **10.52970** | **72.89498** | **16.07924** | **97.90994** | **0.055966** |
| | | **(8.06913)** | **(4.69910)** | **(8.22046)** | **(2.33747)** |
| **9** | **10.92527** | **71.83617** | **17.07147** | **97.75060** | **0.101714** |
| | | **(8.19258)** | **(4.93742)** | **(8.47246)** | **(2.81971)** |
| **10** | **11.28006** | **70.31782** | **18.67321** | **97.52872** | **0.176418** |
| | | **(8.34267)** | **(5.23958)** | **(8.76423)** | **(3.30645)** |
| **11** | **11.60201** | **68.60340** | **20.57255** | **97.24411** | **0.283631** |
| | | **(8.51478)** | **(5.51490)** | **(9.09871)** | **(3.77831)** |
| **12** | **11.89735** | **66.95214** | **22.40216** | **96.89576** | **0.423617** |
| | | **(8.71958)** | **(5.73136)** | **(9.50324)** | **(4.23983)** |
| **13** | **12.17065** | **65.50835** | **23.93862** | **96.49087** | **0.591447** |
| | | **(8.95224)** | **(5.92798)** | **(9.97647)** | **(4.67224)** |
| **14** | **12.42476** | **64.33815** | **25.08512** | **96.04839** | **0.777273** |
| | | **(9.20215)** | **(6.09619)** | **(10.4592)** | **(5.04791)** |

| | | | | | |
|---|---|---|---|---|---|
| **15** | **12.66116** | **63.45354** | **25.82370** | **95.59419** | **0.968539** |
| | | **(9.48674)** | **(6.25605)** | **(10.9016)** | **(5.35658)** |
| **16** | **12.88045** | **62.81930** | **26.19536** | **95.15476** | **1.152481** |
| | | **(9.78954)** | **(6.40604)** | **(11.2827)** | **(5.60215)** |
| **17** | **13.08283** | **62.36990** | **26.28411** | **94.75310** | **1.317992** |
| | | **(10.1048)** | **(6.54237)** | **(11.5956)** | **(5.79036)** |
| **18** | **13.26835** | **62.03141** | **26.19676** | **94.40674** | **1.456892** |
| | | **(10.4397)** | **(6.66794)** | **(11.8359)** | **(5.92746)** |
| **19** | **13.43716** | **61.73698** | **26.04433** | **94.12652** | **1.564651** |
| | | **(10.7874)** | **(6.78802)** | **(12.0047)** | **(6.02226)** |
| **20** | **13.58969** | **61.43567** | **25.92606** | **93.91612** | **1.640525** |
| | | **(11.1472)** | **(6.91770)** | **(12.1111)** | **(6.08619)** |
| **21** | **13.72670** | **61.09853** | **25.91387** | **93.77252** | **1.687079** |
| | | **(11.5026)** | **(7.05632)** | **(12.1727)** | **(6.13088)** |
| **22** | **13.84924** | **60.72172** | **26.04025** | **93.68740** | **1.709256** |
| | | **(11.8536)** | **(7.20805)** | **(12.2109)** | **(6.16608)** |
| **23** | **13.95862** | **60.32355** | **26.29534** | **93.64923** | **1.713234** |
| | | **(12.1954)** | **(7.37137)** | **(12.2444)** | **(6.19830)** |
| **24** | **14.05623** | **59.93529** | **26.63605** | **93.64533** | **1.705312** |
| | | **(12.5240)** | **(7.54254)** | **(12.2847)** | **(6.23056)** |
| **25** | **14.14343** | **59.58960** | **27.00366** | **93.66374** | **1.691011** |
| | | **(12.8376)** | **(7.71664)** | **(12.3374)** | **(6.26325)** |
| **26** | **14.22150** | **59.31097** | **27.34221** | **93.69449** | **1.674497** |
| | | **(13.1355)** | **(7.88767)** | **(12.4039)** | **(6.29515)** |
| **27** | **14.29153** | **59.11081** | **27.61159** | **93.73025** | **1.658389** |
| | | **(13.4211)** | **(8.05379)** | **(12.4818)** | **(6.32414)** |
| **28** | **14.35444** | **58.98690** | **27.79338** | **93.76639** | **1.643896** |
| | | **(13.6885)** | **(8.20838)** | **(12.5635)** | **(6.34766)** |
| **29** | **14.41101** | **58.92571** | **27.89056** | **93.80049** | **1.631207** |
| | | **(13.9357)** | **(8.34598)** | **(12.6384)** | **(6.36359)** |
| **30** | **14.46190** | **58.90634** | **27.92307** | **93.83154** | **1.619990** |
| | | **(14.1622)** | **(8.46330)** | **(12.6961)** | **(6.37126)** |

Shocks based on one standard deviation (One SD) Calculated using Cholesky decomposition (with degrees of freedom correction). Standard deviations reported in parentheses are standard errors from simulation. Monte Carlo with 100 iterations.

Table 4-4 Results of analysis of variance of prediction error Two macro variables, the inflation rate and the money supply, respond to shocks. Inflation targeting shows. These results allow us to assess the relative importance of inflation targeting in explaining the fluctuations of each of the variables under study over different time horizons. Unlike the instantaneous response, which shows the path and direction of the effect of a shock, variance analysis focuses on the relative contribution of each shock in explaining the fluctuations of the variables and, in this respect, is very important for answering policy questions.

The results of the variance analysis of the inflation rate show that in the short term, a very large part of the inflation fluctuations is explained by inflation shocks themselves, and the contribution of inflation targeting shocks is almost negligible. This finding indicates that in the short term, inflation in the Iraqi economy is highly self-reinforcing and inertial in nature, and is more affected by past inflation behavior, supply shocks, structural imbalances, and macro-instabilities than by the inflation targeting policy framework.

As time passes and the forecast horizon increases, the contribution of inflation targeting shocks to explaining inflation fluctuations gradually increases. In the medium and long term, about a quarter of the variance in inflation forecast error is explained by inflation targeting shocks. This result indicates that the effect of inflation targeting on actual inflation has a significant time lag and its role is more pronounced in the long term. From a theoretical perspective, this finding is consistent with the inflation targeting literature, which emphasizes that this policy operates mainly through the inflation expectations channel and that its effectiveness requires time, institutional credibility, and policy stability.

However, the persistence of a high share of inflation shocks even over long-term horizons suggests that inflation targeting in the Iraqi economy has failed to act as a strong and dominant nominal anchor. In other words, although inflation targeting explains part of the inflation fluctuations in the long run, this policy alone is not able to fully control inflation dynamics, and inflation remains largely subject to structural and exogenous factors.

The results of the variance analysis of money supply provide a very clear picture of the weak link between inflation targeting and liquidity control in the Iraqi economy. At all time horizons, the contribution of inflation targeting shocks to explaining money supply fluctuations remains very small, and even at long horizons does not exceed about one to two percent. In contrast, almost all money supply fluctuations are explained by shocks to this variable itself.

This finding suggests that inflation targeting in Iraq has failed to act as an effective tool to guide or contain liquidity growth. From an institutional perspective, this result is well consistent with the characteristics of the Iraqi economy, where money growth is influenced by factors such as the dominance of fiscal policy, the financing of government deficits, the sharp fluctuations in oil revenues, and the limitations of monetary policy instruments, rather than being subject to a coherent monetary rule.

In other words, the results of the variance analysis show that in practice, inflation targeting has been more of a declarative or reactive framework than a strict operational rule for controlling liquidity. This is one of the main reasons for the weak impact of inflation targeting on inflation and other macroeconomic variables in developing economies.

## 5. Conclusions and policy recommendations

The main objective of this study was to simulate the effect of inflation targeting on the money supply and inflation rate in the Iraqi economy and to assess the effectiveness of this monetary policy framework in controlling nominal macroeconomic variables. For this purpose, using the vector autoregression (VAR) model, instantaneous response functions, and variance analysis of forecast error, the response of money supply and inflation rate to shocks caused by inflation targeting was examined. The results of the model estimation showed that although inflation targeting can theoretically stabilize inflation expectations, control liquidity growth, and reduce price fluctuations in the Iraqi economy, the effectiveness of this framework faces significant challenges due to the structural characteristics of the economy and institutional constraints.

The results of the instantaneous response functions showed that the shock caused by inflation targeting does not have a significant and stable effect on the money supply. The response of the money supply in the initial periods is very limited and after a few periods it quickly returns to its equilibrium path. This finding shows that the implementation of inflation targeting in the Iraqi economy has not yet been able to become an effective tool for managing liquidity and controlling the growth of the money supply. One of the most important reasons for this can be found in the strong dependence of the Iraqi economy on oil revenues, the dominance of fiscal policy over monetary policy, the limited indirect tools of the central bank and the weakness of the monetary policy transmission channels.

In contrast, the results for the inflation rate indicate that although inflation targeting does not have a significant effect on controlling inflation in the short term, it does lead to a gradual reduction in inflationary fluctuations over long time horizons. In other words, the inflation response to inflation targeting shocks appears with a time lag and gradually declines. This finding suggests that even in an economy with structural constraints such as Iraq, inflation targeting can help stabilize inflation expectations and reduce price volatility to some extent in the long term, although the magnitude of this effect is relatively limited.

The results of the analysis of variance also confirm the above findings. The contribution of shocks resulting from inflation targeting in explaining changes in the money supply is very small in all time horizons, and the bulk of liquidity fluctuations is explained by endogenous shocks to the money supply itself and other economic factors. Also, although the contribution of inflation targeting in explaining inflation rate fluctuations is gradually increasing, the bulk of inflation changes are still due to shocks to inflation itself and other structural factors of the Iraqi economy. These results indicate that the inflation targeting policy in the current conditions of the Iraqi economy has not yet achieved the status of a powerful nominal anchor for controlling liquidity and containing inflation.

In general, the findings of this research are consistent with studies that consider the effectiveness of inflation targeting to depend on the availability of institutional prerequisites, central bank independence, financial discipline, and the development of financial markets (Ball & Sheridan, 2004; Batini & Laxton, 2007; Arsić et al., 2022). In an economy like Iraq, which faces high dependence on oil revenues, fiscal dominance, exchange rate volatility, and weak financial markets, the mere implementation of inflation targeting alone cannot ensure effective liquidity and inflation control.

Overall, the results of this study show that inflation targeting in the current institutional and structural conditions of Iraq, rather than affecting the control of the money supply, can help gradually reduce inflationary fluctuations in the long run. Therefore, the success of this policy framework requires structural reforms, strengthening the independence of the central bank, improving the efficiency of monetary policy instruments, reducing the government's financial dominance, and creating greater coordination between monetary and fiscal policies.

According to the research findings, the following suggestions are made to increase the effectiveness of inflation targeting in the Iraqi economy:

1. Strengthening the independence of the Central Bank of Iraq: Increasing the operational and institutional independence of the Central Bank will enhance the credibility of the inflation targeting policy, stabilize inflation expectations, and increase the ability of this institution to control inflation.
2. Reducing financial dominance over monetary policy: It is essential to reduce the dependence of monetary policy on government budget deficits and oil revenues so that the central bank can make its decisions based on price stability objectives.
3. Reforming the liquidity management mechanism: Expanding open market operations, expanding the debt securities market, and using indirect monetary policy tools more effectively can make money and liquidity management more efficient.
4. Strengthening monetary policy transmission channels: Reforming the banking system, developing financial markets, increasing competition in the banking sector, and improving access to financial instruments will increase the effectiveness of inflation targeting policy.

5. Greater coordination between monetary and fiscal policies: The success of inflation targeting requires coordination between the central bank and the government in the areas of public expenditure management, exchange rate policies, and budget deficit control.

6. Gradual implementation of the inflation targeting framework: Given the specific conditions of the Iraqi economy, it is recommended that this framework be implemented gradually, along with strengthening institutional infrastructure, improving the quality of economic data, and increasing policy transparency, in order to increase economic actors' confidence in monetary policies.

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