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Examining the Effect of Bank Loans and Credits in the Transmission Mechanism and Intensity of Monetary Policy Impact on Iran's Macroeconomic Variables

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ABSTRACT

This study investigates the role and impact of monetary policy in response to an external shock on the real sector of the economy and the banking system. The research examines to what extent the government can respond appropriately through the implementation of monetary policy via the (commercial) banking network. In this regard, the profitability status of the banking network, as one of the target variables in the aftermath of economic shocks—an issue rarely addressed in previous studies—is taken into account. The main objective of this study is to examine the effect of bank loans and credits in the transmission mechanism and the intensity of monetary policy impact on Iran's macroeconomic variables. The statistical sample of the study includes data from Bank Mellat, Tejarat Bank, Sepah Bank, Refah Bank, Bank Melli, and Bank Saderat for the period from the first quarter of 2016 to the second quarter of 2022. To analyze the data, the Bayesian Vector Autoregression (BVAR) model was employed. The results showed that the total bank loans and credits are among the significant financial factors influencing the transmission mechanism and the intensity of monetary policy impact on Iran's macroeconomic variables.

Keywords: Bank loans and credits, transmission mechanism, monetary policy impact intensity, Bayesian Vector Autoregression model

Introduction

The design, implementation, and effectiveness of monetary policy remain central concerns in both advanced and developing economies. Monetary policy acts as a critical mechanism for stabilizing the macroeconomy, influencing inflation, employment, exchange rates, and the overall trajectory of economic growth. Its impact is particularly visible in countries where structural vulnerabilities in the banking sector amplify or constrain the effectiveness of transmission mechanisms. The global literature on monetary policy has highlighted the multi-channel nature of transmission mechanisms. For instance, interest rate channels, exchange rate channels, credit channels, and expectations channels jointly define how policy impulses translate into real-sector outcomes [1-3]. The effectiveness of these channels depends heavily on the quality of institutional frameworks, the independence of the central bank, and the responsiveness of the financial system [4, 5]. In Iran and similar economies, where the financial sector has often operated under significant regulation and political influence, understanding these dynamics becomes all the more important.

One crucial dimension of modern monetary policy concerns the profitability and stability of the banking sector. In Indonesia, for instance, research has shown that monetary policy exerts significant influence on bank profitability and capital structures [6, 7]. Similarly, in Iraq, the profitability of the banking industry is highly dependent on the responsiveness of monetary policy design to local macroeconomic conditions [8]. These studies emphasize that banking profitability is not simply a reflection of operational efficiency but is intertwined with policy impulses and their distribution through credit allocation mechanisms. The Iranian case mirrors these dynamics, though under unique circumstances such as sanctions, high inflation, and partial insulation from global financial flows [9, 10].

Moreover, empirical evidence suggests that monetary policy effectiveness depends heavily on the structural independence of central banks and their credibility in pursuing inflation-targeting or stabilization objectives. Research on central bank independence shows that higher degrees of autonomy correlate with more effective inflation management and policy transmission [4, 5]. Yet, in politically constrained environments, monetary policy often becomes discretionary, limiting its long-term effectiveness. The Iranian banking system, much like other systems in emerging markets, has faced these institutional constraints, creating a gap between theoretical transmission mechanisms and observed macroeconomic outcomes [11].

The challenges extend beyond conventional policy variables to include risks associated with credit management and non-performing loans. Poor credit risk management can undermine monetary policy by weakening banks' resilience to shocks, ultimately reducing their ability to lend countercyclically. For instance, in Tanzania, the quality of credit risk management practices is directly linked to the financial performance of commercial banks [12], while in Nigeria, the quality of banks' asset portfolios has been identified as a critical determinant of policy effectiveness [13, 14]. Similarly, studies from Iran demonstrate how the exchange rate channel and non-linear mechanisms exacerbate volatility in monetary policy transmission [15, 16]. These findings are highly relevant to contexts such as Iran, where banking fragility and exchange rate fluctuations often amplify policy uncertainties.

At the same time, the globalization of financial flows and the increasing integration of sustainability concerns into financial markets have introduced new complexities. Recent studies argue that environmental, social, and governance (ESG) factors, when integrated into banks' credit departments, reshape their capacity to respond to monetary policy impulses by altering lending portfolios and risk assessments [17]. In Iran, although ESG integration is still at an early stage, the gradual transformation of banking priorities suggests that sustainability-linked risk factors will increasingly intersect with policy effectiveness.

Technological disruption, particularly through fintech, is another frontier that complicates the monetary-banking nexus. Fintech innovations, while increasing efficiency, also alter the nature of credit and risk management practices [18, 19]. In the Iranian context, where fintech is gradually expanding in spite of regulatory hurdles, the intersection between technology-driven risk, monetary shocks, and the credit allocation capacity of banks remains underexplored. Evidence from other regions shows fintech's role in enhancing efficiency while simultaneously raising new risks of systemic importance [20, 21].

Another critical dimension is the role of monetary policy under conditions of external shocks, sanctions, and inflationary pressures. Iran, in particular, has faced recurrent stagflationary environments, where inflation and unemployment coexist. Research emphasizes that the use of monetary policy tools to counter stagflation has often been limited, requiring more targeted interventions [22]. Similarly, comparative studies of Iran under sanctions reveal that transmission channels respond differently depending on whether shocks are domestically or externally driven [9]. This reinforces the importance of understanding not just the existence of policy mechanisms but their relative strengths under constrained environments.

The theoretical foundation for analyzing these dynamics lies in both rule-based and discretionary approaches. Rule-based frameworks, such as Taylor rules, provide predictable guidance for interest rate adjustments, while discretionary approaches allow for flexibility in times of crisis. In contexts such as Iran, where interest rate targeting is complicated by non-interest-based banking, researchers have proposed adapting the Taylor rule to alternative monetary variables such as monetary base growth [1, 10]. This adaptation reflects the necessity of aligning theoretical frameworks with institutional realities.

In parallel, Iranian scholars have pointed out the importance of understanding policy pathologies in the design and allocation of monetary tools. Weaknesses in policy formulation and implementation, coupled with allocation inefficiencies in the banking system, reduce the intended impacts of monetary interventions [11, 23]. At the operational level, these weaknesses manifest in misaligned credit allocation, persistent inflationary pressures, and heightened vulnerability to external shocks. By identifying such gaps, the literature emphasizes the importance of structural reform in the banking sector as a prerequisite for effective policy transmission.

Regional comparisons further highlight both commonalities and divergences. For example, Nigerian evidence shows that monetary policy instruments, particularly in controlling inflation, significantly shape banking stability and long-term economic growth [13, 14]. In Indonesia, monetary policy not only influences capital structure and credit risk but also directly affects bank profitability, suggesting strong interconnectedness between macro policy and micro-level financial health [6, 7]. Meanwhile, in Iraq, the profitability of the banking sector underlines the challenges of designing responsive monetary tools in a politically unstable environment [8]. These comparative insights provide useful parallels for Iran, which shares institutional weaknesses but also faces unique sanction-related pressures.

From a methodological perspective, advanced modeling approaches have been used to examine these issues. Studies applying stochastic general equilibrium (DSGE) and nonlinear VAR techniques highlight the complexity of monetary policy transmission in Iran and similar economies [10, 15]. Quantile regression and non-linear methods have also been employed to capture asymmetric responses of the banking sector to shocks [1, 9]. These approaches underscore the need for robust empirical designs that accommodate both heterogeneity across banks and structural breaks in the economy.

In addition, the literature reflects an evolution in understanding the long-term institutional and structural reforms necessary for improving policy effectiveness. For instance, structural reforms to reduce the dominance of government-owned banks, greater reliance on independent central banking practices, and the integration of modern risk management systems are repeatedly emphasized [5, 11, 17]. Such reforms are also aligned with broader global trends that see monetary policy not only as a macroeconomic stabilizer but as an integrated component of financial system resilience.

In summary, the literature demonstrates that the effectiveness of monetary policy cannot be assessed in isolation from the banking system. Bank profitability, credit allocation, credit risk management, technological disruption, ESG integration, and institutional independence all represent interconnected factors that determine whether monetary policy achieves its stated objectives. For Iran, these factors are further complicated by sanctions, political constraints, and a non-interest-based banking framework, creating a hybrid environment where traditional transmission channels operate in modified ways. This study builds on these insights to explore the role of loans and credits in the transmission mechanism and the intensity of monetary policy impacts on Iran’s macroeconomic variables.

Methods and Materials

This research is both field-based and library-based. Accordingly, first, by using concentration indices, the structure of the banking industry in terms of the degree of concentration was measured, and then, to address the above research questions, Dynamic Stochastic General Equilibrium (DSGE) models were employed as the main research tool. The statistical population of this study consists of all commercial banks in the country, including both listed and non-listed banks such as Iran's commercial banks. The statistical sample includes Bank Mellat, Tejarat Bank, Sepah Bank, Refah Bank, Bank Melli, and Bank Saderat. For modeling purposes, seasonal data of Iran's economy during the period from the first quarter of 2016 to the fourth quarter of 2022 were used. In addition, considering the nature of this research, data collection was conducted using databases, documents, records, and financial reports of the relevant listed companies.

For comparing the simulation power of the models, the relative deviations of simulated data from actual data and the mean squared prediction error of each model were used. Furthermore, seasonal data from the first quarter of 2016 to the fourth quarter of 2022 were employed for modeling. The parameters of each model were also estimated using the Bayesian Vector Autoregression (BVAR) method.

Christou et al. (2018) extended the following equation by incorporating the effect of the real exchange rate to demonstrate the monetary policy response to movements in the real exchange rate:

$$i_t = f(y_t, \pi_t, RER_t) \quad (1)$$

In equation (1), i_t represents the nominal interest rate, y_t the output gap, π_t the inflation rate, and RER_t the real exchange rate at time t. The Taylor rule, derived from past economic experiences, has been used as a monetary policy rule for decision-making regarding the interest rate as a monetary instrument (Christou et al., 2018).

The model under investigation for analyzing the performance index of commercial banks on monetary policy variables in Iran, within the Taylor rule framework, is based on theoretical foundations and the study by Christou et al. (2018). The research variables include: HMR_t (monetary base growth rate), $LGVO_t$ (logarithm of government expenditures), $GDPGAP_t$ (output gap), $LCPI_t$ (logarithm of the consumer price index at constant 2016 base year prices), CPI_t (consumer price index at constant 2016 base year prices), and $LRER_t$ (logarithm of the real exchange rate). All statistical and time-series data of Iran's monetary sector during 2016–2022 were obtained from the Central Bank of Iran's website. The output gap was calculated as the difference between actual and potential gross domestic product (GDP). Data on GDP at the 2004 base year published by the Central Bank were used, and potential GDP was calculated using the Hodrick–Prescott filter. Then, the difference between actual and potential GDP yielded the output gap. The real exchange rate was derived from the following equation, calculated as the product of the nominal exchange rate and the ratio of the foreign to domestic price indices:

$$RER = e \times (CPI^{US} / CPI^{IR}) \quad (2)$$

where RER represents the real exchange rate, e is the nominal exchange rate (free market rate), CPI^{IR} denotes the consumer price index in Iran, and CPI^{US} denotes the foreign (U.S.) consumer price index.

One of the most important considerations in interpreting the empirical results of this study regarding the rule-based behavior of monetary policymakers is the choice of monetary and fiscal policy instruments. In the Taylor rule, the policy instrument is the interest rate; however, due to the prevalence of the interest-free banking system in Iran, the monetary base growth rate was used instead. In this regard, studies such as Zarrin-Eghbal et al. (2018) and Erfani & Kasaeepour (2018) have employed the monetary base as the monetary policy variable.

Moreover, in analyzing the shocks of macroeconomic variables on fiscal policies—as opposed to monetary policy—there exists no universally accepted fiscal policy rule. Nevertheless, today, government expenditures and taxation are considered among the most important fiscal policy instruments. Economic policymakers in Iran emphasize reducing government expenditures and increasing the share of tax revenues as a sustainable source in the government's resource composition and as an appropriate tool for financing the budget. Another important consideration in interpreting the empirical results of this study is the inclusion of total government expenditures as the fiscal policy instrument.

Findings and Results

As can be observed, the highest mean corresponds to the Economic Openness Index. The lowest data value belongs to the Output Gap, while the highest value again corresponds to the Economic Openness Index. The kurtosis value also indicates that the distribution of the sample's dispersion is either higher than or shorter than a normal distribution. In the examined sample, the kurtosis of the variables shows that the dispersion distribution of the variables is greater than the normal type. A similar judgment can be made regarding the other research variables and other criteria.

Table 1.

Descriptive Statistics and Dispersion Indices of Variables

Variables	Mean	Minimum	Maximum	Skewness	Kurtosis	Standard Deviation
Monetary base growth rate	0.264	0.123	0.342	1.72332	8.49824	0.2394
Output gap	0.235	0.13	0.451	-0.19303	1.702255	0.4601
Economic growth rate	1.997	8.321	9.453	0.347838	1.217889	6.4718
Capital stock growth rate	1.128	9.321	12.332	1.18534	3.228889	12.0568
Economic Openness Index	29.897	12.43	14.754	2.6033	4.249014	56.7698

To determine the existence (or non-existence) of a separate intercept for Iranian banks, the F-statistic was used as follows:

H0: $\alpha 0 = \alpha 1 = ... = \alpha k = \alpha$

H1: $\alpha i \neq \alpha j$

$$(3)\ F(n-1, nt-n-k) = ((RSS\_UR - RSS\_P) / (n-1)) / ((1 - RSS\_UR) / (nt - n - k))$$

In equation (3), the subscript UR denotes the unrestricted model, while the subscript P indicates the pooling or restricted model with a constant term for all groups. k is the number of explanatory variables included in the model, n is the number of cross-sections, and nt is the total number of observations (and the time period considered).

Table 2.

Calculation of Homogeneity Test Results (Limer's F-Test)

Statistical Population	Statistic	Critical Value	F-Statistic
Iranian Banks	0.00	4.18	6.32 (0.0031)

Given that the calculated F is larger than the table value for all groups, the null hypothesis is rejected, group effects are accepted, and separate intercepts must be considered in the estimation. Therefore, the model is of panel type.

To test whether the model should be estimated using the fixed effects method or the random effects method, the Hausman test is defined as follows:

H0: Random Effects

H1: Fixed Effects

$$(4)\ H = n\ \hat{q}\ (A\ var(\hat{q}))^{(-1)}\ \hat{q}$$

$$\hat{q} = (\hat{\beta}\_FE - \hat{\beta}\_EC)$$

where q̂ represents the difference between the estimated coefficients for explanatory variables included under the fixed effects and random effects methods. A var(q̂) is the asymptotic variance, and n is the number of observations. The Hausman test statistic follows a chi-square distribution with ß degrees of freedom.

The value of the Hausman test statistic is presented below. This value indicates the use of fixed effects estimation for the panel data. The statistic was calculated using EViews 9. The null hypothesis states that the estimators of the random effects and fixed effects models do not differ significantly. If the null hypothesis is rejected, we conclude that the random effects method is not appropriate and that the fixed effects method is preferable. The Hausman statistic follows a chi-square distribution with degrees of freedom equal to the number of coefficients estimated in the model. If the calculated statistic at a given probability level is greater than the chi-square table value, the null hypothesis is rejected.

Table 3.

Calculation of Homogeneity Test Results (Hausman Test with Chi-Square Distribution)

Statistical Population	Statistic	Critical Value	F-Statistic
Iranian Banks	0.00	9.456	12.25 (0.0017)

As observed, the calculated statistic is greater than the chi-square table value at the specified probability level. Therefore, the null hypothesis is rejected, and the model with fixed effects is accepted.

It should be noted that before estimating the model, in order to avoid the problem of spurious regression, the stationarity of all variables must be tested. For this purpose, the Fisher (PP) test can be used. The results of this test are presented in Table 4.

Table 4.

Results of Panel Unit Root Test of Variables at Level

Variable	Levin, Lin & Chu Test	Breitung Test	Im, Pesaran & Shin Test	Fisher-type Augmented Dickey–Fuller Test	Fisher-type Phillips–Perron Test	Hadri Test	Heteroscedasticity-Consistent Test	Result
Monetary base growth rate	Statistic 7.33	2.551	7.643	4.343	43.643	6.321	3.441	Stationary at first order
	Probability 1.000	0.0054	0.543	0.4323	0.431	0.0031	0.422	Stationary at first order
Output gap	Statistic 5.88	2.341	5.643	4.87	9.321	7.232	8.56543	Stationary at first order
	Probability 1.000	0.01564	1.000	0.4343	0.473	0.0023	0.9841	Stationary at first order
Economic growth rate	Statistic 4.67	4.633	8.651	97.432	7.421	5.341	5.751	Stationary at first order
	Probability 0.871	0.8455	0.533	0.753	0.4321	0.001	0.411	Stationary at first order
Capital stock growth rate	Statistic 7.95	10.543	14.65	24.33	23.42	16.425	17.53	Stationary at first order
	Probability 0.671	0.086	0.0764	0.43264	0.1345	0.0043	0.4131	Stationary at first order
Economic openness index	Statistic 8.09	12.54	15.54	12.44	16.534	18.43	14.75	Stationary at first order
	Probability 0.954	0.654	0.0854	0.5321	0.445	0.0035	0.7533	Stationary at first order

The findings of Table 4 indicate rejection of the null hypothesis at the 1 percent error level. After obtaining the results of the unit root tests and ensuring that all variables used in this study are integrated of order one, it is now possible to examine the existence of a long-term relationship between the variables. For this purpose, the Kao test was used. The results of this test are presented in Table 5.

The results of the cointegration test show that the null hypothesis of no cointegration between variables cannot be accepted, and consequently, there is a significant long-term relationship between the variables included in the model.

Table 5. Westerlund Panel Cointegration Test

Null Hypothesis: No Cointegration

With intercept and trend	With intercept	Test Statistic
Strong Prob. 0.0005	Prob. 0.00079	-5.984 (G1)
Strong Prob. 0.0000	Prob. 0.00020	-4.089 (G2)
Strong Prob. 0.0001	Prob. 0.00050	-5.876 (P1)
Strong Prob. 0.0003	Prob. 0.00850	-5.323 (P2)
Strong Prob. 0.00001	Prob. 0.00018	-4.985 (G1)
Strong Prob. 0.00003	Prob. 0.00038	-5.975 (G2)
Strong Prob. 0.00002	Prob. 0.00020	-5.875 (P1)
Strong Prob. 0.00001	Prob. 0.00041	-4.651 (P2)

Table 6.

Kao Residual Cointegration Test

Probability	t-statistic	Model	Test Result
0.0054	-3.52147	dY_it, dPR_it, dHC_it, dKL_it, dEF_it, dAVREGEGOOD_it, dDEMO_it, dOPEN_it	Existence of long-term relationship

It should be noted that, prior to estimating the model, in order to prevent the problem of spurious regression, the stationarity of all variables must be tested. For this purpose, the Fisher (PP) test can be applied. The results of this test are presented in Table 7.

Table 7.

Results of Optimal Lag Selection

Lag Length	FPE	AIC	SC	HQ
0	224.235	45.81541	45.99136	45.87682
1	271.5796	37.94367	38.8234	38.25072
2	81.88749	35.79969	33.60450*	36.35238
3	33.19258	35.24542	37.53272	36.04375
4	102.0565*	30.76292	33.75401	31.80689
5	26.13279	29.90962*	37.3832	31.19923*

Typically, the effect of changes in independent variables on the dependent variable is not immediate, and the impact of economic decision-making appears with a lag on the variables under study. Finding the optimal lag in panel autoregressive models is a critical issue because causality and its results depend on the number of lags of explanatory variables. Generally, three methods exist for selecting the optimal lag. In the first method, the lag is determined without any statistical test and solely based on the researcher’s judgment. In this method, the researcher decides how many previous periods of the dependent variable or other explanatory variables may influence the dependent variable. The drawback of this method is that it relies on subjective judgment and may lead to different results across studies.

In the second method, statistical criteria such as the Akaike Information Criterion (AIC), Schwarz Criterion (SC), Hannan–Quinn Criterion (HQ), Final Prediction Error (FPE), and the Adjusted Likelihood Ratio Test (LR) determine the optimal maximum lag. In this approach, lags are added until the values of the above criteria are minimized. This method is problematic, especially in models with short time spans, because each lag reduces the degrees of freedom of the model.

In the third method, which is applied in this study, a combination of the two previous methods is used. The researcher first specifies the maximum lag based on theoretical knowledge and the time horizon and then applies Akaike and Schwarz criteria to identify the best lag length within the predetermined range. In the present study, a maximum of four lags was proposed, and the Schwarz criterion confirmed two lags. Considering that this criterion conserves degrees of freedom in lag selection and due to the short time horizon under study, two lags were chosen as the optimal lag according to Table 7.

To determine the number of cointegration vectors, the Trace statistic (λ-Trace) was used. The test statistic value (λ-Trace = 43.84) is greater than the critical value 39.01 at the 95% confidence level, so the null hypothesis is rejected.

Table 8.

Trace Test Statistics for Determining the Cointegration Vectors

H0 vs. H1	Critical Value at 95%	Test Statistic	Probability
r = 0 vs. r ≥ 1	27.79	41.101	0.0041
r ≤ 1 vs. r ≥ 2	39.01	43.84	0.002
r ≤ 2 vs. r ≥ 3	17.61	16.67	0.032
r ≤ 3 vs. r ≥ 4	11.621	10.123	0.023

According to Table 8, two cointegration vectors were identified; therefore, there exists a positive cointegration relationship among the variables influencing monetary policy, and the Error Correction Model can be applied to investigate the short-term and long-term relationships among the variables. The results of the panel causality test and the short-term effect of independent variables on monetary policy in Iran are presented in Table 9.

Table 9.

Panel Causality Test and Short-Term Relationship among Variables

t-statistic	Standard Error	Coefficients	Variables
2.38	0.128	0.89	Monetary base growth rate
2.12	0.0145	0.25	Output gap
2.62	0.184	0.67	Economic growth rate
1.09	0.036	0.89	Capital stock growth rate
2.85	0.025	0.78	Economic openness index
1.99	0.121	0.12	Error correction term

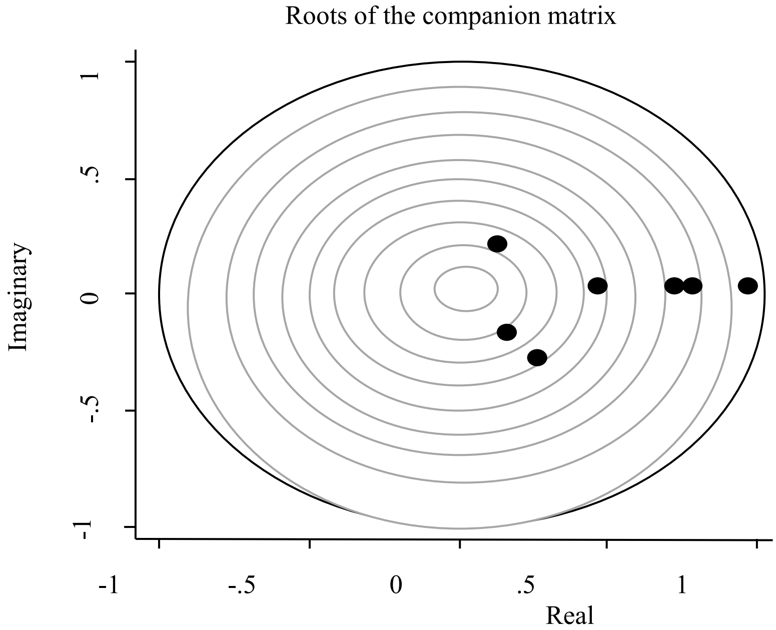
Dependent Variable: Monetary Base Growth; *Sample Period: 2016–2022*; *Years Examined: 6*; *Country: Iranian Banks;* R^2 = 0.88

As can be seen in the table, all the variables under study are significant. The error correction coefficient is negative, significant, and equal to -0.12, which indicates that in case of a shock and deviation from equilibrium, 0.12 of the short-term disequilibrium is corrected in each period to achieve long-term equilibrium. In other words, each year, 12 percent of the disequilibrium in the dependent variable is adjusted in the following period; therefore, the adjustment toward equilibrium occurs relatively effectively. The R^2 coefficient equals 0.88, indicating the high explanatory power of the model.

To examine the stability condition and based on the view of Abrigo and Love (2015), it is necessary, before estimating the shock response, to test the panel VAR stability condition. Figure (1) presents the results of the stability test of the model. As can be observed, all points are located within the circle; therefore, the stability condition for the model holds.

Figure 1.

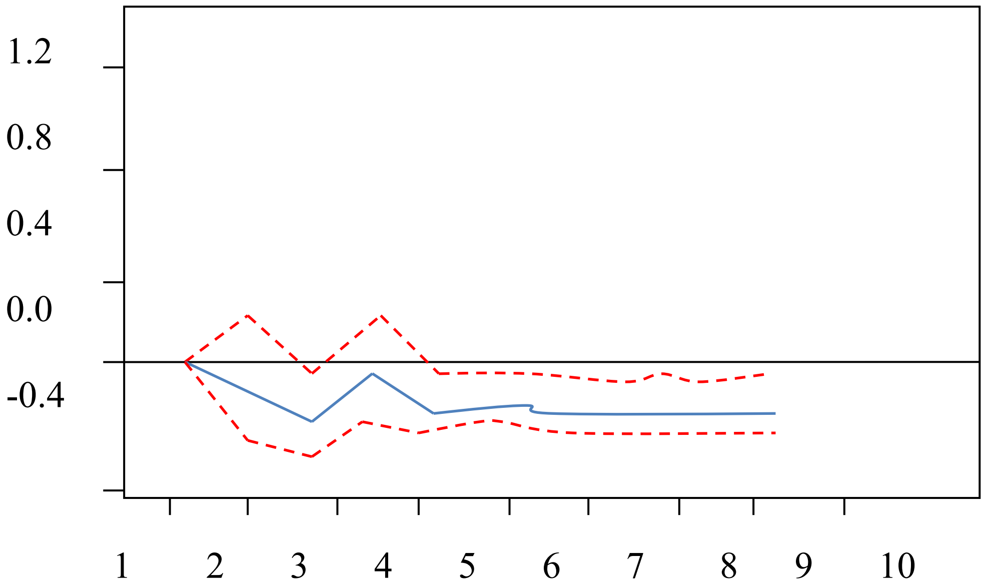
Results of the Stability Test of the Model



Impulse Response Functions (IRFs) illustrate the dynamic behavior of the model's variables when a one-unit shock is applied to each of the variables over time. These impulses (shocks) are usually set equal to one standard deviation and are referred to as unit shocks or impulses. Based on the figures presented below, the response of monetary base growth to a one-standard-deviation impulse in government expenditures, output gap, consumer price index, real exchange rate, economic growth rate, capital stock growth rate, and economic openness index is demonstrated.

Figure 2.

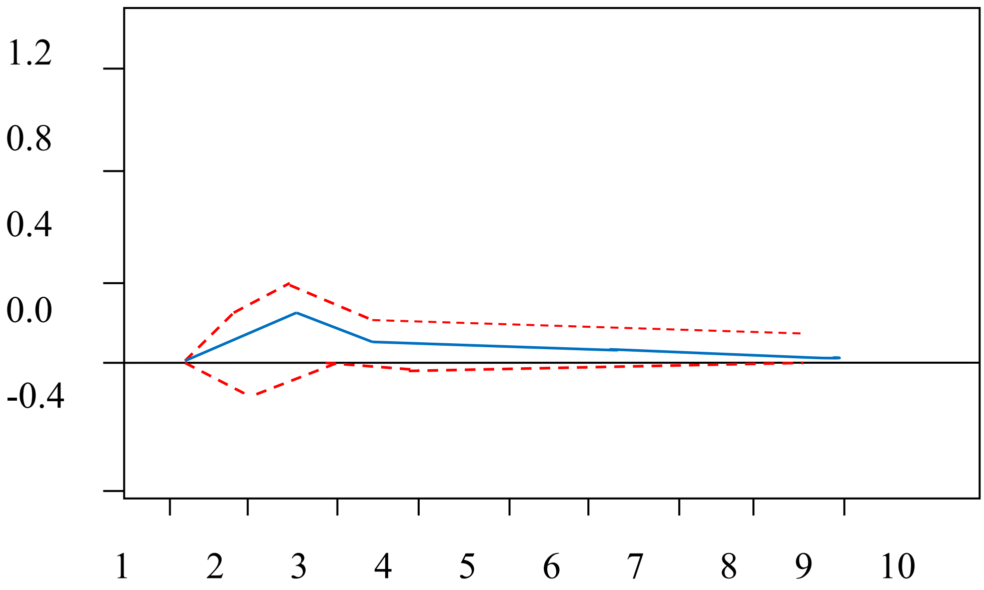
Impulse Response of Monetary Base Growth to Output Gap



According to Figure 2, if a one-standard-deviation impulse or sudden change occurs in the output gap variable, its effect on monetary base growth increases sharply up to period two, then suddenly decreases until period three, rises steeply again until period four, suddenly decreases by period five, and then stabilizes.

Figure 3.

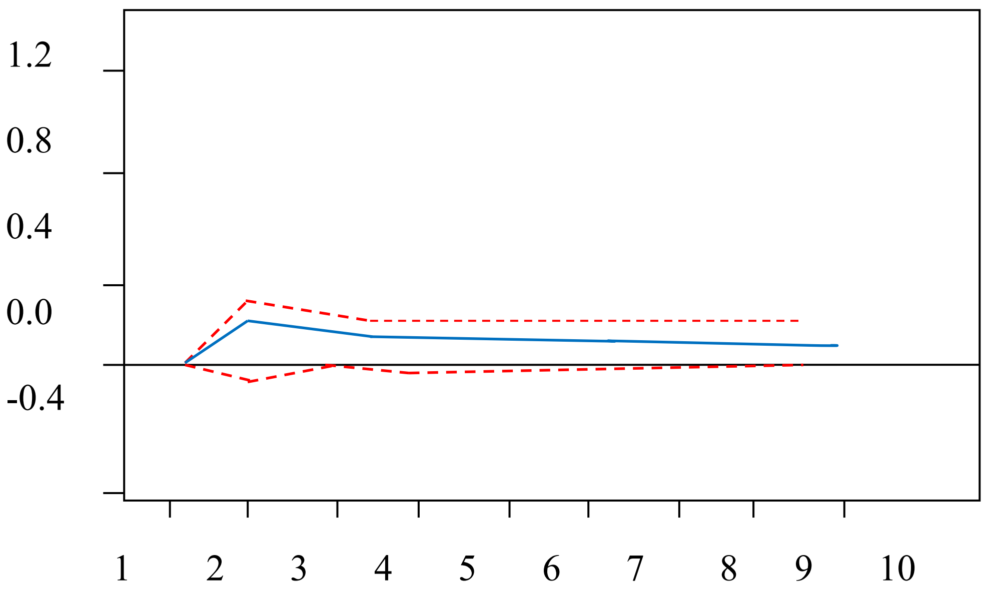
Impulse Response of Monetary Base Growth to Economic Growth



According to Figure 3, if a one-standard-deviation impulse or sudden change occurs in the economic growth variable, its effect on monetary base growth increases moderately until period two, then sharply decreases until period three, and subsequently stabilizes.

Figure 4.

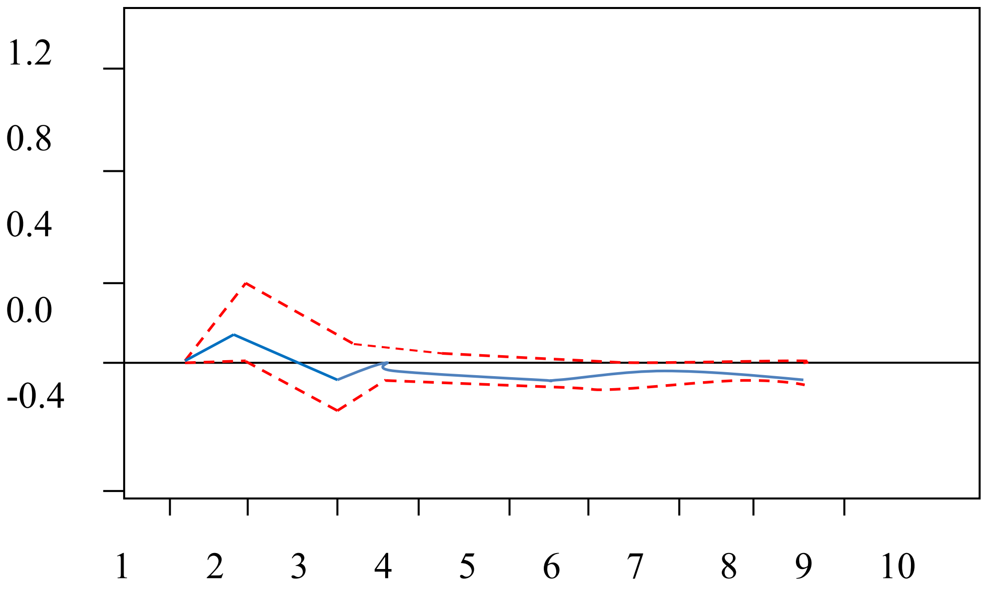
Impulse Response of Monetary Base Growth to Capital Stock Growth



According to Figure 4, if a one-standard-deviation impulse or sudden change occurs in the capital stock growth variable, its effect on monetary base growth increases sharply until period two, then decreases moderately until period three, and subsequently stabilizes.

Figure 5.

Impulse Response of Monetary Base Growth to Economic Openness



According to Figure 5, if a one-standard-deviation impulse or sudden change occurs in the economic openness variable, its effect on monetary base growth increases sharply until period two, then suddenly decreases until period three, increases moderately thereafter, and finally stabilizes.

The significance tests of the error correction coefficients and lagged variables, which were conducted based on the estimation of the error correction model, are interpreted as in-sample causality tests. These tests only identify the exogeneity or endogeneity of the dependent variable in the Granger sense within the sample but do not provide information regarding the dynamics of the model. The variance decomposition method (VDCS) analyzes the dynamic mutual effects of shocks generated in the model. Variance decomposition shows what percentage of the fluctuations in the dependent variable can be explained by the fluctuations of each of the endogenous explanatory variables. Variance decomposition measures the degree of exogeneity of the variables. By using variance decomposition, the share of shocks to different model variables in the forecast error variance of a variable in both the short term and long term is determined. Through this method, the contribution of each variable to changes in other variables over time can be measured.

Table 10.

Variance Decomposition of Monetary Base Growth in Relation to Research Variables in Iranian Banks

Economic growth rate	Economic openness	Real exchange rate	Consumer price index	Capital stock growth rate	Government expenditure growth	Output gap	Monetary policy shock	Monetary base growth	Period
0.000000	0.00000	0.00000	0.00000	0.000000	0.00000	0.000000	100.000	0.979977	1
0.007877	2.560094	1.202582	0.61137	0.013967	1.227921	0.620353	93.75584	1.017598	2
0.638965	2.934722	1.1740485	2.549637	3.632889	1.678961	3.461744	83.36260	1.099330	3
0.776764	2.941327	2.132104	2.974651	5.627183	1.601481	3.675970	80.27052	1.125624	4
1.954284	2.936243	2.754110	3.095655	7.062528	1.521956	4.946761	75.72846	1.164022	5
2.357217	2.856055	3.177934	3.288883	7.839306	1.468512	6.060857	72.98454	1.189997	6
2.954980	2.841758	3.630768	3.362142	8.242593	1.461539	7.373138	70.13308	1.219998	7

3.381573	2.818800	4.063823	3.443617	8.363864	1.465233	8.484564	67.97853	1.244594	8
3.859820	2.809507	4.521280	3.490236	8.329409	1.490260	9.604038	65.89545	1.270035	9
4.252891	2.793197	4.978657	3.520883	8.214024	1.518598	10.62298	64.09877	1.293475	10

In the first period, 100 percent of the changes in monetary base growth are explained by monetary policy shocks, and 0.9 percent of the changes are explained by gross domestic product.

In the second period, 93 percent of the changes are explained by monetary policy shocks, 2 percent by economic openness, 1 percent by physical capital per capita, 1 percent by the real exchange rate, 1 percent by monetary base growth, and the remaining variables contribute less than 1 percent.

In the third period, 83 percent of the changes are explained by monetary policy shocks, 3 percent by the output gap, 3 percent by capital stock growth, 2 percent by the consumer price index, 2 percent by economic openness, 1 percent by monetary base growth, 1 percent by government expenditure growth, and less than 1 percent by the economic growth rate.

In the fourth period, 80 percent of the changes are explained by monetary policy shocks, 3 percent by the output gap, 5 percent by capital stock, 2 percent by the consumer price index, 2 percent by economic openness, 1 percent by government expenditure growth, 2 percent by the real exchange rate, and 1 percent by monetary base growth.

In the fifth period, 75 percent of the changes are explained by monetary policy shocks, 4 percent by the output gap, 7 percent by capital stock growth, 3 percent by the consumer price index, 2 percent by economic openness, 1 percent by monetary base growth per capita, 2 percent by the real exchange rate, and 1 percent by government expenditure growth.

In the sixth period, 72 percent of the changes are explained by monetary policy shocks, 6 percent by the output gap, 7 percent by capital stock growth, 3 percent by the consumer price index, 2 percent by economic openness, 1 percent by monetary base growth, 3 percent by the real exchange rate, and 2 percent by the economic growth rate.

In the seventh period, 70 percent of the changes are explained by monetary policy shocks, 7 percent by the output gap, 8 percent by capital stock growth, 3 percent by the consumer price index, 2 percent by economic openness, 1 percent by monetary base growth, 3 percent by the real exchange rate, and 2 percent by the economic growth rate.

In the eighth period, 67 percent of the changes are explained by monetary policy shocks, 8 percent by the output gap, 8 percent by capital stock growth, 3 percent by the consumer price index, 2 percent by economic openness, 1 percent by monetary base growth, 4 percent by the real exchange rate, and 3 percent by the economic growth rate.

In the ninth period, 65 percent of the changes are explained by monetary policy shocks, 9 percent by the output gap, 8 percent by capital stock growth, 3 percent by the consumer price index, 2 percent by economic openness, 1 percent by monetary base growth, 4 percent by the real exchange rate, and 3 percent by the economic growth rate.

In the tenth period, 64 percent of the changes are explained by monetary policy shocks, 10 percent by the output gap, 8 percent by capital stock growth, 3 percent by the consumer price index, 2 percent by economic openness, 1 percent by monetary base growth, 4 percent by the real exchange rate, and 4 percent by the economic growth rate.

Discussion and Conclusion

The results of this study revealed that loans and credits in the Iranian banking system serve as critical channels in the transmission mechanism of monetary policy, exerting significant influence on macroeconomic variables such as output gap, capital accumulation, inflation, and exchange rate dynamics. The findings highlight that bank-related variables not only respond directly to monetary shocks but also mediate the intensity and persistence of policy impacts on the broader economy. This aligns with the theoretical and empirical evidence in both domestic and international literature, where the interaction between the banking system and monetary policy determines the success or failure of stabilization efforts.

Our results demonstrated that fluctuations in bank credit and loan allocation amplify or dampen monetary impulses depending on the health of banks' balance sheets. This is consistent with studies emphasizing the role of the banking sector in monetary transmission, where profitability, asset quality, and credit distribution condition the responsiveness of macroeconomic aggregates [6, 7, 21]. Specifically, when bank profitability and credit quality are high, monetary policy is more effective in influencing real-sector outcomes. However, when credit risk is elevated, the transmission becomes weaker, echoing findings from Tanzania and Nigeria, where credit risk management practices and asset quality proved to be decisive in shaping banks' resilience [12, 13].

Another critical insight from the results is the strong explanatory power of monetary shocks, especially in the early periods of variance decomposition, where policy shocks explained the majority of fluctuations in monetary base growth. Over time, however, the contribution of other macroeconomic variables—such as the output gap, capital stock growth, and exchange rate—became increasingly significant. This pattern is in line with studies on nonlinear and dynamic responses of economies to monetary impulses, particularly in contexts like Iran where asymmetric responses emerge due to structural rigidities and sanctions [2, 9, 15]. Such findings support the view that while monetary policy can dominate short-term dynamics, long-term stabilization requires the interaction of fiscal policies, structural reforms, and banking sector resilience.

Impulse response analysis further confirmed that monetary base growth responds dynamically to shocks in government expenditure, output gap, consumer price index, real exchange rate, and openness of the economy. For example, output gap shocks initially amplified monetary base growth but eventually stabilized, a pattern consistent with Christou et al.'s evidence of nonlinear Taylor-rule reactions in emerging markets [1]. The finding that capital stock growth significantly contributes to monetary fluctuations in medium-term horizons resonates with broader macroeconomic modeling approaches, which underscore the dual role of investment cycles in amplifying and stabilizing policy effects [10].

In addition, the results highlight the centrality of central bank credibility and independence in shaping policy effectiveness. Our evidence that monetary shocks retain significant explanatory power in early periods suggests the dominance of discretionary interventions rather than stable rule-based approaches. This is consistent with findings that highlight how weak central bank independence undermines inflation targeting and policy credibility [4, 5]. In Iran, where political influence over monetary institutions is strong, such dynamics are especially evident. Sharifnia's analysis of monetary policy pathologies in the Iranian banking system similarly emphasized inefficiencies in policy formulation and allocation, pointing to structural flaws that reduce the predictability of policy outcomes [11].

Comparisons with international evidence confirm that the Iranian case shares both similarities and divergences. For instance, while the explanatory dominance of monetary shocks in the short run mirrors evidence from Nigeria and Indonesia [6, 14], the persistence of structural constraints in Iran resembles patterns observed in economies with politicized banking systems [8, 21]. Furthermore, the increasing explanatory share of capital and output variables over time reflects findings in DSGE modeling frameworks, where long-term equilibrium paths are determined more by structural and supply-side variables than by monetary factors [10].

The results also confirmed the relevance of financial innovations and external challenges. Fintech-driven transformations, though not directly measured in this study, have been shown in other contexts to alter the risk profile and efficiency of banking systems [18, 19]. The Iranian system, still in early stages of fintech integration, may see similar dynamics in future, where fintech reshapes credit allocation and modifies how monetary impulses are transmitted. Moreover, ESG factors, though absent from the Iranian policy discourse, have been shown to increasingly influence banks' credit frameworks elsewhere [17]. This suggests that global trends in sustainability integration will eventually intersect with Iran's banking-monetary nexus, further complicating transmission channels.

From a theoretical perspective, the results underline the hybrid nature of Iran's monetary policy. While traditional frameworks such as the Taylor rule rely on interest rates, Iran's Islamic banking system replaces these with monetary base growth as the operational target [1, 22]. Our findings support the adaptation of such frameworks, showing that base money reacts dynamically to shocks in both domestic and external variables. This validates earlier Iranian studies that proposed the monetary base as a viable policy instrument under non-interest-based systems [3, 23].

Overall, the findings emphasize that monetary policy effectiveness in Iran depends not only on the design of instruments but also on the health of the banking sector, the quality of credit risk management, the independence of monetary authorities, and structural reforms. They also show that while policy shocks are dominant in the short run, long-term stabilization is contingent on structural variables such as capital accumulation, fiscal discipline, and exchange rate management. This multi-dimensional view aligns with comparative evidence from diverse contexts—Indonesia, Iraq, Nigeria, and Tanzania—while highlighting Iran's unique constraints under sanctions and institutional fragility.

This study faced several limitations. First, the dataset was restricted to quarterly financial and macroeconomic data from a subset of Iranian banks, which limits the generalizability of findings across the entire banking system. Second, while the Bayesian VAR model captures dynamic interactions effectively, it may not fully account for nonlinearities or structural breaks inherent in Iran's sanction-driven economy. Third, external global shocks, such as oil price volatility or international political developments, were not explicitly modeled, even though they exert substantial influence on Iran's monetary and banking systems. Finally, the absence of micro-level data on credit allocation and risk management practices limited the ability to directly link bank-level behaviors to macroeconomic outcomes.

Future research should expand the dataset to include a larger sample of banks, encompassing both private and state-owned institutions, to provide more comprehensive insights. Methodologically, applying nonlinear and structural break models could better capture the complexities of Iran's economy. Comparative cross-country studies with other sanction-affected or non-interest-based banking systems would provide valuable benchmarks. Additionally, future studies should examine the role of fintech innovations and ESG integration in shaping monetary transmission, as these emerging trends are likely to redefine the policy-banking nexus. Finally, integrating global variables such as oil prices, geopolitical risks, and trade flows could help capture the external dimension of monetary effectiveness more robustly.

For policymakers, the results emphasize the need to strengthen credit risk management practices within banks to ensure effective transmission of monetary policy. Enhancing the independence and credibility of the central bank is also crucial for reducing inflationary pressures and increasing the predictability of monetary interventions. Policymakers should focus on structural reforms, including reducing government dominance in banking and aligning fiscal and monetary policies to avoid counterproductive outcomes. Banks themselves should invest in modern risk management tools, including fintech applications, while preparing for eventual integration of ESG standards. Such reforms and practices would not only improve the effectiveness of monetary policy in Iran but also enhance financial stability and resilience in the face of domestic and external shocks.

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Authors' Contributions

All authors equally contributed to this study.

Declaration of Interest

The authors of this article declared no conflict of interest.

Ethical Considerations

The study protocol adhered to the principles outlined in the Helsinki Declaration, which provides guidelines for ethical research involving human participants. Written consent was obtained from all participants in the study.

Transparency of Data

In accordance with the principles of transparency and open research, we declare that all data and materials used in this study are available upon request.

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