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The Channels of Monetary Shocks' Effects on Income Inequality in Iran: A TVP-FAVAR Model Approach

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Highlights

- This study examines the effectiveness of monetary shock transmission channels on income inequality in the Iranian economy.
- The TVP-FAVAR model is employed to identify the effects of monetary shock transmission channels.
- It provides a realistic approach to understanding how monetary shocks affect income inequality (Gini coefficient)in the Iranian economy.

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Abstract

Income inequality is one of the structural challenges of Iran's economy, and in recent decades, it has been exacerbated by significant fluctuations in monetary, exchange rate, and asset markets. From a theoretical perspective, monetary policy can affect income distribution through three main channels: the labor market, asset market, and credit channel. However, the intensity and direction of these effects are not constant over time in developing economies, necessitating a model that can reveal the dynamics of these changes. Therefore, the objective of this study is to investigate the mechanisms and magnitude of the transmission of monetary shocks on income inequality in Iran during the period from March 1991-February 2025. The study employs the TVP-FAVAR model to enable the estimation of time-varying effects of monetary shocks, accounting for the large number of variables involved. The results indicate that the impact of monetary policies on income inequality in Iran is characterized by asymmetric features, time-dependence, and reliance on specific monetary transmission channels. Among the channels examined, the credit channel, particularly through liquidity growth and exchange rate fluctuations, plays a significant role in exacerbating inequality and generates persistent short-term responses. Additionally, the asset market channel is associated with an increase in the Gini coefficient and the expansion of income inequality, although its impact is relatively smaller than that of the credit channel. In contrast, the labor market channel has the least effect on income distribution, only causing minor and temporary deviations in the pattern of income inequality.

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1. Introduction

Income inequality, defined as the unequal distribution of income among individuals in society, has become one of the central issues and a significant challenge in contemporary economic literature in recent decades. This phenomenon is commonly measured by indices such as the Gini coefficient and stems from a range of macroeconomic factors (Korobilis, 2013). Fluctuations in the Gini coefficient reflect household income responses to changes in monetary policies and economic conditions (Furceri et al., 2018). One of the most influential factors in this regard is monetary policy shocks, particularly unexpected changes in central bank decisions, such as adjustments in money supply or interest rates, which can alter macroeconomic dynamics through various channels (Dhital et al., 2023). Monetary shocks affect income distribution through channels such as the labor market, asset prices, and access to credit, and depending on their nature and intensity, they may either increase or decrease income inequality. Recent empirical findings suggest that the effects of these shocks are asymmetric and vary over time (Liu et al., 2019). For example, contractionary monetary policies typically increase inequality by reducing employment and exerting downward pressure on wages, particularly affecting low-income groups. On the other hand, expansionary policies can have different, sometimes opposing effects on income distribution depending on the economic conditions (Xiang et al., 2023; Mumtaz & Theophilopoulou, 2023).

In recent decades, monetary policy shocks have been one of the key factors shaping macroeconomic developments in Iran. These developments have occurred against the backdrop of a set of persistent structural challenges, including chronic inflation, exchange rate fluctuations, and constraints resulting from external sanctions. Expansionary monetary policies, primarily implemented through liquidity injections by the Central Bank of Iran to stimulate economic growth, have often led to increased inflationary pressures in practice (Pahlavani et al., 2021). As a result, these policies have ultimately reduced the purchasing power of low-income deciles, exacerbating income inequality (Abdi et al., 2024). Empirical evidence derived from Iranian economic data suggests that shocks from liquidity growth initially lead to a temporary reduction in income inequality; however, from the third period onward, their effects reverse, leading to increased inequality (Mehrgan et al., 2025). In contrast, positive exchange rate shocks have consistently and sustainably increased income inequality across all periods, reflecting the higher vulnerability of low-income groups to exchange rate instability.

In the Iranian economy, income inequality, as a structural phenomenon, has become more complex, particularly in recent decades. Empirical evidence based on the Gini coefficient, one of the most reliable indicators for measuring the unequal distribution of household income, shows that this index has increased from 0.37 in 2011 to approximately 0.42 in 2020, indicating a deepening income gap between various social and economic groups (Fakhrhosseini, 2024). In this context, monetary policies, particularly through liquidity and inflation channels,

play a decisive role in shaping the income distribution pattern. Changes in money supply and the general price level, through weakening household purchasing power, disproportionately affect lower-income deciles, exacerbating inequality (Furceri et al., 2018). Although monetary shocks can, in the short term, stimulate effective demand, contributing to economic growth and employment improvement, in the long term, they leave nonlinear and asymmetric effects on income distribution through inflationary pressures. Rising inflation and fluctuations in asset prices such as housing, stocks, and gold primarily benefit high-income groups, while low-income groups, due to their higher dependency on essential goods and limited access to assets, bear the greatest burden. This ultimately reflects in the increase of the Gini coefficient and the intensification of income inequality(Alves & Silva, 2021).

Although previous studies, such as those by Xiang et al. (2023) and Mumtaz & Theophilopoulou (2020), have explored the distributional effects of monetary policy, significant gaps remain in analyzing the temporal dynamics of monetary policy shocks and the transmission channels through asset markets (stocks, gold, coins, and housing) in the Iranian economy. Additionally, structural economic breaks lead to changes in the functioning and mechanisms of these transmission channels. This study employs the Time-Varying Parameter Factor-Augmented Vector Autoregressive (TVP-FAVAR) model. The key feature of the TVP-FAVAR model, compared to traditional VAR models, is its ability to extract common factors from a wide range of variables and provide time-varying impulse response functions of these variables .Therefore, this approach offers a suitable tool for providing dynamic and precise analyses of the asymmetric and time-varying effects of monetary policies on the Gini coefficient and income inequality in the Iranian economy.

The importance of this study arises from the fact that, in recent decades, Iran's economy has faced chronic inflation, external shocks, and increasing income inequality. The adoption of evidence-based monetary policies to control these trends has become an imperative. Persistent income inequality can have negative consequences for social stability, public trust, and the sustainability of economic growth. Therefore, identifying and analyzing the transmission mechanisms of monetary policy plays a crucial role in designing effective and equity-oriented policies (Nasr Esfahani et al., 2025). The objective of this study is to analyze the effects of monetary shocks through transmission channels, including the labor market (unemployment and wages, inflation rate), asset markets (stocks, gold, real estate), and the credit channel (liquidity growth and exchange rates) on gini and income inequality in Iran. Furthermore, this research evaluates the time-varying effects of monetary shocks on income inequality within the framework of the TVP-FAVAR model, examining the dynamics of responses and variance decompositions using the Gini index, thereby providing an analytical framework to achieve sustainable growth and a more equitable income distribution in Iran's economy.

2. Literature Review

Monetary policies, as key instruments in macroeconomics, have significant effects on income distribution and social inequality (Jorda et al., 2020; Mumtaz & Theophilopoulou, 2017). These policies impact income inequality through multiple channels, including asset markets, the labor market, and the credit channel (Fratto et al., 2022; Xiang et al., 2023). First, the income composition channel suggests that low-income households derive a substantial portion of their income from transfer payments (such as government subsidies, unemployment benefits, pensions, or other public assistance programs). Expansionary monetary policies can reduce inequality by increasing these payments (Creel & Herradi, 2024 ; Chen et al., 2022; Mumtaz & Theophilopoulou, 2020). However, the role of fiscal policies in determining the volume of these payments is crucial. In economies like Iran, an increase in transfer payments often leads to a widening budget deficit. In the absence of efficient financing tools, monetization of the deficit and rising inflation can create adverse distributional effects, exacerbating income inequality. This highlights the need for precise coordination between monetary and fiscal policies. Second, the wage disparity channel emphasizes the role of expansionary monetary policies in reducing unemployment rates, as low-income households are more sensitive to employment changes, and this reduction can mitigate inequality (Liosi & Spyrou, 2022). Third, heterogeneous agent models highlight the impact of monetary policies on inequality through changes in asset prices and interest rates, where a decrease in interest rates disproportionately benefits wealthier households, potentially exacerbating inequality (Bartscher et al., 2022). Finally, Schumpeterian monetary growth models suggest that expansionary monetary policies, by stimulating innovation and economic growth, can create more opportunities for low-income groups, thus reducing inequality (Çerçil and Aksaray, 2025; Huang et al., 2023). On the other hand, contractionary monetary policies, by restricting access to credit and increasing unemployment rates, can exacerbate income gaps and have adverse distributional effects on low-income groups (Sen & Sensarma, 2025). However, the effects of these policies may vary across countries and depend on the economic structure, income distribution, and market characteristics of each country (Drossidis, 2024).

In this context, the Gini coefficient, as the most important indicator of income inequality, serves as a fundamental tool for evaluating the effects of monetary policies on income distribution (Pahlavani et al., 2021). Changes in this index reflect household income responses to fluctuations in monetary policies and macroeconomic conditions, particularly in countries with economies dependent on oil revenues, where the impact of monetary shocks is quickly reflected in income distribution through changes in inflation, employment, and asset prices. Moreover, due to its high sensitivity to changes in the income levels of lower-income deciles, the Gini coefficient is an efficient indicator for assessing economic fairness in the face of macroeconomic policies (Atkinson & Bourguignon, 2014). Additionally, the dynamics of the Gini coefficient can reflect

the indirect transmission of monetary policy effects through changes in asset values and the labor market (Topuz, 2022).

In Iran's economy, monetary policies face numerous challenges that affect their effectiveness in reducing inequality. Economic sanctions, exchange rate fluctuations, chronic inflation, and liquidity growth are among the factors that influence the impact of monetary policies on income inequality (Fakhrhosseini, 2024; Barkhordari & Foroughifar, 2020). Accordingly, monetary shocks in Iran can affect income distribution and its inequality through various channels, such as asset markets, the labor market, and the credit channel (Alahverdi et al., 2025). For instance, positive exchange rate shocks can exacerbate inequality by increasing asset prices and reducing the purchasing power of low-income groups (Alves & Silva, 2021). Likewise, an increase in interest rates can raise inequality by limiting access to credit and increasing unemployment (Maghsoudi et al., 2023).These specific and complex economic conditions in Iran necessitate the precise alignment of monetary policies with the country's economic circumstances. Therefore, the design of these policies should specifically aim to optimize their effects on income distribution and reduce income inequality.

In this section, the literature review examines both domestic and international studies related to the research domain and its methodology. The purpose of presenting this review is to clarify the trajectory of previous research and to identify the existing gaps within the body of literature.

Table 1. Literature Review of Domestic and International Studies

Authors	Research Topic	Results Background
Farzanegan & Habibpour (2017)	Resource rent distribution, income inequality, and poverty in Iran	This study shows that the unequal distribution of income from natural resources leads to increased income inequality and poverty depth in the country.
Furceri et al. (2018)	Effects of monetary policy shocks on income inequality	The results indicate that expansionary monetary policies have complex and varying effects on income inequality. In the short term, inequality may rise, but the long-term effects are diverse.
Mumtaz & Theofilopoulos (2020)	Monetary policies and wealth inequality	This paper analyzes the impact of expansionary and contractionary monetary policies on income inequality using macro-financial models. The findings show that monetary policies can alter income inequality through labor and asset market channels.
Jorda et al. (2020)	Effects of monetary policies on income inequality	This study examines the asymmetric effects of monetary shocks on income distribution using a structural model. The results show that expansionary monetary policies can temporarily reduce income inequality, but in the long term, these effects reverse due to asset price increases, exacerbating inequality.
Alves & Silva (2021)	Empirical evaluation of monetary policy	The results indicate that monetary policies, through asset price increases and labor market effects, raise wealth and income inequality

	channels in income and wealth inequality	across different classes. Moreover, the income composition channel and sensitivity of lower deciles to employment are less significant compared to the asset market channel.
Fratto et al. (2022)	Distributional effects of monetary policies	This paper analyzes the effects of monetary policies on income inequality through various transmission channels, including interest rates and asset markets. The results show that monetary shocks through changes in interest rates and asset prices can increase income inequality.
Maghsoudi et al. (2023)	Exchange rate gap, inflation asymmetry, and unemployment effects on income inequality in Iran	The results indicate that exchange rate shocks and inflation asymmetrically affect inequality, where increases in these variables exacerbate inequality. Additionally, the long-term effects of unemployment also increase inequality, while the impact of reduced unemployment on inequality is limited.
Xiang et al. (2023)	Effects of monetary shocks on income inequality using the TVP-FAVAR model	The results indicate that monetary shocks, particularly exchange rate and liquidity shocks, have asymmetric and time-varying effects on income inequality.
Fakhrhosseini (2024)	Examining the impact of economic growth on income distribution in Iran	The results show that economic growth is positively related to the Gini index (income inequality) and that factors such as government current expenditures, unemployment rate, bank loans, inflation rate, and various taxes play important roles in changing income inequality, where government spending and indirect taxes reduce inequality, while inflation and unemployment increase it.
Alahverdi et al. (2025)	Response of the financial condition index to macroeconomic shocks	The results indicate that the financial condition index reacts dynamically and differently to shocks in macroeconomic variables, with varying levels of impact over time and between variables.
Sen & Sensarma (2025)	The Effects of Monetary Policy on Income and Consumption Inequality	The findings indicate that contractionary monetary policy leads to a reduction in income inequality on the one hand, while on the other hand, it increases consumption inequality. Furthermore, restrictive monetary policies have heterogeneous effects on different income groups, such that some groups benefit from the implementation of these policies, while others are adversely affected.

Source: *Research findings*

In conclusion, this section of the literature review provides a detailed and analytical exploration of the theoretical and empirical foundations related to the

impact of monetary policies on income inequality. Initially, the key concepts of income inequality and monetary policies are fully explained, and various models of how these policies affect income distribution are examined. Subsequently, prior studies, both domestic and international, that have analyzed the effects of monetary shocks and related dynamics on income inequality are reviewed. These studies, particularly those using advanced methodologies such as the TVP-FAVAR model, shed light on the gaps and challenges in analyzing the asymmetric and time-varying effects of monetary policies. Finally, the review emphasizes that to gain a deeper understanding of the mechanisms through which monetary policies influence income inequality and to fill the existing gaps in previous studies, the use of more advanced and dynamic econometric models is essential. Specifically, models with time-varying parameters and multi-factor structures can better reveal the complex dynamics between macroeconomic variables and inequality indicators.

3. Methodology

In this study, to analyze the transmission mechanisms and channels through which monetary shocks affect income inequality in the Iranian economy during the period from March 1991-February 2025, an empirical approach based on the Time-Varying Parameter Factor-Augmented Vector Autoregressive (TVP-FAVAR) model is employed. The conceptual framework of this model is inspired by the research of Korobilis (2013). For this purpose, data related to key macroeconomic variables, including money supply, inflation rate, exchange rate (unofficial), Gini coefficient, unemployment rate, economic growth, and asset market price indices (including stocks, coins, gold, and housing), for the specified period were extracted from reliable domestic statistical sources such as the Central Bank of the Islamic Republic of Iran, the Statistical Center of Iran, the Tehran Stock Exchange, and the unions of gold and coins. Data processing involved statistical tests and model estimation using RStudio software. In the TVP-FAVAR model framework, the identification of monetary shocks is based on the recursive identification approach. To apply structural restrictions, the ordering of variables in the VAR block was determined such that real and slow-moving variables, including economic growth, unemployment rate, and Gini coefficient, are placed first, followed by nominal variables with slower responses, such as inflation. Next, the monetary policy tool, i.e., money supply growth, is placed as the main substitute for the monetary shock, and finally, fast-moving and financial variables such as exchange rate growth, stock index, and asset prices (including coins, gold, and housing) are included. This ordering is based on conventional assumptions in the FAVAR model literature and empirical evidence from developing economies, particularly studies related to the Iranian economy. The logic is that real variables and income distribution indicators do not show an immediate response to monetary policy shocks in the short term due to informational and adjustment lags, while monetary policy tools can instantly affect financial and exchange rate variables. However, the inverse effect of these variables on monetary policy in

the short term is assumed due to the relative exogeneity of monetary policy. Additionally, this study assumes that monetary shocks have an exogenous and independent effect on income inequality. This assumption is made to analytically focus on identifying and evaluating the direct effects of monetary policies on the Gini coefficient and income distribution. It is clear that, in real-world economic conditions, the central bank's response to macroeconomic shocks, including supply shocks, can affect income inequality through various channels. However, within the scope of this study, the primary focus is on examining the initial and direct effects of monetary shocks on income inequality, and the modeling of the central bank's endogenous responses to other shocks is excluded. This approach, given the specific characteristics of the Iranian economy and the complexity of monetary policy interactions, allows for a better separation of the net effects of monetary shocks on income distribution and provides a deeper understanding of the transmission mechanisms of monetary policy to income inequality.

In this research, the Time-Varying Parameter Factor-Augmented Vector Autoregressive (TVP-FAVAR) model is used for data analysis. This model was chosen due to its high capability in analyzing large and complex datasets, particularly in conditions where monetary shocks have a nonlinear and time-varying nature. The main feature of the TVP-FAVAR model, compared to classical models like VAR and FAVAR, is its ability to dynamically change parameters over time, allowing for a more accurate assessment of the effects of monetary shocks (Korobilis, 2013). Additionally, this model can decompose the dynamic effects of shocks and provide more sophisticated analyses by reducing the dimensionality of the data.The model is estimated within a Bayesian framework using the Gibbs sampler algorithm in the Monte Carlo Markov Chain (MCMC) method. The prior distributions were set according to the standard recommendations of Primiceri (2005) and Korobilis (2013). For the model coefficients, a normal distribution was used, and for the innovation covariance matrix, an Inverse-Wishart distribution was applied. This setup ensures precise control over the dynamics and time-varying changes of the parameters. The MCMC chain was run for 50000 iterations, with the first 10000 iterations discarded as the burn-in period and thinning applied every 10 iterations. A total of 4,000 valid samples were used to infer the posterior distribution and extract the results. In this framework, the model coefficients were calibrated using a normal distribution with a shrinkage factor of 4, and the innovation covariance matrix was calibrated using an Inverse-Wishart distribution with low degrees of freedom (0.01) to prevent unrealistic fluctuations and ensure the stability of the estimates. Convergence tests, including the Gelman–Rubin statistic ($\hat{R}$) of less than 1.05 and a minimum Effective Sample Size (ESS) of 600 for key parameters, indicated appropriate convergence of the chains and sufficient independence of the posterior samples.

Thus, this model is used as an efficient and innovative tool to examine the nonlinear and dynamic effects of monetary policy shock channels on income inequality in Iran. Subsequently, data processing includes the Augmented Dickey-

Fuller test for examining the stationarity of the variables, and logarithmic transformation is applied to price-related variables. The TVP-FAVAR model, which considers time-varying parameters and error variances, analyzes nonlinear relationships through time-varying impulse response analysis and variance decomposition. Therefore, this study employs the Time-Varying Parameter Factor-Augmented Vector Autoregressive (TVP-FAVAR) model, along with the developed approach for capturing the common connections among the research variables, to analyze and examine the channels through which monetary shocks affect income inequality in Iran. The standard approach for studying the effects of monetary shocks on the economy involves estimating a structural model based on several key variables. Models of this type typically have the following reduced form representation:

$$y_t = \beta_1 y_{t-1} + \cdots + \beta_n y_{t-n} + v_t \quad , \quad v_t \sim N(0, \Omega) \tag{1}$$

Where $y_t' = [z_t', r_t]$ and $z_t = (l \times 1)$ represents the research variables that reflect the economic conditions of Iran, while r_t is considered as the representative of the monetary policy tool (the central bank's control variable). The coefficient β_i for $\mathrm{i} = 1, \ldots, \mathrm{n}$ are $(l+1) \times (l+1)$ matrices of dimensions.

The TVP-FAVAR model is defined as follows, based on the research variables (with time t incorporated):

$$\mathrm{y_t} = \beta_{1\mathrm{t}} \mathrm{y_{t-1}} + \cdots + \beta_{\mathrm{nt}} \mathrm{y_{t-n}} + \mathrm{v_t} \quad , \quad \mathrm{v_t} \sim \mathrm{N}(0, \Omega) \tag{2}$$

Where $y_t' = [f_t', z_t', r_t]$ with f_t being a $1 \times K$ vector and $[z_t', r_t]$ still being a vector containing observed variables plus the monetary policy tool, with dimensions $1 \times (l+1)$. The coefficient matrix β_{jt} has dimensions $m \times m$ for $j = 1, \ldots, n$ and $t = 1, \ldots, T$. In this model, $m = k + l + 1$ indicating that the variables in the model are a combination of latent factors, observed macroeconomic variables, and monetary policy tools.

Each of the main observed variables x_{it} for $\mathrm{i} = 1, \ldots, \mathrm{n}$ is modeled through analytical regression with stochastic fluctuations of the research variables and monetary policy tools as follows:

$$x_{it} = \lambda_i^f f_t + \lambda_i^z z_t + \lambda_i^r r_t + u_{it} \tag{3}$$
$$u_{it} = \alpha_{i1} u_{it-1} + \cdots + \alpha_{in} u_{it-n} + \varepsilon_{it}$$

Where λ_i^f is a matrix of dimensions $n \times k$, λ_i^z is a matrix of dimensions $n \times l$ and λ_i^r is a matrix of dimensions $n \times 1$. To ensure that the errors in the model are uncorrelated, equation (3) is rewritten as follows:

$$x_t = \lambda^f f_t + \lambda^z z_t + \lambda^r r_t + \phi(l) x_t + \varepsilon_t \quad , \quad \varepsilon_t \sim N(0, H_t) \tag{4}$$

Where $\phi(l) = diag(\alpha^1(l), \ldots, \alpha^n(l))$ and $\alpha^i(l) = p_{i1} l + \cdots + p_{in} l^n$ and the logarithmic conditional variances of each variable evolve as a random process without trend. The core TVP-FAVAR model consists of equations (2) and (4), and to complete the model specifications, all parameters and their dynamics need to be described.

Equation (2) represents a VAR system for the latent factors and observable variables z_t and r_t, where the coefficients are allowed to float over time and are defined with conditional error variances. In the context of efficient parameter estimation for large covariance matrices, Primiceri (2005), Cogley & Sargent (2005), and Canova & Gambetti (2009) have used a decomposition for the covariance matrix of the model errors FAVAR as follows:

$$A_t \Omega A_t' = \sum_t \sum_t \quad (5)$$

Or equivalently:

$$\Omega_t = A_t^{-1} \sum_t \sum_t' (A_t'^{-1}) \quad (6)$$

Where $\sum_t = diag(\sigma_{1,t}, \dots, \sigma_{k+1,t})$ and A_t is a matrix with all diagonal elements equal to 1, and only the elements below the diagonal are non-zero, with all elements above the diagonal being zero.

$$A_t = \begin{bmatrix} 1 & 0 & \cdots & 0 \\ \alpha_{21,t} & 1 & \ddots & \vdots \\ \vdots & \ddots & \ddots & 0 \\ \alpha_{m1,t} & \cdots & \alpha_{m(m-1),t} & 1 \end{bmatrix} \quad (7)$$

By adding all parameters of equation (2) into the vectors below, the set of time-varying parameters follows a stepwise random process. For each period, innovations from the stepwise random process of parameter evolution are defined as a combination of two normal distributions, and all error parameters are independent from each other (Koop et al., 2013), as follows:

$$\begin{aligned} \mathrm{B}_t &= \mathrm{B}_{t-1} + J_t^{\mathrm{B}} \eta_t^{\mathrm{B}} \\ \theta_t &= \theta_{t-1} + J_t^{\theta} \eta_t^{\theta} \\ \log\sigma_t &= \log\sigma_{t-1} + J_t^{\sigma} \eta_t^{\sigma} \end{aligned} \quad (8)$$

Where $\eta_t \sim N(0, Q_t)$ are innovation vectors that are independent from each other and from v_t and u_t. Here, Q_t represents the covariance matrices of innovations corresponding to each of the parameter vectors. Thus, this unit framework facilitates the analysis of models with time-varying parameters that involve multiple variables.

3.1. Statistical Data and Descriptive Statistics

In this section, the data related to the key research variables from March 1991-February 2025 for variables such as money supply, inflation rate, exchange rate (unofficial), Gini coefficient, unemployment rate, economic growth, and asset market price indices (including stock market, gold, coins, and real estate) have been extracted from reliable domestic sources such as the Central Bank of the Islamic Republic of Iran, Iran Statistics Center, Tehran Stock Exchange, and Coin and Gold Unions, and processed accordingly. The correlation matrix presented shows the relationships between the research variables, as follows:

Table 2. Correlation Matrix of Research Variables

	GINI	INF	UNEMP	GROWTH	M2	EX	STOCK	COIN	GOLD	HOUSE
GINI	1	-0.32	0.26	0.44	-0.42	-0.38	-0.36	-0.30	-0.34	-0.37
INF	-0.32	1	-0.64	-0.29	0.57	0.55	0.61	0.41	0.50	0.52
UNEMP	0.26	-0.64	1	0.002	-0.67	-0.66	-0.68	-0.61	-0.66	-0.67
GROWTH	0.44	-0.29	0.002	1	-0.015	-0.017	0.035	0.012	0.026	0.024
M2	-0.42	0.57	-0.67	-0.015	1	0.95	0.97	0.90	0.97	0.98
EX	-0.38	0.55	-0.66	-0.017	0.95	1	0.98	0.95	0.98	0.96
STOCK	-0.36	0.61	-0.68	0.035	0.97	0.98	1	0.88	0.96	0.98
COIN	-0.30	0.39	-0.61	0.012	0.90	0.95	0.88	1	0.96	0.90
GOLD	-0.34	0.50	-0.66	0.026	0.97	0.98	0.96	0.96	1	0.97
HOUSE	-0.37	0.58	-0.67	0.024	0.98	0.96	0.98	0.90	0.97	1

Source: *Research findings*

The analysis of the correlation matrix table reveals significant relationships among the macroeconomic variables of Iran, enabling the interpretation of the interactive structures governing the country's economy. One notable finding is the negative correlation between the Gini coefficient (GINI) and inflation rate (INF), with a value of -0.32. This inverse relationship suggests that during periods of rising inflation, income inequality has relatively decreased, a phenomenon that may reflect the unique characteristics of Iran's economy, particularly under conditions of high inflation and the nominal redistributive effects on real incomes. Additionally, the negative correlation between the Gini coefficient and money supply (M2) at -0.42 indicates that an increase in liquidity in the short term may lead to a reduction in income inequality. However, in the long run, the inflationary consequences of money supply growth and the intensification of macroeconomic fluctuations could have the reverse effect, potentially leading to an increase in income inequality.

On the other hand, the high positive correlations between the exchange rate (EX) and stock market (STOCK) as well as the gold price (COIN), with coefficients of 0.97 and 0.95, respectively, demonstrate the central role of exchange rate fluctuations in determining the behavior of asset markets. These results suggest that an increase in the exchange rate is directly associated with growth and volatility in the stock market and other financial assets, which is consistent with the conditions of Iran's economy, particularly within the context of external constraints and currency shocks. Further results show the relationship between the unemployment rate (UNEMP) and variables such as liquidity (M2) and the exchange rate (EX), with correlation coefficients of -0.67 and -0.66, respectively. This indicates that monetary and exchange rate fluctuations have

adverse effects on the labor market. In other words, an increase in the unemployment rate typically coincides with restricted access to financial resources and heightened exchange rate instability, placing additional pressure on low-income groups and ultimately exacerbating inequality.

Additionally, the extremely high correlation between the stock market and liquidity (0.98) and exchange rate (0.97) highlights the sensitivity of financial markets to monetary policies and currency shocks. Finally, the strong correlation between housing prices (HOUSE) and liquidity (M2) with a coefficient of 0.98 clearly indicates that liquidity growth and macroeconomic instabilities have a direct impact on rising housing prices. This trend plays a significant role in exacerbating economic and social inequalities by increasing the cost of housing accessibility. Overall, the results from the correlation matrix underscore the complex and interdependent effects of monetary policies, exchange rate fluctuations, and macroeconomic conditions on income distribution and inequality in Iran's economy.

In this section, in order to examine the effect of monetary shocks on income inequality within the framework of the TVP-FAVAR model, the variables of money supply, stock market index, gold price, coin price, and housing price were transformed into their natural logarithms and then utilized as their respective logarithmic growth rates. Furthermore, to avoid spurious regression and ensure the validity of econometric inferences, non-stationary variables were converted to stationary form through appropriate differencing. This data preprocessing allows for the dynamic estimation of relationships among the variables and facilitates a more accurate analysis of income inequality's response to monetary shocks within the time-varying parameter factor model framework. Accordingly, a table of descriptive statistics, including mean, median, variance, standard deviation, skewness, and kurtosis, is provided for these transformed variables to elucidate their distribution and dispersion characteristics over the period March 1991-February 2025, prior to the estimation of the model.

Table 3. Descriptive Statistics of the Research Variables

Variable	Mean	Median	Variance	StdDev	Skewness	Kurtosis
GINI	0.002	0.001	0.0001	0.010	-1.77	5.74
INF	0.004	0.17	0.0088	0.093	-0.832	1.44
UNEMP	-0.12	-0.1	0.0143	0.019	0.162	3.97
GROWTH	0.032	0.031	0.0012	0.035	-0.746	0.70
M2	0.25	0.25	0.0029	0.054	-0.271	-0.51
EX	0.01	0.018	0.0727	0.269	-0.429	1.18
STOCK	0.27	0.23	0.1275	0.357	0.510	0.42
HOUSE	0.23	0.22	0.0450	0.212	0.771	0.19
COIN	0.001	0.006	0.1148	0.338	0.091	0.79
GOLD	0.02	0.007	0.1863	0.431	-0.488	2.46

Source: *Research findings*

Based on the results from the descriptive statistics table, the variables related to inequality and real macroeconomic variables exhibit relatively smoother and

more concentrated behavior compared to monetary and asset-related variables. The mean of the Gini coefficient is 0.002, with a standard deviation of 0.01, indicating that changes in the Gini coefficient have fluctuated around very small values close to zero. At the same time, a notable negative skewness (-1.77) and kurtosis of 5.74 suggest the presence of several relatively larger reductions in inequality compared to other years. Regarding inflation, with a mean of 0.004 and a standard deviation of 0.093, the negative skewness of -0.832 and kurtosis of 1.44 suggest that the distribution of inflation changes during this period has been slightly biased toward negative values, with relatively sharper declines than increases in certain years (e.g., 2001-2006 and 2014-2017). The unemployment variable, with a mean of -0.12 and a median of -0.1, along with positive skewness of 1.621 and kurtosis of 3.97, indicates a slight tendency toward a decrease, although significant upward shocks also occurred in some years. Additionally, the mean of the economic growth variable is 0.032, with a standard deviation of 0.035. The negative skewness of -0.746 and kurtosis of 0.70 suggests that during the period under review, relatively negative economic growth shocks (recessions) were somewhat more pronounced than positive shocks. However, overall, the distribution of growth changes around its mean was relatively symmetrical with no significant outliers.

In the monetary and asset markets section, the results from the table show much more volatile dynamics. The mean of the money supply variable is 0.25, with a standard deviation of 0.054, indicating a steady upward trend in the transformed money supply variable, accompanied by relatively limited fluctuations around this trend. The negative skewness of -0.271 and kurtosis of -0.51 suggest that the distribution of money supply changes is somewhat flatter than the normal distribution. In contrast, variables related to asset markets and the exchange rate show much more pronounced volatility. Specifically, the mean of the exchange rate, stock index, and housing prices are 0.01, 0.27, and 0.23, respectively, with standard deviations of 0.269, 0.357, and 0.212, indicating considerable fluctuations in these variables. The positive skewness of 0.510 for the stock index and 0.771 for housing prices suggests that in both the stock and housing markets, relatively larger changes (sharp increases) were observed more frequently. Meanwhile, the negative skewness for gold, along with kurtosis of 2.46, reflects significant shocks in the gold market during some years.

3.2. Model Estimation and Interpretation of Empirical Results

In this section, the effects of monetary shocks on income inequality through three channels—the labor market (unemployment, economic growth, inflation), asset markets (stock index, coin, gold, and housing), and credit (money supply, exchange rate)—are analyzed. Since studying the complex and dynamic relationships between economic variables requires precise analysis and proper visualization, impulse response graphs of the research variables to the Gini coefficient are initially presented. The purpose of these graphs is to analyze the response of different channels and markets to monetary shocks over time and their

effect on income inequality. Specifically, these graphs demonstrate how the Gini coefficient evolves over time in response to monetary shocks through various channels and latent factors.

To determine the lag length of the model, information criteria such as the Akaike Information Criterion (AIC), Bayesian-Schwarz Information Criterion (BIC), Hannan-Quinn Information Criterion (HQIC), and the Final Prediction Error (FPE) were used for lags 1 to 4. Considering the annual frequency of the series and the number of observations in the study, lag 1 was selected as the base lag length in the TVP-FAVAR framework to avoid parameter inflation. For robustness, the model was also re-estimated with lags 2 and 3. Residual diagnostics and stability tests indicate that lag 1 is appropriate for the current data, and qualitative results remain stable with respect to changes in the lag.

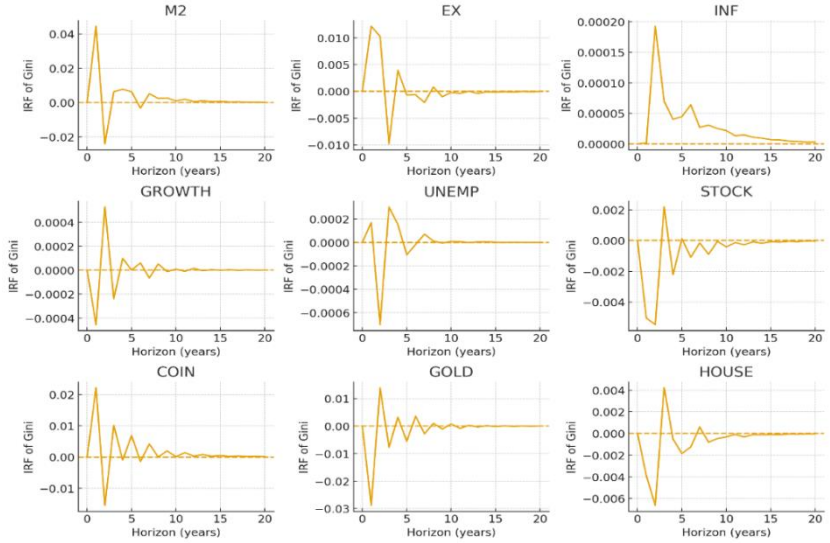

Figure1. Time-varying Impulse Response Functions (IRF) to Gini Coefficient
Source: *Research Findings*

The impulse response graphs illustrate how income inequality (Gini coefficient) reacts to shocks introduced by key monetary, real, and asset variables over different time horizons. As observed in the graphs, the effect of monetary shocks on income inequality differs in the short and long run. The results of the impulse response functions show that monetary shocks affect income inequality in Iran through three main channels: the labor market, asset markets, and the credit channel. In the credit channel, a positive shock to the growth of the money supply (M2) leads to a significant increase in inequality in the initial horizons due to the transfer effect on asset prices and inflation. This effect gradually diminishes over time. This behavior aligns with the structure of Iran's economy, where liquidity growth, driven by credit expansion, increases the general price level and asset

prices, benefiting higher-income households. Exchange rate (EX) shocks also generate a generally positive response in the Gini coefficient, which can be seen as a reflection of the transmission of exchange rate fluctuations on import costs, the price of tradable goods, and the reduced purchasing power of low-income households. Inflation (INF), which plays a role in both the credit and labor market channels, shows a positive effect on inequality in response to monetary shocks. This means that a sudden increase in the price level puts additional pressure on the consumption basket of low-income households in the short run, exacerbating income gaps, although this effect dissipates in the long run.

In the labor market channel, the response of inequality to both real and nominal shocks is consistent with the theoretical expectations from Iran's economy. A positive shock to economic growth (GROWTH) leads to a reduction in the Gini coefficient in the short run, after which it fluctuates around an equilibrium value. This pattern suggests that strengthening real activity and improving production conditions, through increased employment opportunities and improved income for workers, can somewhat contribute to better income distribution. Alongside this, changes in unemployment (UNEMP) and inflation, although with a limited scope, indicate that labor market conditions and price levels interact to affect the sensitivity of inequality to monetary shocks. In the asset market channel, shocks to the stock index, coin prices, gold, and housing prices lead to relatively small responses, and in some horizons, they show a tendency to increase inequality. This can be explained by the reality of Iran's economy, where a sudden increase in asset prices generally creates profit opportunities for households owning financial and real estate assets. As a result, it can deepen the income and wealth gap between higher and lower deciles.

Overall, comparing the impulse response patterns reveals that the intensity of the effect of monetary shocks on income inequality is not the same across the three main transmission channels. Credit shocks, particularly those stemming from money supply growth and exchange rate fluctuations, create the largest deviations in the Gini coefficient and have a more prominent impact in terms of size and persistence than the other channels. The asset market channel follows in importance, with shocks to asset prices (such as stock indices, coin, gold, and housing) having a somewhat smaller effect compared to liquidity and exchange rate shocks, but significantly increasing inequality in certain horizons. This is consistent with the asset-based structure of Iran's economy, where asset price jumps generally benefit wealthier households that own a larger share of financial and real estate assets and profit from capital returns. In contrast, the labor market channel shows a smaller effect compared to the other two channels, with responses to shocks related to unemployment and economic growth typically being small and short-term. This suggests that labor market conditions play a more limited role in transmitting the effects of monetary shocks on income inequality compared to the other channels.

This section analyzes the estimation of spillovers from the monetary shock channels on income inequality using the Time-Varying Parameter Factor-

Augmented Vector Autoregressive (TVP-FAVAR) model. In the first step, the average spillover results are presented to explain the relative role of the credit, asset market, and labor market channels as net transmitters of monetary shocks on the income inequality index (Gini coefficient). Subsequently, the investigation of the channel spillovers enables the identification of dynamic patterns of the impact and mutual influence between monetary shocks and income inequality, as well as the gradual evolution of these relationships within the context of the Iranian economy. In this regard, short-term (1 year), medium-term (5 years), and long-term (10 years) horizons are employed for the variance spillover analysis, so that the response of the Gini coefficient to monetary shocks over different time periods can be coherently examined, revealing the distributional dynamics of monetary policy with higher analytical precision.

Table 4. Spillover Effects of Monetary Shock Channels on the Gini Coefficient

Time Horizon (Year)	Credit Channel (%)	Asset Market Channel (%)	Labor Market Channel (%)	Contribution of Own Shocks to Gini (%)	Total (%)
1	41.8	30.5	17.2	10.5	100
5	38.4	32.1	19.8	9.7	100
10	35.6	33.9	21.4	9.1	100

Source: *Research Findings*

Table 4 illustrates the spillover effects and the role of monetary shock transmission channels in explaining fluctuations in the Gini coefficient across different time horizons. According to these results, in the short term, the credit channel, with a share of approximately 41%, is identified as the most significant route for the spillover of monetary shocks on income inequality. This aligns with the structural features of the Iranian economy, particularly the rapid transmission of money supply growth and exchange rate fluctuations to imported inflation, which weakens the purchasing power of lower-income deciles. Meanwhile, the asset market channel, with a share of 30%, ranks second, indicating the impact of rising asset prices, such as stocks, gold, coins, and housing, in intensifying capital gains for higher-income groups and deepening the gap between income deciles. The labor market channel, with a share of 17%, plays a more limited role.

In the medium-term (5 years) and long-term (10 years) horizons, although the share of the credit channel gradually decreases (to 38% and 35%, respectively), it remains the most significant channel through which monetary shocks affect income inequality. In contrast, the share of the asset market channel increases in the medium and long-term horizons, reaching about 33% in the long term. This may reflect the persistence of asset-driven effects of monetary policies in the Iranian economy. The labor market channel continues to have the smallest share, around 19% to 21%.Overall, based on the research findings, income inequality in Iran is primarily influenced by monetary shocks, especially through

the credit and asset market channels. This highlights the need for the adoption of a more equitable monetary policy, with a focus on controlling money supply growth and stabilizing the exchange rate.

4. Conclusion and Recommendations

This study aims to analyze the transmission mechanisms of monetary shocks and explain how they affect income inequality in Iran's economy during the period from March 1991-February 2025. To achieve this, the dynamic and multivariate TVP-FAVAR model framework was employed, which, in addition to reducing data dimensionality and extracting latent factors, allows for the examination of time-varying changes in the intensity and direction of shock effects. The selection of this approach is necessary given the structural characteristics of Iran's economy, including its significant dependence on monetary variables, wide exchange rate fluctuations, asset-driven market behaviors, and deep income disparities. In such an economy, static analysis cannot explain the dynamics of inequality, and analyzing the effects of monetary shocks can be reliably performed within the framework of a dynamic, time-varying, and multi-channel model.

The findings of this study show that monetary shocks in Iran's economy have asymmetric and time-varying effects on income inequality. Specifically, the credit channel, which includes money supply growth and exchange rate fluctuations, plays the most significant role in transmitting the effects of monetary policy on the Gini coefficient, leading to increased inequality in the short run. These results align with the realities of Iran's economy, as liquidity growth, primarily through rising asset prices and inflation, disproportionately benefits high-income households while negatively affecting low-income ones. Furthermore, the asset market channel (stock index, coins, gold, and housing) shows smaller but still increasing effects on inequality. In contrast, the labor market channel (unemployment and economic growth) exhibits limited and short-term effects. The overall pattern of impulse responses indicates that Iran's economy is heavily asset-driven, with monetary shocks affecting inequality more through asset prices and nominal variables than through employment and economic growth. This characteristic is consistent with the structure of Iran's economy, where asset markets, particularly during inflationary periods, experience sharp fluctuations.

Additionally, the findings of this study are consistent with the results from a series of domestic and international studies, emphasizing the meaningful relationship between monetary policies and income inequality in developing economies that are heavily dependent on macroeconomic fluctuations. The findings of Jorda et al. (2020), Fratto et al. (2022), and Mumtaz & Theophilopoulou (2020) show that expansionary monetary policies increase inequality by driving up asset prices and reducing interest rates, a phenomenon observed in Iran as well. Also, the findings related to the persistent and increasing effects of exchange rate shocks on inequality align with the results of Alves & Silva (2021), who highlight that exchange rate jumps disproportionately affect the

purchasing power of low-income groups, exacerbating income gaps. Furthermore, the results regarding the role of the labor market in transmitting the effects of monetary shocks (in comparison to the credit and asset market channels) are in line with the empirical evidence of Barkhordari and Foroughi Far (2020) and Sen & Sensarma (2025), who indicate that, due to structural inefficiencies, limited labor market flexibility, and high adjustment lags in developing economies, changes in employment and unemployment have limited capacity to control the distributional outcomes of monetary policy. Also, the observed short-term positive effect of economic growth on reducing inequality in the model's responses is consistent with the findings of Fakhrhosseini (2024), which emphasize that economic growth in Iran has a moderating effect, although this effect is limited and unstable.

Despite the use of the advanced TVP-FAVAR framework, which enables dynamic analysis of monetary shock transmission channels, this study still faces some limitations. First, due to limited access to micro-level household data (such as long time series on income deciles or detailed expenditure data), the Gini coefficient was used as a composite measure of inequality. While this is standard, it limits the ability to conduct a detailed analysis of the distributional effects of monetary shocks on specific income groups or occupational classes. Second, some of the variables employed in this study are available at an annual frequency(such as the Gini coefficient), while others are published on a quarterly or monthly basis. Therefore, in order to ensure frequency consistency across the dataset, all variables were converted to an annual frequency. Moreover, several core variables in the Iranian economy(most notably asset market indicators and the exchange rate)are influenced by structural shocks, international sanctions, as well as institutional and policy-driven factors. These influences may, in turn, affect the stability and time-varying behavior of the estimated parameters over the sample period. Furthermore, the following suggestions are made for future research:

1. Utilize household budget microdata to analyze income and wealth inequality at the decile level.
2. Investigate the role of fiscal and budgetary policies alongside monetary policy using SVAR or DSGE models.
3. Examine the impact of structural shocks such as economic uncertainty and political instability to assess the broader effects of external factors on income inequality.
4. Include variables such as wealth inequality indices, homeownership, digital financial indices, and access to credit (loans) to identify new channels of monetary shock transmission in the model.

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The authors declare no conflict of interest.

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