

Inflation Dynamics In Iran: A Time-Series Analysis

Arif Ullah¹, Rehmat Ali², Mukamil Shah³

¹ PhD Economics scholar, Institute of Management Sciences Peshawar, arifkhanafridi4425@gmail.com

² Assistant Professor Economics, Institute of Management Sciences Peshawar,
rehmat.ali@imsciences.edu.pk

³ Assistant Professor Economics, Institute of Management Sciences Peshawar,
mukamil.shah@imsciences.edu.pk

Abstract

Inflation poses a persistent and complex challenge for Iran, driven by structural inefficiencies, institutional weaknesses, and the compounded effects of international sanctions. This study examines the key macroeconomic determinants of inflation in Iran from 2001Q1 to 2023Q4 using the Autoregressive Distributed Lag (ARDL) approach. The analysis focuses on the role of real interest rates, money supply, GDP growth, fiscal deficits, and international sanctions in shaping inflationary trends. The findings reveal that higher real interest rates and robust GDP growth are associated with reduced inflationary pressures, highlighting their stabilizing effects. Conversely, fiscal deficits are found to exacerbate inflation, underscoring the inflationary consequences of unsustainable public finance. While the money supply shows a positive but weak influence on inflation, international sanctions do not exhibit a significant direct impact within the estimated model. These results underscore the importance of coordinated macroeconomic policies, emphasizing monetary prudence and fiscal discipline, to address inflation in geopolitically sensitive and structurally vulnerable economies like Iran.

Keywords: Inflation, ARDL, Real Interest Rate, Money Supply, Fiscal Deficit, Sanctions, Time-Series Analysis.

1. INTRODUCTION

Iran's economy has undergone profound political, social, and economic transformations shaped by its complex historical trajectory. A pivotal moment occurred with the 1953 coup, orchestrated by the United States and the United Kingdom, which reinstalled Shah Mohammad Reza Pahlavi and deepened foreign control over Iran's oil resources. This foreign dominance contributed to economic expansion but also widened income disparities, fueling the discontent that culminated in the 1979 Islamic Revolution. The revolution ushered in a new era marked by nationalization and redistributive economic policies. However, these shifts were accompanied by severe economic disruptions, including rising inflation—exceeding 20% by the mid-1980s—driven by declining productivity and chronic fiscal deficits (Kinzer, 2008). Iran's heavy reliance on oil revenues has historically made its economy vulnerable to global price fluctuations. The 1973 oil crisis highlighted this susceptibility, producing both economic booms and subsequent volatility (Karshenas, 1990). The Iran-Iraq War (1980–1988) exacerbated these challenges, as increased military spending and falling oil output led to fiscal deficits surpassing 50% of GDP and inflation reaching as high as 30%. In the decades that followed, a series of international sanctions—particularly those targeting the banking and energy sectors—significantly hindered Iran's economic growth. The years 2011–2013 were especially severe, marked by sharp declines in oil

exports, inflationary surges, and a dramatic depreciation of the Iranian rial, which lost over 80% of its value relative to the U.S. dollar. These dynamics contributed to rising living costs and heightened public discontent. While the 2015 Joint Comprehensive Plan of Action (JCPOA) offered temporary relief through partial sanctions removal, the United States' withdrawal from the agreement in 2018 reintroduced significant economic uncertainty (Katzman, 2013). Iran's inflationary trends are intricately linked to fiscal imbalances, expansionary monetary policies, global oil price shocks, and external economic pressures—including the 2008 global financial crisis. The interaction between money supply, exchange rates, and oil dependency forms a complex macroeconomic landscape, further destabilized by geopolitical tensions and sanctions (Amuzegar, 2004). Heightened geopolitical rivalry, particularly in the context of the Israel–Palestine conflict and Iran's regional alliances, has intensified Western scrutiny and sanctions. These developments have destabilized oil markets and disrupted vital supply chains, amplifying inflationary pressures and eroding living standards (Parsi, 2012). Despite the critical importance of understanding inflation dynamics in Iran, there remains a lack of comprehensive empirical studies that incorporate recent data and modern econometric methodologies to analyze both domestic and external determinants of inflation. This study aims to fill that gap by identifying the key macroeconomic drivers of inflation in Iran over the period 2001Q1 to 2023Q4, using the Autoregressive Distributed Lag (ARDL) model. By linking theoretical insights with empirical evidence, this research provides actionable guidance for policymakers seeking to address inflation while promoting macroeconomic stability and inclusive growth. Unlike much of the existing literature, which tends to focus on post-2018 external shocks, this study emphasizes the broader institutional, structural, and geopolitical context of inflation, offering a more nuanced understanding of Iran's economic challenges.

2. Literature Review

A substantial body of empirical literature has investigated the determinants of inflation in developing and oil-dependent economies, particularly Iran. These studies employ a range of econometric approaches—including ARDL, cointegration analysis, and error correction models—to examine the macroeconomic and structural drivers of inflation. Liu and Adedeji (2000) conducted a seminal study on the Islamic Republic of Iran, highlighting the long-run impact of money supply growth, oil output, and non-oil GDP on inflation. Their findings also revealed that foreign prices and post-war reconstruction were major short-term inflationary drivers. Similarly, Pahlavani et al. (2009) used the ARDL approach to analyze inflation between 1971 and 2006, identifying liquidity, exchange rates, and both expected and imported inflation as significant long- and short-run contributors. Several other studies reinforce the critical role of monetary and fiscal variables in Iran's inflation dynamics. Teimourizad et al. (2014) found that import prices and money supply exert significant upward pressure on inflation, while higher GDP levels have a dampening effect. Atrkar Roshan (2014), through causality and cointegration tests, identified a bidirectional relationship between money supply and price levels, underscoring a feedback loop in inflationary persistence. Khandan et al. (2016) emphasized that budget deficits, often monetized via bond financing, indirectly contribute to inflation through expanded money supply, reflecting deeper fiscal vulnerabilities. Hemmati et al. (2023) expanded this narrative by analyzing post-sanction inflation persistence, concluding that money supply growth, currency depreciation, and fiscal imbalances remain dominant inflationary forces in both the short and long run. Political and institutional dimensions have also received scholarly attention. Khani Hoolari et al. (2014) revealed that governance and political instability significantly amplify

inflation, suggesting that non-economic factors play a substantial role in Iran's inflationary processes. Research from other developing countries provides valuable comparative insights. In Bangladesh, Arif et al. (2012) used Johansen-Juselius cointegration and error correction modeling to demonstrate that government spending, money supply, and imports positively influence inflation, while revenue and exports exert a deflationary effect. Salma and Research (2021) found similar inflationary effects stemming from broad money supply and trade imbalances in post-crisis Bangladesh. Studies from India (Sahadudheen, 2012) and Malaysia (Hashim et al., 2014) affirm the relevance of monetary aggregates, exchange rates, and GDP growth as inflationary determinants. In India, GDP and money supply were positively associated with inflation, while interest and exchange rates had deflationary effects. In contrast, the Malaysian context highlighted the dominant roles of fiscal expenditure, money supply, and external trade variables. Mohammed et al. (2015), examining Algeria's inflationary experience using ARDL modeling, found that external variables such as oil prices, import costs, and exchange rate fluctuations dominated inflation dynamics, while internal policy levers had limited short-term impact. This theme was echoed by Monfared and Akin (2017), who showed that both exchange rates and monetary expansion drive inflation in Iran, with exchange rate volatility acting as a significant channel for external shocks. Ethiopia's experience, as explored by Kahssay (2017), demonstrated a strong link between inflation and GDP, highlighting the challenges of managing inflation amid growth-led development. In Pakistan, Ghumro et al. (2015) found that money supply, exchange rates, and national expenditure were all inflationary in the long run, while the error correction term revealed a high speed of adjustment toward equilibrium. Sadeghi and Tayebi (2018) provided one of the few empirical treatments of sanctions within an ARDL framework. Their findings revealed that international sanctions affect inflation primarily through exchange rate volatility and budgetary pressures, while oil revenues and taxation influence inflation indirectly. Overall, the literature suggests that inflation in Iran and comparable developing economies is multifactorial, driven by both domestic and external forces. Key inflationary drivers include money supply, exchange rate fluctuations, GDP growth, fiscal deficits, and in Iran's case, the institutional context and international sanctions. While monetary and fiscal policy tools remain central to inflation control, the effectiveness of these tools is often constrained by structural weaknesses, political instability, and external shocks. This study builds on these insights by employing an updated ARDL framework to examine Iran's inflation dynamics from 2001Q1 to 2023Q4, incorporating both economic and geopolitical determinants.

3. METHODOLOGY

This study employs a quantitative time-series econometric approach to investigate the key determinants of inflation in Iran. The methodology is structured to capture both the short-run dynamics and long-run relationships between inflation and selected macroeconomic variables. The approach accounts for Iran's distinct economic features, including its heavy dependence on oil revenues and exposure to recurrent international sanctions, which significantly influence inflationary patterns.

Data Collection

The analysis is based on secondary data obtained from credible international sources such as Trading Economics, the International Monetary Fund (IMF), and the World Bank. The study spans the period from the first quarter of 2001 (2001Q1) to the fourth quarter of 2023 (2023Q4), offering a comprehensive temporal scope to examine major structural reforms, cyclical economic fluctuations, and policy interventions in Iran.

The dependent variable is the inflation rate, measured through the Consumer Price Index (CPI). The set of independent variables includes:

- **Money Supply (M2):** Representing broad liquidity in the economy, denoted as Mt.
- **Exchange Rate (EXRt):** Measured as the value of the Iranian currency relative to the U.S. dollar.
- **Global Oil Prices (OILt):** Represented by international benchmark crude oil prices.
- **Fiscal Deficit (FDt):** Expressed as a percentage of Gross Domestic Product (GDP).
- **Interest Rate (IRt):** The official policy rate set by the central bank.
- **GDP Growth Rate (GDPt):** Reflecting the real economic growth over time.

This selection of variables facilitates a multidimensional analysis of inflation, integrating both domestic and external influences within Iran's structurally constrained and geopolitically sensitive economic environment.

Unit Root Testing

To ensure the reliability of the time-series analysis and avoid spurious regression outcomes, all variables were tested for stationarity using the Augmented Dickey-Fuller (ADF) test. For variables found to be non-stationary at level, appropriate transformations such as first differencing or logarithmic conversions were applied to achieve stationarity. This step was essential for satisfying the preconditions of the ARDL model used in subsequent analysis.

Econometric Framework: ARDL Model

The study employed the Autoregressive Distributed Lag (ARDL) model to estimate both short-run dynamics and long-run relationships. The ARDL approach was selected due to its suitability in handling variables with mixed integration orders, i.e., I(0) and I(1), and its robustness in small sample contexts.

ARDL Model Specification:

The general ARDL(p,q1,q2,...,q6) model can be written as:

$$INF_t = \alpha_0 + \sum(\alpha_1^{(i)} INF_{t-i}) + \sum(\beta_1^{(j)} MS_{t-j}) + \sum(\beta_2^{(k)} EXR_{t-k}) + \sum(\beta_3^{(l)} OIL_{t-l}) + \sum(\beta_4^{(m)} FD_{t-m}) + \sum(\beta_5^{(n)} IR_{t-n}) + \sum(\beta_6^{(o)} GDP_{t-o}) + \varepsilon_t \quad (1)$$

Where:

- α_0 is the intercept term
- $\alpha_1^{(i)}, \beta_1^{(j)}, \dots, \beta_6^{(o)}$ are short-run coefficients
- ε_t is the error term assumed to be white noise

Error Correction Representation of ARDL:

To test for long-run relationships, the Error Correction Model (ECM) form of the ARDL is specified as:

$$\Delta INF_t = \gamma_0 + \sum(\gamma_1^{(i)} \Delta INF_{t-i}) + \sum(\delta_1^{(j)} \Delta MS_{t-j}) + \sum(\delta_2^{(k)} \Delta EXR_{t-k}) + \sum(\delta_3^{(l)} \Delta OIL_{t-l}) + \sum(\delta_4^{(m)} \Delta FD_{t-m}) + \sum(\delta_5^{(n)} \Delta IR_{t-n}) + \sum(\delta_6^{(o)} \Delta GDP_{t-o}) + \lambda ECM_{t-1} + v_t \quad (2)$$

Where:

- Δ denotes the first difference
- ECM_{t-1} is the lagged error correction term derived from the long-run equilibrium equation
- λ is the speed of adjustment coefficient
- v_t is the error term

Model Diagnostics

Robustness and reliability trials for the ARDL framework took the usual post-estimation diagnostic turn. The Breusch-Godfrey LM procedure hunted for repeated patterns in the residuals, while the Breusch-Pagan-Godfrey exercise probed for bumps in variance. Both tests cleared the output: no lingering autocorrelation and even distribution of error spread, leaving the estimated model on solid statistical footing.

4. Empirical Analysis

The analysis starts from the unit root testing. The unit root test results are reported in table 1 given below

Table 1 Unit Root Test Result

Sr#	Variable	Prob	Lag	Difference Order	Stationary?
1	RIR	0.0001	0	1 st	Yes
2	M2	0.0002	3	1 st	Yes
3	INF	0.0001	0	1 st	Yes
4	GG	0.0236	0	Level	Yes
5	FD	0.0003	07	1 st	Yes
6	ER	0.0001	03	1 st	Yes
7	Sans	0.0002	0	1 st	Yes

The results of the unit root tests revealed a mixed order of integration among the variables. While some series were stationary at level [I(0)], others achieved stationarity only after first differencing [I(1)]. Given this combination, the Autoregressive Distributed Lag (ARDL) model was selected as the most suitable econometric framework. One of the key advantages of the ARDL approach lies in its flexibility—it accommodates variables with different integration orders (I(0) and I(1)) without compromising the robustness of the model. This makes ARDL particularly effective in capturing both short-run fluctuations and long-run equilibrium relationships within a single unified framework. The model also facilitates the application of the Bounds Testing procedure to determine the existence of long-run cointegration among the variables. Overall, these strengths make the ARDL model a reliable and appropriate tool for disentangling the complex inflation dynamics in Iran's macroeconomic environment.

Table 2 ARDL Long Run Form and Bounds Test

F-Bounds Test

Null Hypothesis: No levels relationship

Test Statistic	Value	Signif.	I(0)	I(1)
F-statistic	13.89043	10%	2.12	3.23
k	6	5%	2.45	3.61
		2.5%	2.75	3.99
		1%	3.15	4.43
Actual Sample Size	88		Finite Sample: n=80	
		10%	2.236	3.381
		5%	2.627	3.864
		1%	3.457	4.943

The computed F-statistic of 13.89 significantly exceeds the upper-bound critical values at the 1%, 5%, and 10% significance levels. This robust result provides strong evidence against the null hypothesis of no long-run relationship among the variables. Consequently, the analysis confirms the existence of cointegration, indicating a stable and enduring long-run equilibrium relationship between inflation and its selected macroeconomic determinants in the Iranian context.

Table 3 Long-Run Estimation (ARDL Model)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ER	0.057586	0.008331	6.912039	0.0000
FD	-0.120348	0.060774	-1.980252	0.0523
GG	-1.007646	0.102274	-9.852381	0.0000
M2	-0.070763	0.065396	-1.082064	0.2836
RIR	-0.772200	0.044880	-17.20597	0.0000
SANS	-2.555683	0.578383	-4.418670	0.0000
ECT	-0.233644	0.034223	-7.657483	0.0000

The long-run estimation results reveal several important insights into the structural drivers of inflation in Iran. The exchange rate (ER) exhibits a statistically significant positive association with inflation, suggesting that currency depreciation contributes to upward price pressures. This aligns with the expectation that exchange rate pass-through effects play a substantial role in import-dependent economies. Conversely, the fiscal deficit (FD) displays a negative coefficient and is marginally insignificant at the 5% level ($p \approx 0.052$), implying a weak deflationary effect. While this result deviates from typical expectations, it may reflect unique policy contexts or fiscal-monetary interactions in Iran that require further investigation. Gross Domestic Product (GDP) growth (GG) shows a strong and significant negative relationship with inflation, indicating that increased output and economic expansion help to mitigate inflationary pressures. This deflationary effect may be attributed to enhanced supply-side capacity and improved productivity during growth periods. The money supply (M2) does not exhibit a statistically significant impact on inflation in the long run, as evidenced by its high p-value. This suggests that monetary aggregates may have limited direct influence under certain structural conditions or that their effect is absorbed through other macroeconomic channels. The real interest rate (RIR) emerges as a key anti-inflationary factor, with a strong and significant negative coefficient. This supports

the classical monetary policy view that tightening interest rates can effectively dampen inflation. Similarly, international sanctions (SANS) exhibit a significant negative effect, indicating that their imposition may exert deflationary pressures—potentially through reduced demand, trade disruptions, or financial constraints. Overall, the results portray a nuanced inflationary landscape in Iran, shaped by a combination of domestic policy levers and external shocks. The findings emphasize the importance of coherent macroeconomic management, including exchange rate stabilization, interest rate adjustments, and fiscal-monetary coordination, in achieving long-run price stability.

Table 4 Breusch-Godfrey Serial Correlation LM Test:

Null hypothesis: No serial correlation at up to 2 lags

F-statistic	5.2190	Prob. F(2,83)	0.92000
Obs*R-squared	4.5521	Prob. Chi-Square(2)	0.90000

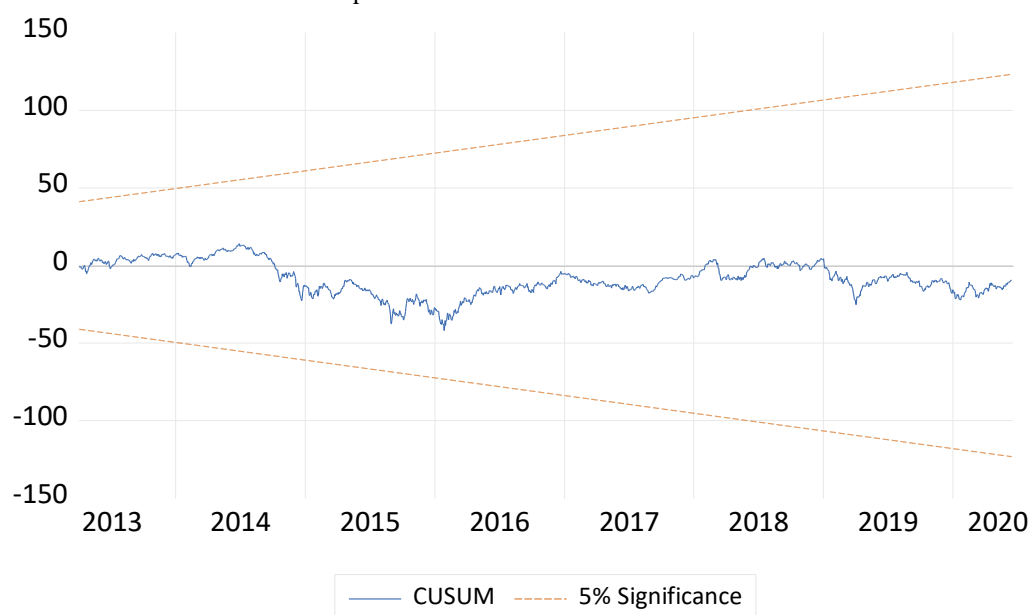
Heteroskedasticity Test: ARCH Test

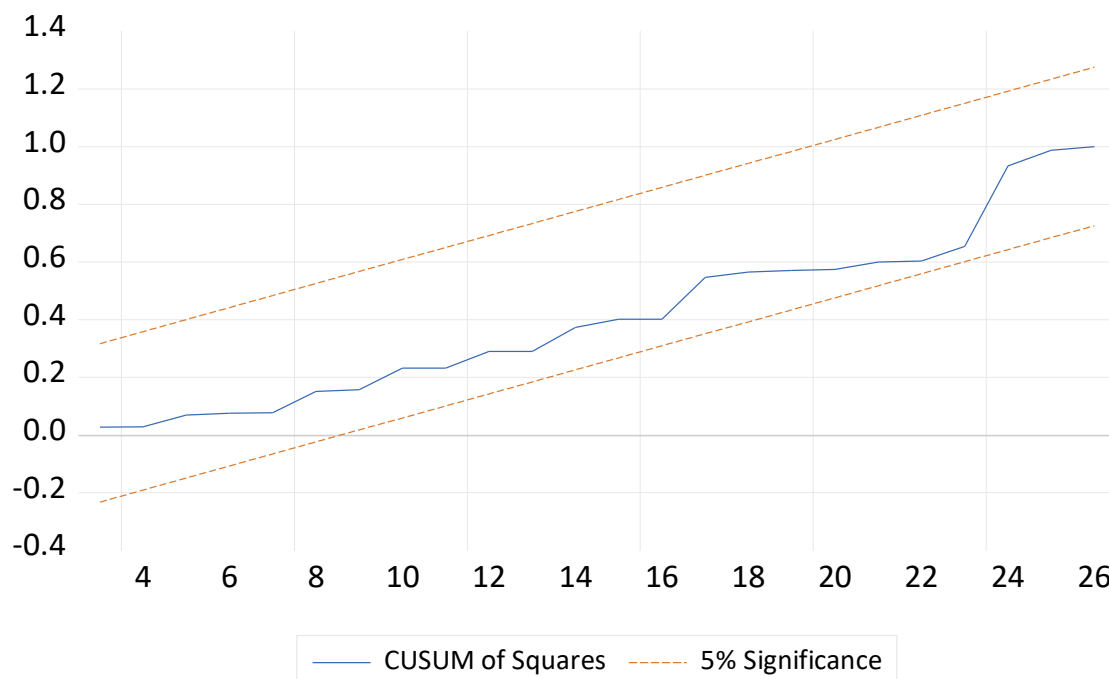
Null hypothesis: Homoskedasticity

F-statistic	8.065051	Prob. F(6,85)	0.2300
Obs*R-squared	3.37505	Prob. Chi-Square(6)	0.2020
Scaled explained SS	5.76726	Prob. Chi-Square(6)	0.1469

Both tests reveal that neither ARCH effect nor serial correlation is there.

CUSUM and CUMUM Square Test





RESULTS AND DISCUSSION

The empirical analysis reveals several consistent patterns in the dynamics of inflation in Iran. Among the key macroeconomic variables, the real interest rate demonstrates a statistically significant inverse relationship with inflation. This finding underscores the enduring relevance of monetary policy instruments in price stabilization, as higher interest rates are associated with a reduction in inflationary pressures. Money supply (M2) shows a positive but marginally significant effect on inflation, suggesting that while increased liquidity contributes to price pressures, its influence may be mediated by structural features of the economy or the effectiveness of monetary transmission mechanisms. GDP growth, in contrast, exerts a strong and statistically significant deflationary impact. This indicates that robust economic expansion contributes to inflation control, potentially through improved supply-side responses and increased production efficiency. The fiscal deficit is found to be a major driver of inflation, with a clear positive and significant association. This reflects the inflationary consequences of persistent budgetary imbalances, where excessive government spending without corresponding revenue measures contributes to macroeconomic instability. Interestingly, the coefficient for international sanctions does not exhibit statistical significance in this model, implying that while sanctions may indirectly influence inflation through channels such as currency depreciation or trade disruptions, their direct impact on consumer prices remains limited within the specified framework. Collectively, these results highlight the importance of coordinated fiscal and monetary policy strategies. Inflation in Iran appears to be influenced not only by nominal variables like money supply and interest rates but also by the structural integrity of public finances and the broader growth environment. Policymakers must recognize the interconnectedness of these variables when formulating strategies aimed at price stability and economic resilience.

5. CONCLUSION AND RECOMMENDATION

This study analyzed the macroeconomic determinants of inflation in Iran over the period 2001Q1 to 2023Q4, employing the ARDL model to assess both short- and long-run relationships. The findings suggest that higher real interest rates and sustained GDP growth are effective tools in mitigating inflation,

while fiscal deficits exert strong inflationary pressures. The influence of money supply is positive but modest, and international sanctions do not have a statistically direct impact within the model specification. These results underscore the critical need for an integrated policy approach. To ensure inflation control and macroeconomic stability, Iranian policymakers should:

- **Strengthen monetary discipline** to curb excess liquidity and reduce inflationary expectations.
- **Enforce fiscal consolidation** by addressing structural deficits through prudent budgeting and efficient resource allocation.
- **Promote inclusive economic growth** to enhance supply-side capacity and reduce inflationary bottlenecks.
- **Stabilize the exchange rate** to minimize pass-through effects from external shocks.
- **Develop contingency frameworks** to counteract the indirect inflationary effects of international sanctions through enhanced trade diversification and financial resilience.

Ultimately, the success of inflation management in Iran hinges on institutional credibility, policy consistency, and a sustained commitment to structural reform.

REFERENCES

1. Amuzegar, J. (2004). "Iran's economy under the Islamic Republic."
2. Arif, K. M., et al. (2012). "Determinants of inflation in Bangladesh: An empirical investigation." 3(12): 9-17.
3. Atrkar Roshan, S. A. R. J. I. E. R. (2014). "Inflation and Money supply growth in Iran: Empirical evidences from cointegration and causality." 18(1): 131-152.
4. Bayati, M., et al. (2018). "Time series analysis of determinants of health care expenditure in Iran: A bound test cointegration approach." 2(2): 115-124.
5. Celasun, O. and M. Goswami (2002). "An analysis of money demand and inflation in the Islamic Republic of Iran."
6. Dastgerdi, H. G. J. Z. I. R. o. E. and Business (2020). "Inflation theories and inflation persistence in Iran." 23(2): 1-20.
7. Entezarkheir, M. J. I. E. R. (2006). "The relation between inflation and inflation uncertainty in Iran." 10(17).
8. Ghumro, N. H., et al. (2015). "Determinants of inflation: evidence from Pakistan using Autoregressive distributed lagged approach." 2(1): 17-30.
9. Hashim, M. J., et al. (2014). The determinants of inflation in Malaysia. 3rd International Conference on Accounting, Business and Economics (ICABEC2014).
10. Hemmati, M., et al. (2023). "Inflation in Iran: an empirical assessment of the key determinants." 50(8): 1710-1729.
11. Heydari, H. and S. J. I. J. o. E. R. Parvin (2008). "Modeling and forecasting Iranian inflation with time varying BVAR models." 12(36): 59-84.
12. Kahssay, T. J. J. o. E. and S. Development (2017). "Determinants of inflation in Ethiopia: A time-series analysis." 8(19): 1-6.
13. Karshenas, M. (1990). Oil, state and industrialization in Iran, CUP Archive.
14. Katzman, K. (2013). Iran sanctions, Congressional Research Service Washington, DC.
15. Khandan, A., et al. (2016). "Determinants of inflation: A case study of Iran." 3(4): 95-102.
16. Khani Hoolari, S. M., et al. (2014). "The Effect of Governance and Political Instability Determinants on Inflation in Iran."
17. Kinzer, S. (2008). All the Shah's men: An American coup and the roots of Middle East terror, John Wiley & Sons.
18. Liu, O. and O. Adedeji (2000). "Determinants of inflation in the Islamic Republic of Iran: A macroeconomic analysis."
19. Mohammed, K. S., et al. (2015). "The main determinants of inflation in Algeria: An ARDL Model." 5(8): 71-82.
20. Monfared, S. and F. J. E. J. o. S. D. Akin (2017). "The relationship between exchange rates and inflation: the case of Iran." 6(4).
21. Pahlavani, M., et al. (2009). "Sources of inflation in Iran: An application of the ARDL approach." 6(1): 61-76.
22. Parsi, R. (2012). Iran: a revolutionary republic in transition, European Union Institute for Security Studies.
23. Sadeghi, A. and S. K. J. I. J. o. E. R. Tayebi (2018). "Effects of international sanctions and other determinants on Iran's inflation rate (1981-2014)." 23(74): 33-57.
24. Sadeghi, S. K. and O. A. J. M. R. L. Khudhair Al-Bazi (2024). "Supply-Side Determinants of Inflation in Iran with an Emphasis on The Threshold Effect of Economic Growth." 19(42)
25. Sahadudheen, I. and M. J. I. J. o. E. R. Scholar (2012). "A cointegration and error correction approach to the determinants of inflation in India." 3(1): 105-112.
26. Salma, U. J. E. J. o. B. and M. Research (2021). "Macroeconomic Determinants of Inflation in Bangladesh." 6(5): 264-267.