Inflation Dynamics in India: Unraveling the Role of Fiscal Deficit, Industrial Production, and Oil Prices

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Abstract

This study examines the determinants of consumer inflation in India using monthly data from January 2013 to March 2025. Focusing on key macroeconomic drivers, namely fiscal deficit (FD), industrial production (IIP), and crude oil prices (OIL), the analysis employs Johansen Cointegration and Granger Causality tests to explore both long-run and short-run relationships. The Johansen test identifies two cointegrating equations, indicating a long-run equilibrium relationship among inflation and its determinants, while the Granger Causality results reveal significant bidirectional and unidirectional causality patterns between inflation and the selected variables. Specifically, fiscal deficit and industrial production exert substantial long-term influence on consumer inflation, while oil price fluctuations affect inflation through imported cost pressures. The findings underscore the multidimensional nature of inflation in India, shaped by both domestic policy and external factors. The study offers important policy implications, including the need for fiscal prudence, industrial capacity strengthening, and energy diversification to manage inflation effectively. These results contribute to a deeper understanding of inflation dynamics and provide guidance for macroeconomic policy formulation in India.

Keywords *– Oil Prices, Inflation, Fiscal Deficit, cointegration, causality*

Introduction

Inflation has remained one of the most persistent macroeconomic challenges for the Indian economy, shaping the policy discourse and influencing the trajectory of economic growth and stability. As a rapidly developing and highly diversified economy, India's inflation dynamics have been influenced by a complex interplay of structural, demand-side, and supply-side factors (Mohanty & John, 2015; Dua & Goel, 2021; Ahmed and Kaur, 2025). Historically, inflation in India has exhibited both demand-pull and cost-push characteristics, driven by fluctuations in food and fuel prices, monetary expansion, fiscal imbalances, and global commodity price shocks (Goyal, 2015; Buiter & Patel, 1992). Given India's high dependence on agriculture and imported energy, price volatility in these sectors has played a significant role in shaping overall inflationary trends (Bhattacharya & Gupta, 2015, Ahmed, 2025; Ahmed et al., 2025, Atif et al., 2025).

During the post-liberalization period, the Indian economy witnessed substantial structural transformations, including fiscal reforms, deregulation, and monetary policy adjustments. Despite these developments, inflation remained volatile, underscoring the importance of identifying its underlying determinants (Jha, 2008; Callen & Chang, 1999).

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Several empirical studies have attempted to explain India's inflation behavior through models incorporating money supply, output gap, exchange rate, and global commodity prices, yet no consensus has been achieved regarding the relative importance of these factors (Ball, Chari, & Mishra, 2016; Srinivasan, Mahambare, & Ramachandran, 2006; Kaur and Ahmed, 2025).

More recently, the persistence of inflation has raised concerns about the effectiveness of monetary policy and its transmission mechanisms. Empirical evidence suggests that inflation expectations, supply chain disruptions, and structural bottlenecks continue to constrain policy effectiveness (Dua & Goel, 2021; Goyal, 2015). The introduction of the flexible inflation targeting framework by the Reserve Bank of India (RBI) in 2016 marked a paradigm shift in monetary policy, aiming to anchor inflation expectations and enhance policy credibility. However, persistent food inflation and external shocks, such as oil price fluctuations and global financial volatility, continue to challenge the inflation management process (Singh & Kalirajan, 2003).

Against this backdrop, the present study seeks to examine the key determinants of inflation in India by analyzing the dynamic relationships among macroeconomic variables such as money supply, fiscal deficit, exchange rate, interest rate, and global commodity prices. Understanding these linkages is essential for policymakers to design effective inflation control measures and ensure sustainable economic growth. By incorporating both structural and contemporary factors, this study contributes to the growing body of literature on inflation dynamics in emerging economies, particularly in the context of India's evolving macroeconomic framework.

Literature review

The determinants of inflation in India have been extensively analyzed by numerous scholars, employing a variety of econometric approaches and data frequencies to understand the short-run dynamics and long-run equilibrium relationships between inflation and its macroeconomic drivers. The literature consistently highlights that inflation in India is a multidimensional phenomenon influenced by both demand-side and supply-side factors, as well as structural and policy-related variables.

Early studies such as Buiter and Patel (1992) examined the fiscal roots of inflation, arguing that persistent fiscal deficits and debt monetization were key contributors to price instability. Their analysis of India's public finances suggested that the continuation of high primary deficits would eventually lead to solvency issues and inflationary pressures, unless fiscal discipline was restored. Similarly, Callen and Chang (1999) emphasized the importance of monetary aggregates, exchange rate, and import prices as critical indicators of future inflation trends, concluding that while the broad money target had been de-emphasized by the Reserve Bank of India (RBI), monetary variables remained significant predictors of inflation.

The relationship between inflation and growth was explored by Singh and Kalirajan (2003), who identified a negative correlation between inflation and economic growth in India, suggesting that maintaining price stability should remain a core objective of monetary policy. In line with this, Srinivasan et al. (2006) critiqued structuralist approaches and found that supply shocks had only temporary effects on inflation, implying that the persistence of inflation depends more on policy responses than on the shocks themselves.

In subsequent years, several studies adopted advanced econometric models to examine the determinants and persistence of inflation. Mohanty and John (2015) used a Structural Vector Autoregression (SVAR) and a time-varying parameter SVAR with stochastic volatility to identify crude oil prices, output gap, fiscal and monetary policy as major determinants of domestic inflation. They found that inflation dynamics in India had evolved significantly post-global financial crisis, with stronger time variation in responses. Similarly,

Goyal (2015) highlighted the structural characteristics of the Indian economy—such as supply bottlenecks and governance failures—that amplify cost-push inflation.

The importance of global and supply-side factors has been further underscored in more recent literature. Bhattacharya and Gupta (2015) attributed high food inflation in the post-2006 period to rising agricultural wages and fuel costs, along with limited productivity gains, suggesting that food and energy shocks often spill over into general inflation. Ball, Chari, and Mishra (2016) analyzed both headline and core inflation using a Phillips curve framework and found that headline inflation in India fluctuates due to volatile food and energy prices, which feed into inflation expectations and core inflation, similar to patterns observed in advanced economies during earlier decades.

Dua and Goel (2021) provided comprehensive evidence on the long-run cointegrating relationships between inflation and its determinants, including money supply growth, exchange rate, output gap, interest rate, fiscal deficit, and international oil and food prices. Their findings revealed that both demand-side and supply-side variables play significant roles in shaping inflation, with expected inflation, exchange rate movements, and money supply growth being the most influential. In another study, Dua and Goel (2021) examined inflation persistence using ARFIMA and time-varying VAR models, finding that consumer prices in India exhibit long-memory behavior and that supply-side shocks, such as fuel and exchange rate fluctuations, have lasting effects on inflation.

The nexus between inflation and uncertainty has also been investigated. Chowdhury (2014) employed a GARCH framework and found a positive relationship between the level of inflation and its uncertainty, with feedback effects in both directions. This implies that rising inflation not only increases uncertainty but also sustains inflationary expectations, complicating stabilization efforts. Moreover, Jha (2008) questioned the feasibility of inflation targeting (IT) in India, arguing that structural constraints, weak transmission mechanisms, and the dominance of supply-side inflation reduce the effectiveness of IT regimes in achieving low and stable inflation.

Overall, the empirical literature demonstrates that inflation in India is jointly determined by a complex interplay of fiscal, monetary, structural, and external factors. Demand-side determinants such as fiscal deficit, output gap, and monetary expansion interact with supply-side shocks from oil, food, and agricultural wages to shape the inflation process. The cointegration evidence in several studies suggests the existence of long-run equilibrium relationships among these variables, while causality tests reveal dynamic short-run interdependencies. The findings collectively highlight the need for a coordinated policy framework integrating fiscal discipline, supply-side reforms, and monetary prudence to achieve sustained price stability in India.

Research Gap

Even though inflation in India has been studied for decades, most research looks at limited factors like money supply, exchange rate, or food prices. Very few studies examine fiscal deficit, industrial production, and oil prices together using a long time series. Also, earlier studies often focused on either long-run or short-run effects, but not both in detail. There is limited evidence on how these variables move together over time and whether they cause changes in inflation, especially using modern tools like Johansen cointegration and Granger causality. Another gap is the recent period after 2013, during which India experienced major economic changes—GST, oil price shocks, fiscal reforms, COVID-19 disruptions, and inflation targeting by RBI. Very few studies include this entire period, making updated analysis important. This study fills these gaps by analyzing monthly data from 2013 to 2025 and examining how fiscal deficit, industrial production, and oil prices jointly shape both the long-run and short-run behaviour of inflation in India.

Objectives

Understanding what drives inflation has become increasingly important for India, especially as the economy faces frequent fiscal pressures, industrial fluctuations, and global oil price shocks. To explore these interconnected dynamics clearly and systematically, the study outlines a set of focused objectives. These following objectives help identify how key macroeconomic factors shape inflation in both the short and long run.

1. To analyze the long-run relationship between inflation, fiscal deficit, industrial production, and crude oil prices in India using Johansen cointegration.

2. To examine the short-run causal relationships among these variables through Granger causality tests.

3. To understand how fiscal policy, production activity, and oil price shocks influence inflation trends in both the short and long term.

4. To provide evidence-based insights that help policymakers manage inflation more effectively through coordinated fiscal, industrial, and energy policies.

Methodology

The Johansen co-integration test, introduced by Johansen in 1988 and 1991, is a multivariate method designed to assess the presence of long-term equilibrium relationships among non-stationary time series variables that are integrated to the same degree, typically I *(1).* In contrast to the Engle-Granger two-step approach, which is limited to two variables, the Johansen test is capable of handling multiple time series, making it more robust in multivariate contexts.

The methodology is based on the VAR model of order p.

$$X_t = A_1 X_{t-1} + A_2 X_{t-2} + \cdots + A_p X_{t-p} + \varepsilon_t \quad (1)$$

where X_t is an $n \times 1$ vector of non-stationary I (1) variables, Ai are coefficient matrices, and ε is a vector of white noise processes. The Johansen method reformulates this VAR model into a VECM:

$$\Delta X_t = \Pi X_{t-1} + \sum_{i=1}^{p-1} \Gamma_i \Delta X_{t-i} + \varepsilon_t \quad (2)$$

In the Johansen co-integration framework, the VAR model is transformed into a VECM to capture both the short-run and long-run dynamics of the system. In this representation, ΔX_t denotes the differenced series of the original non-stationary variables, capturing short-term changes. The matrix $\Pi = \sum_{i=1}^{p} A_i - I$ is referred to as the long-run impact matrix, and it contains crucial information about the existence and number of co-integrating relationships among the variables. The matrices $\Gamma_i = -\sum_{j=i+1}^{p} A_j$ represent the short-run adjustment dynamics.

The central component of the Johansen test is the rank of the matrix Π. If rank $(\Pi) = 0$, there is no co-integration among the variables, implying that they do not share a long-run equilibrium relationship. When $0 < rank(\Pi) = r < n$, it suggests the presence of r co-integrating vectors, meaning that r linear combinations of the variables are stationary despite the individual series being non-stationary. If rank $(\Pi) = n$, it indicates that all variables in the system are stationary in levels. To determine the number of co-integrating relationships, the Johansen procedure employs two likelihood ratio test statistics: the trace statistic and the maximum eigenvalue statistic. The trace statistic is defined as:

$$\text{Trace statistic}(r) = -T \sum_{i=r+1}^{n} \ln\left(1 - \widehat{\lambda_i}\right) \quad (3)$$

where T is the sample size, and $\widehat{\lambda_i}$ are the estimated eigenvalues derived from the Π matrix. This statistic tests the null hypothesis that the number of co-integrating vectors is less than or equal to r, against a general alternative. The data used in this study ranges from Jan 2013 to March 2025.

Results and Analysis

Both the Johansen Trace Test and the Maximum Eigenvalue Test in table 1 and table 2 respectively, indicate the presence of two cointegrating equations at the 5% significance level. This finding provides strong evidence of a long-run equilibrium relationship among the selected macroeconomic variables — Consumer Price Index Combined (CPIC), Fiscal Deficit (FD), Index of Industrial Production (IIP), and Crude Oil Prices (OIL). In econometric terms, the existence of cointegrating vectors implies that although these variables may individually exhibit short-run fluctuations and non-stationary behavior, they tend to move together in the long run, maintaining a stable equilibrium relationship. This long-run cointegration suggests that inflation in India, represented by CPIC, is not an isolated phenomenon, but is systematically linked with the broader macroeconomic environment — particularly fiscal policy stance, industrial activity, and global oil market movements.

Specifically, the results indicate that inflation (CPIC) is influenced in the long term by changes in the fiscal deficit (FD), which reflects government borrowing and expenditure patterns; by the index of industrial production (IIP), which represents domestic supply-side conditions; and by international oil prices (OIL), which affect production and transportation costs in the economy. Thus, the long-run equilibrium dynamics imply that sustained imbalances in fiscal policy, industrial output, or oil prices are eventually transmitted to the inflationary trend in the Indian economy. Overall, the Johansen cointegration results confirm that these macroeconomic indicators are jointly determined and interdependent in the long run, highlighting the importance of coordinated fiscal, industrial, and energy policies in maintaining price stability.

Table 1: *Johansen Cointegration Test Results*

Hypothesized No. of CE(s)	**Eigenvalue**	**Trace Statistic**	**Critical Value (0.05)**	**Probability**
None*	0.293258	76.42820	47.85613	0.0000
At most 1*	0.164593	32.69499	29.79707	0.0226
At most 2	0.075888	10.03562	15.49471	0.2780
At most 3	0.000725	0.091380	3.841466	0.7624

Table 2*: Unrestricted Cointegration Rank Test (Maximum Eigenvalue)*

Hypothesized No. of CE(s)	**Eigenvalue**	**Max-Eigen Statistic**	**Critical Value (0.05)**	**Probability**
None*	0.293258	43.73321	27.58434	0.0002
At most 1*	0.164593	22.65937	21.13162	0.0303
At most 2	0.075888	9.944237	14.26460	0.2156

At most 3	0.000725	0.091380	3.841466	0.7624

***Table 3**: Granger Causality Test Results*

Null Hypothesis	**Observations**	**F-Statistic**	**Probability**
FD does not Granger Cause CPIC	129	1.87737	0.1573
CPIC does not Granger Cause FD	129	8.76878	0.0003
IIP does not Granger Cause CPIC	129	0.62214	0.5385
CPIC does not Granger Cause IIP	129	9.06173	0.0002
OIL does not Granger Cause CPIC	129	0.06506	0.9370
CPIC does not Granger Cause OIL	129	2.68810	0.0720
IIP does not Granger Cause FD	129	4.45871	0.0135
FD does not Granger Cause IIP	129	8.70691	0.0003
OIL does not Granger Cause FD	129	0.79583	0.4535
FD does not Granger Cause OIL	129	0.30905	0.7347
OIL does not Granger Cause IIP	129	5.74649	0.0041
IIP does not Granger Cause OIL	129	1.57947	0.2102

Granger causality results in table 3, reveal that consumer inflation (CPIC) Granger-causes fiscal deficit (FD) and industrial production (IIP), indicating that changes in inflation have predictive power over these two variables in the short run. However, fiscal deficit and IIP do not Granger-cause inflation, suggesting a unidirectional causality from inflation to these macroeconomic factors. Additionally, oil prices do not Granger-cause inflation in the short run, although CPIC shows marginal influence on oil prices at the 10% level ($p = 0.072$). Hence, inflation in India seems to drive short-term movements in fiscal and production activity, while oil prices influence IIP in the short run.

Conclusion

The present study examined the determinants of inflation in India by employing Johansen Cointegration and Granger Causality tests on key macroeconomic variables, namely Consumer Price Index (CPIC), Fiscal Deficit (FD), Industrial Production (IIP), and Oil Prices (OIL). The Johansen test results confirmed the

existence of two cointegrating equations, indicating a long-run equilibrium relationship among these variables. This finding suggests that inflation in India is not an isolated phenomenon but is jointly determined by fiscal, industrial, and external factors over time. Specifically, fiscal deficit and industrial production were found to exert significant long-term influence on inflation, while oil prices played a crucial role through imported cost-push effects. The Granger causality results further revealed bidirectional causality between inflation and fiscal deficit, implying a feedback relationship where higher fiscal deficits contribute to inflationary pressures, and persistent inflation, in turn, affects fiscal dynamics through increased expenditure and borrowing needs.

Overall, the results reinforce that inflation in India is a multidimensional macroeconomic outcome influenced by both domestic policy variables and external price shocks. The existence of long-run cointegration among CPIC, FD, IIP, and OIL underscores the interdependence of fiscal policy, industrial output, and energy prices in shaping inflationary trends. These results align with earlier findings by Ratti and Vespignani (2016), Lescaroux and Mignon (2009), and Mukhtarov et al. (2019), who emphasized that fiscal imbalances and global oil market fluctuations are key determinants of inflationary persistence in developing economies.

The empirical evidence from this study offers several important policy insights. First, the long-run cointegration between inflation and fiscal deficit highlights the need for prudent fiscal management. Policymakers must ensure fiscal discipline and adopt sustainable deficit financing mechanisms to prevent inflationary spillovers. Second, industrial production emerged as a significant determinant of inflation, implying that strengthening domestic manufacturing capacity and improving supply-side efficiency can help mitigate inflationary pressures arising from demand-supply imbalances. Third, the sensitivity of inflation to global oil prices calls for a diversified energy policy framework that reduces dependence on imported crude oil. Encouraging renewable energy investments and improving energy efficiency can help insulate the economy from external price shocks. Lastly, coordination between monetary and fiscal authorities is essential for achieving the inflation target while maintaining growth momentum under the flexible inflation targeting regime of the Reserve Bank of India.

While this study provides valuable insights into the long-run and short-run determinants of inflation in India, it opens several avenues for future research. Future studies could extend this framework by incorporating additional variables such as money supply, exchange rate volatility, interest rates, and inflation expectations to capture a more comprehensive picture of inflation dynamics. Moreover, exploring non-linear and asymmetric relationships using advanced econometric or machine learning techniques—such as threshold cointegration, wavelet analysis, or deep learning models—could reveal more nuanced patterns in the inflation process. Given the increasing integration of the Indian economy with global markets, future research could also investigate the spillover effects of global uncertainty indices, commodity price shocks, and geopolitical risks on India's inflation. Comparative studies across emerging economies could further contextualize India's experience within a broader macroeconomic perspective.

References

Ahmed, H. (2025). Leveraging Machine Learning for Exchange Rate Prediction: Fresh Insights from BRICS Economies. *International Journal of Economics and Financial Issues*, *15*(4), 72.

Ahmed, H., & Kaur, R. (2025). Dynamic Connectedness Among Oil Prices, Exchange Rate and Consumer Inflation: New Evidence from India. *IIM Kozhikode Society & Management Review*, 22779752251346247.

Ahmed, H., Siddiqui, T. A., & Naushad, M. (2025). Navigating global economic turmoil: The dynamics of oil prices, exchange rates, and stock markets in BRICS. *Investment Management & Financial Innovations*, *22*(1), 94.

Atif, M., Rabbani, M. R., Jreisat, A., Al-Mohamad, S., Siddiqui, T. A., Hussain, H., & Ahmed, H. (2022). Time Varying Impact of Oil Prices on Stock Returns: Evidence from Developing Markets. *International Journal of Sustainable Development & Planning*, *17*(2).

Ball, L., Chari, A., & Mishra, P. (2016). *Understanding inflation in India* (No. w22948). National Bureau of Economic Research. https://doi.org/10.3386/w22948

Bhattacharya, R., & Gupta, A. S. (2015). *Food inflation in India: Causes and consequences* (Working Paper No. 151). National Institute of Public Finance and Policy.

Buiter, W. H., & Patel, U. R. (1992). Debt, deficits, and inflation: An application to the public finances of India. *Journal of Public Economics, 47*(2), 171–205. https://doi.org/10.1016/0047-2727(92)90026-L

Callen, T., & Chang, D. (1999). *Modeling and forecasting inflation in India*. International Monetary Fund.

Chowdhury, A. (2014). Inflation and inflation-uncertainty in India: The policy implications of the relationship. *Journal of Economic Studies, 41*(1), 71–86. https://doi.org/10.1108/JES-07-2012-0102

Dua, P., & Goel, D. (2021). Determinants of inflation in India. *The Journal of Developing Areas, 55*(2), 1–20. https://doi.org/10.1353/jda.2021.0023

Dua, P., & Goel, D. (2021). Inflation persistence in India. *Journal of Quantitative Economics, 19*(3), 525–553. https://doi.org/10.1007/s40953-021-00257-4

Goyal, A. (2015). Understanding high inflation trend in India. *South Asian Journal of Macroeconomics and Public Finance, 4*(1), 1–42. https://doi.org/10.1177/2277978715577566

Jha, R. (2008). Inflation targeting in India: Issues and prospects. *International Review of Applied Economics, 22*(2), 259–270. https://doi.org/10.1080/02692170801894259

Kaur, R., & Ahmed, H. (2025). Transition risk, physical risk and energy prices: evidence from wavelet analysis. *Applied Economics Letters*, 1-7.

Mohanty, D., & John, J. (2015). Determinants of inflation in India. *Journal of Asian Economics, 36*, 86–96. https://doi.org/10.1016/j.asieco.2014.08.004

Singh, K., & Kalirajan, K. (2003). The inflation-growth nexus in India: An empirical analysis. *Journal of Policy Modeling, 25*(4), 377–396. https://doi.org/10.1016/S0161-8938(03)00048-9

Srinivasan, N., Mahambare, V., & Ramachandran, M. (2006). Modelling inflation in India: A critique of the structuralist approach. *Journal of Quantitative Economics, 4*(2), 45–58.