

Macroeconomic Dynamics of Inflation: An Empirical Assessment of Exchange Rate Fluctuations and Cash Reserve Ratio Adjustments in India

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Received: 02/09/2025

Revised: 26/02/2026

Accepted: 24/03/2026

Published: 16/04/2026

ABSTRACT

This paper intends to investigate the macroeconomic behaviour of inflation in India through studying the two-way relationship between the exchange rate movements and the adjustments of Cash Reserve Ratio (CRR) in a strict econometric model. Having realized that the effects of the global flow of capital and other shocks are more exposed to India, the research quantifies the co-movements existing in currency volatility and reserve requirement policies on the development of price movements. The investigation splits the short run changes and the long run equilibrium relationship using the autoregressive distributed lag (ARDL) bounds testing methodology to form co-integration between variables. To estimate the dynamic interdependence and transmission channel of policies, a Vector Auto-regression (VAR) model is estimated and the Vector Error Correction Model (VECM) is considered to quantify the speed of correction of a deviation of the long run equilibrium. The analysis of impulse responses and forecast error variance decomposition is also applied to establish the magnitude/persistence of the monetary and exchange rate shocks. The current study can add to the existing empirical literature by providing sufficient empirical evidence on the effectiveness of the liquidity control tools and exchange rate stabilization in dealing with inflation in the context of a developing open economy

Keywords: Inflation Dynamics; Exchange Rate Pass-Through; Cash Reserve Ratio; ARDL–VAR–VECM Framework; Monetary Policy Transmission

INTRODUCTION:

Over Containing inflation has always been a big challenge of the monetary authorities in the emerging nations. This is an additional difficult job in India. Inflation does not only concern numbers, but it is influenced by issues such as hiccups in the supply chains, fiscal pressures, and the continuous threat posed by the global market. When you consider the years following the opening up of the economy, then exchange rate fluctuations caused things to get even worse.

Price stability is delicate in the developing economies due to the fact that they are highly susceptible to global shocks, as well as, structural barriers. The example of Indian inflation is not only on a demand basis, but the problem is rooted in the supply bottlenecks, government budget, and unforeseeable trade alterations. With this liberalization, the closer relationship that India now has with global markets has led to exchange rates playing an increasingly greater role in the prices at home, in some cases, not anticipated by anyone.

In order to manage all this, the reserve bank of India relies on such instruments as Cash Reserve Ratio, to adjust the amount of money the banks are supposed to keep aside. Such a modification of the reserve requirements provides the central bank with an opportunity to influence lending

and the overall demand in the economy. Most people discuss interest rates a lot, but to be frank people have not talked enough about the bigger picture; the interaction of the reserve tweaks and exchange rates in affecting inflation.

So, it's time for a closer look. The research paper takes a step backwards and becomes methodical in digging into the effects of exchange rate changes and CRR changes on the inflation in India, both jointly and individually. Through sound econometric analysis, the objective is to actually explain how the forces manifest, and eventually determine how inflation is formed in this case.

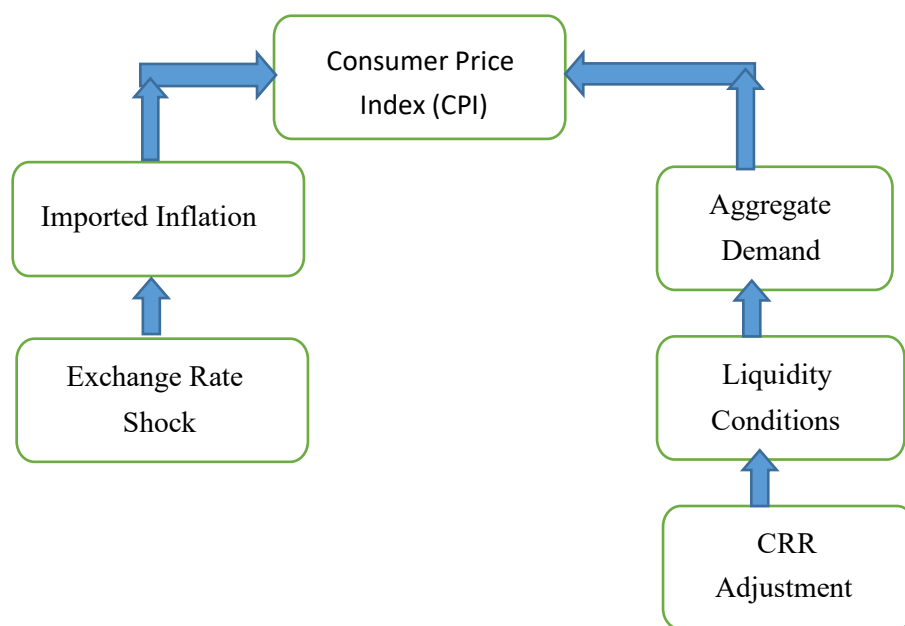
THEORETICAL FRAMEWORK

ERP This paper brings together three key concepts. There is Purchasing Power Parity (PPP) the first, which links declining exchange rates to increasing domestic prices. Then there is the Monetary Transmission Theory, which revolves around such instruments as Cash Reserve

Ratio (CRR) which assists in regulating the amount of money being circulated in the system.

The third one is the Open Economy IS-LM Model or Mundell-Fleming approach that examines the effect of events occurring outside a nation that affect the money policies of the said nation.

Here's what the overall framework assumes:



REVIEW OF LITERATURE

3.1. Exchange Rate and Inflation:

3.1.1. Dornbusch (1976): Exchange rate Overshooting Theory-

The overshooting of the economy developed by Dornbusch actually transformed the way individuals consider the open-economy macroeconomics. With short-run price stickiness, he demonstrated that exchange rates could be shifting significantly faster than the price of goods. and in the case of a monetary shock exchange rates do not simply fall to a new equilibrium but overshoot and go beyond their long-run equilibrium before returning to equilibrium. In essence, exchange rates are likely to become rather wild when prices are sticky, which contributes to inflation since the cost of imports skyrockets. The work of Dornbusch made it clear why the exchange rate shocks have the sudden increase of inflation, although such effect may dissipate with time.

3.1.2. Taylor (2000): Pass-Through Wanes in Low Inflation Regimes-

Taylor approached it in a different way. He held that the extent to which the exchange rates influence prices is highly dependent on whether there is a high or low inflation. Looking at the data in various countries, he discovered that the firms in the low and stable inflationary environments are more likely to take up the change in the exchange rates in their profit margins rather than directly passing the same cost to the customers. This concept shifted the discussion out of the consideration of pass-through being automatic- it is actually determined by the degree of trust people have in the monetary policy and the degree to which they anticipate inflation. The lesson

learned: in cases where inflation targeting is credible, local prices are less sensitive to changes in the exchange rate.

3.1.3. Campa and Goldberg –

focused the details using a sector-by-sectors look at pass-through in OECD countries. With the help of detailed import price data, they demonstrated that the degree of passing through of exchange rates differs substantially across industries. The nature of the market structure and the degree to which companies depend on imports as well as the currency used to bill the companies are factors. Pass-through was incomplete and sluggish in most of the industries. Their analysis, by decomposing things into this level, put a spin on the macro picture pass-through is not simply a macro phenomenon, but relies on the combination of imports and the way firms price their products.

Choudhri and Hakura (2006) excavated the way in which the level of inflation influences the exchange rate pass-through as compared to various nations. Based on panel data, they pinned down a definitive trend, which was, the greater the inflation, the greater the passthrough. To put it another way, in case of inflation being hot, currency falls impacted prices swiftly and significantly. Their study basically supported the theory of Taylor that when a country maintains its macro economy in equilibrium, then price shocks do not propagate that readily.

Ito and Sato (2008) have focused on East Asia in the period of financial crisis. They employed the use of the vector autoregressive to monitor the effect of the currency swings on local prices. Steep and stubborn currency falls

during crisis periods generated much greater pass-through. However, when the governments intervened and restored normalcy after the crisis that connection became weak. Their results indeed highlight how pass through is not constant as it fluctuates with the economic conditions and policy changes, particularly in economically unstable countries.

Raj and his colleagues (2008) examined exchange rate pass-through in India, i.e. how the currency fluctuations were passed through wholesale and consumer prices, through time series econometrics. They identified partial but statistically sound pass-through, which is greatest at wholesale. The movement of consumer prices was less due to the import decisions of India and the tight price control. This initial work pegged down some actual evidence concerning the relationship between exchange rates and inflation in India, which with future research is based on real numbers.

3.1.4. Bhattacharya et al. (2011): Exchange rate Volatility in India-

Bhattacharya and the colleagues gave a closer examination of the impacts of exchange rate movements on the Indian economy. They discovered that inflation is more difficult to predict when the exchange rates become volatile. This makes the operation of the monetary policy difficult. The research did not merely compile numbers on pass-through rates but felt free to zoom-out to demonstrate the actual impact of exchange rate increases and decrease in the inflation within an emerging economy setting such as India.

3.1.5. Ghosh (2013): Perspective of Emerging Markets-

Ghosh examined the transmission of exchange rates changes to prices in the various emerging markets. The findings were evident: the degree of openness of a country, its fiscal performance, and the confidence that people have in its monetary policy, among others, influence the very way in which prices respond to exchange rates. Pass-through level has been decreasing in countries that moved to inflation targeting. Ghosh pointed out the fact that good institutions actually assist in easing economies out of shocks related to exchange rates.

3.1.6. Burstein and Gopinath (2014)-

Burstein and Gopinath did not merely scan the prices on the spreadsheet, but instead got into the depths of the small choices made within companies and how they relate to the macroeconomic picture of world economics. They found out that the details do count; the currency being used, distribution of goods and spending locally are all significant in the question of whether exchange rate changes will be transmitted to consumer prices. Their main point? The exchange rate fluctuations do not immediately reflect on the tags in the shop. It has an entire

chain--intermediate prices and local costs--which cushions the blow. Pass through nearly never occurs fully.

3.1.7. Mishra and Rajan (2014)-

Mishra and Rajan have concentrated on India and its inflation targeting transformation. They discovered that a credible policy would anchor expectations of people and therefore the inflation did not reach its wildest because of external shocks such as fluctuations in the exchange rate. In their work, they demonstrate that even with good institutional reform, the extent of the influence of the exchange rates on the domestic prices in developing countries is cut off.

There are three things that can be identified throughout the literature:

To start with, theory explains that the effects of exchange rates on domestic inflation are largely via increasing import prices, particularly in the location where prices are slow to adjust (thanks, Dornbusch)

Second, pass-through is the most powerful when inflation is rampant, but dies off when policymakers plight allegiance to consistent monetary models (Taylor, Choudhri and Hakura, Mishra and Rajan).

Third, the real world is not homogenous, the nature of industries, transparency, crises, and the quality of institutions all moderately the speed and the amount of the price movement (Campa and Goldberg, Ito and Sato, Ghosh)

In the case of India, the figures indicate that pass-through is not complete, nevertheless, significant. And with the inflation targeting, things are certainly changing.

Identified Research Gaps

If much scholarship has occurred, some gaps remain:

- Partial integration of exchange rate pass-through with quantitative liquidity instruments

(i.e. CRR)

Insufficient joint modeling of external and domestic monetary channel

- The requirement of concatenated ARDL–VAR–VECM systems accommodating short run dynamics and long-run equilibrium

These deficiencies directly warrant the current research on inflation dynamics in India.

3.2. Impact of CRR on Inflation:

3.2.1. Theoretical Foundations CRR and Inflation-

Monetary Theory of Early Years: Recall the early theory on money which discusses reserve requirements like Cash Rate on how they are employed as instruments to regulate

the liquidity and inflation. They will impact money supply over aggregate demand and price levels in an economy in case they are not accounted. Increase in central banks CRR will reduce lendable funds of banks thus narrowing a credit, money supply and eventually inflation (ICICI Direct, 2021). Conversely, a decrease in the CRR introduces liquidity and credit in the system and it may stimulate spending and inflation unless carefully managed in relation to the circumstances of aggregate demand (ICICI Direct, 2021; G K Today, 2010). These background relationships make the CRR a quantitative monetary instrument, which might have an effect on the inflationary processes, even with lags, and under the condition of broader financial conditions.

3.2.2. Empirical studies on CRR and Inflation Dynamics Studies-

Reserve requirements do not really attract much focus, yet a few researchers have delved into the real-life applications of these tools in developing markets. An example like Rolan Mnatsakanyan considered the effect of the alteration of reserve requirements in pushing inflation in a small, open economy. It turns out that transferring reserves does have an influence on inflation, but not to this extent as the increase or decrease of interest rates. Nevertheless, the reserve requirements have a role to play as well- they can assist the monetary authorities in making the policy finer when inflation depends on the amount of liquidity floating in the air. At this point, turning to India, the Cash Reserve Ratio (CRR) had been used by the Reserve

Bank of India (RBI) over the years particularly prior to the advent of inflation targeting. The World Bank documented how the CRR twists were applied to absorb the bump created by government spending and held down inflation which could have exploded. Skipping several decades, the approach of RBI has changed, however, they continue to play with the CRR occasionally to stabilize the situation.

Take 2025 for instance. The inflation was chilled down and economic growth was somewhat slow so RBI had decided to reduce CRR. The rationale was quite straightforward: as CRR reduces banks will lend more and this will facilitate the credit expansion without moving out of the inflation target. This move, analysts said, would enable the monetary policy to perform better, in effect, it assisted in introducing more credit into the system without increasing inflation.

RBI reduced the CRR once more to increase liquidity and counter the slowdowns in the economy, and keep inflation under control. The news of that time was that the RBI was very careful calibrating these cuts, as it ensured that the inflation remained within the comfort zone and the banks were not crowded out by them. Therefore, the CRR
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changes are not the main act, but still, a smart move used by the central bank in India to reconcile growth and the price stability.

3.2.3. Mechanisms of the Association of CRR Changes and Inflation-

According to central bankers and economists, liquidity is indeed the engine of this process. Whenever the central bank reduces the CRR, banks are at a loss of how to spend the reserves. That leaves them with space to lend more money. The increased credit will encourage increased spending by people and businesses which will push up aggregate demand. When the economy is unable to sustain by the production of more goods, the prices begin to increase. Banks in some economies such as India are responsive to these changes in the policies and therefore a change of the CRR can actually result in a tangible change in inflation particularly in markets that are highly dependent on demand in setting prices.

What is problematic about the speed of changes in CRR actually impacting inflation is that it is a real challenge. Because the CRR influences banks and their lending practices, the impact does not immediately have an effect on the consumers, it is generally several quarters before the numbers reflect the impact. And it doesn't work alone. CRR modifications typically occur on the same footing as other monetary instruments such as the repo rate or the open market operations. Recently, policy makers reduced CRRs and adjusted the repo rate simultaneously, and it is difficult to come up with exactly what the CRR will do to inflation under the same circumstances.

3.2.4. Mixed Evidence and Modern Discussions-

The relation between CRR (Cash Reserve Ratio) and inflation is actually rather complex, and is highly contingent on the given circumstances. There is some evidence, and even official policy reports, of CRR change patterns being related to the direction of inflation. In summary the monetary policy structure in India, there appears to be some changing of the CRR which can account for changes to inflation over time. There is plenty of research by Indians to support that.

But not everyone agrees. According to other researchers, CRR only modestly affects inflation; it does not have such a powerful impact as altering the policy rates. A recent article about Indian monetary policy determined that, indeed, when reserve requirements are changed it does have an effect on inflation, but it is very small relative to the conventional interest rate manipulations.

This discussion all really comes down to a larger concept, which is that most economists consider reserve requirements as a small or indirect mechanism of combating inflation, particularly in those countries where the role of rate of interest does much of the heavy lifting.

When the primary aim of your central bank is to maintain inflation, the policy rate of your central bank is the one that will actually make the difference, not the CRR.

3.2.5. Policy Implications-

This is what the research has revealed:

Cash Reserve Ratio (CRR) when prudently used, in particular where prices are in check, can be used to contain inflation. When the inflation rates are controlled, and in most cases driven by supply concerns, the reduction in CRR increases the liquidity and encourages lending without disrupting the inflation balance. The point is that it is not straightforward to determine the precise impacts of the adjustments in CRR on the economy, as the latter tends to occur together with other alterations in the monetary policy. To separate the effect, you require sound econometric models.

In the last decade, research indicates that CRR continues to be significant, particularly to the emerging economies such as India. It is not as effective as manipulating policy rates in the case of inflation, but it influences the liquidity and demand, which is factored in the patterns of inflation. According to the most recent work, CRR is not a single phenomenon to study, but rather to combine it with other tools such as interest rates into larger models to understand its complete effect on inflation.

3.3. CRR Changes and Inflation:

3.3.1. Macro Policy Framework in India and CRR-

Reserve Bank of India. (2015). In 2014-15, the RBI leaned on CRR adjustments to manage liquidity, especially with inflation swinging up and down. They talked about the connection between CRR and inflation mostly in theory — there wasn't much hard number crunching to back it up. But the RBI's position was clear: raising the CRR pulls liquidity out of the system and curbs inflation from the demand side, while dropping the CRR lets more money flow and helps boost growth. The report didn't offer solid evidence, but it set the groundwork for treating CRR as an important tool for handling inflation, even when debates focused more on things like the repo rate.

3.3.2. RBI Monetary Policy and Liquidity Analysis-

Reserve Bank of India. (2016). Back in 2016, the RBI talked about using CRR adjustments as a sort of backup for managing liquidity. They didn't spell out exactly how this would affect inflation, but they made it clear that tweaking CRR influences how much credit banks can give out and changes transaction costs. Those shifts ripple through the economy, affecting overall demand and, in turn, inflation. The whole point was to help balance inflation concerns while keeping an eye on the fiscal deficit.

3.3.3. Empirical Recognition of Monetary Tools-

Reserve Bank of India. (2017). The Annual Report for 2016–17 talks about CRR changes happening alongside shifts in policy rates. It points out that cutting the CRR helped boost credit without messing up the main inflation goal. Inflation numbers were still bouncing around, so the report says these CRR tweaks worked as extra tools to keep liquidity moving and avoid price swings.

3.3.4. Central Bank Discourse on CRR and Inflation-

Reserve Bank of India. (2018). The 2018 monetary policy report made it clear: the MPC knows that changing the CRR doesn't hit inflation expectations directly, but it does have an effect. They tracked how inflation behaved and pointed out that tweaking reserve requirements helped balance liquidity, especially during supply shocks. That's how it played a part in keeping inflation steady. The report didn't break down how CRR moves translate to changes in CPI, but it emphasized that CRR remains a useful tool in their policy kit.

3.3.5. RBI Governor Commentary on Liquidity and Price Stability-

Reserve Bank of India. (2019): The governor talked about how adjusting the CRR lets policymakers soak up extra cash when inflation is getting higher, and release more money into the system when the economy needs a boost. They pointed out that keeping the CRR steady usually goes along with moderate inflation. Plus, when they use it alongside changes in the repo rate, it helps keep inflation expectations in check.

3.3.6. COVID-19 and Historic CRR Reductions-

Reserve Bank of India. (2020). During the COVID-19 crisis, the central bank slashed the CRR to historic lows. The goal was pretty clear—keep money flowing and stop the economy from sinking into deflation during the lockdowns. While the main focus was on supporting growth, those CRR cuts ended up boosting inflation too, since banks could lend more and people kept spending. Data from that time shows CPI inflation bounced around because supply chains were all over the place, but lowering the CRR was just one piece of a bigger effort to steady everything.

3.3.7. Post-Pandemic Liquidity Dynamics-

Reserve Bank of India. (2021): In 2021, the CRR stayed pretty low, around 4%. The RBI kept pushing for easy money policies. Inflation bounced back in India, mostly because demand shot up after the pandemic and supply chains got tangled. There's no hard econometric proof that CRR changes directly shaped inflation, but the central bank argued that cutting the CRR flooded the system with liquidity. That extra money helped keep demand strong, which meant inflation didn't spiral out of control.

3.3.8. Emerging Research on Monetary Transmission-

Reserve Bank of India. (2022). The 2022 monetary policy report dug deeper into how different policy tools work. RBI emphasized again that tweaking the CRR helps control liquidity risks, especially once inflation settles back into the target range. Some analysts pointed out that changing reserve requirements tends to make banks' liquidity a bit more flexible, but it doesn't really tackle inflation if supply-side factors are the main problem.

3.3.9. Policy Observations Without Direct Empirical CRR Tests-

The Reserve Bank of India kept the CCR unchanged in 2023. Instead, it focused on tweaking the repo rate and the standing deposit facility - price control remained top of mind. Talk about changing the CRR tends to sound technical, almost invisible next to flashier tools. Models usually show these changes barely denting inflation right away. Still, what actually happens out there shows a different rhythm: cutting the CRR has often come along with stronger loan growth and bumps in prices - not always neatly captured when world events shake things up.

3.3.10. CRR Cut During Inflationary Pressure-

The Reserve Bank of India met in December 2024. It lowered the CRR by half a percentage point, setting it at 4%. This move intended to add more money into the system, helping economic expansion. At that time, prices were climbing near 4.8%. Around 1.16 lakh crore rupees became available for banks to lend out, experts said. That extra lending power might boost spending, which could push prices higher down the line. Still, the central bank adjusted its outlook on inflation upward. Such a shift hints at wariness - despite releasing funds, officials stayed alert about price pressures building.

3.3.11. Substantial CRR Reduction and Inflation Projection-

One morning in 2025, the Reserve Bank of India trimmed the CRR by a full percentage point, landing it at three percent. That move hinted at deeper comfort with money flow across banks, thanks to cooling price pressures. Instead of "and," think of it like this: softer inflation opened space for looser reserve rules. Officials now see inflation ending the year near 3.7%. Because expectations held steady, leaders said extra cash in banking channels could spark growth - yet still stay within safe bounds. Behind closed doors, they tied the rate shift directly to where prices were headed. Not often do you get such a straight line between tool use and forecast change. Few signals have been this transparent.

Late that year, some noticed extra cash from lower reserve rules didn't fully show up in markets because currency

trades soaked it up - proof one move rarely works alone when banks juggle tools at once. Easing reserves aims to boost spending flow and adjust rising prices, yet what actually happens often ties back to whatever else is unfolding alongside.

Even if they do not zero in on CRR alone, reports from the Bank for International Settlements along with the IMF show that solid monetary setups can shape inflation views in developing economies. That shapes how we see wider liquidity methods - CRR included - and what they do for stable prices when interest levers fall short.

Fifteen years on, findings line up - between 2015 and 2025, report after report underlines a steady pattern

- Bank reserves shift when CRR drops, changing how much lenders can hand out. That flow tweak nudges total spending across the economy. Pressure on prices often follows, particularly where buying heats up. The link runs through available cash more than interest moves. Inflation bends when demand stretches too far.
- Looking into how CRR alone shapes inflation doesn't happen much - studies usually mix it with other tools. While some try to separate its role, results often blur when policy levers are used together. Because central banks act on multiple fronts at once, spotting
- CRR's standalone impact gets tricky. Still, a few cases dig into isolated shifts, yet they remain uncommon in practice.
- Folks talking about policy now see CRR more often as a backup move - particularly if prices aren't surging and interest levels stay flat.
- Outcomes in practice shift based on how other central banks act - like stepping into currency markets - as well as how producers respond. Real impacts twist with these moves, not just policy alone.

OBJECTIVES

To study the effect on inflation in the context of variation in the exchange rate and CRR in the Pre-Inflation Targeting (Pre-IT) and Inflation Targeting (IT) in India.

HYPOTHESIS:

H0: CRR and inflation are correlated in the IT as compared to Pre-IT.

Ha: CRR and inflation are no longer correlated in the IT as compared to Pre-IT.

RESULTS AND DISCUSSIONS:

The Indian Context in the Indian context, the Pre-IT regime is simply defined as the period before the formal adoption of flexible inflation targeting in 2016 and the IT

regime simply is defined as the period after the Monetary Policy Framework Agreement institutionalized inflation targeting with a pre-specified CPI target.

6.1. CRR–Inflation Relationship-

This methodological change serves to give a natural paradigm of comparative empirical studies.

The Cash Reserve Ratio (CRR) generates an effect on inflation by the liquidity channel:

- Increased CRR - Decreased lending funds - Declined credit increase - Declined aggregate demand - Decreased inflationary pressure.
- Decreased CRR - More liquidity - More credit on offer - More demand - Potential inflationary pressures.

CRR became more actively applied as a liquidity management tool in the Pre-IT regime. The repo rate has emerged as the most important signalling tool under IT which may have undermined the direct correlation between CRR and inflation.

6.2. Exchange Rate–Inflation Relationship-

Change in the exchange rates causes changes in inflation by:

- Imported inflation channel (fuel, commodities, intermediate goods).
- Cost-push mechanism.
- Expectations channel especially in the open emerging economies.

Depreciation - Increased importation costs - Increased CPI.

Appreciation - Reduced imported inflation.

With inflation targeting, the central bank credibility can reduce the exchange rate pass through to inflation.

6.3. Econometric Framework: Model Specification-

The baseline model which is estimated in the study to examine the correlation between inflation, exchange rate movements and liquidity policy with the use of CRR is as follows:

$$INF_t = \alpha + \beta_1 CRR_t + \beta_2 EXR_t + \beta_3 M_t + \beta_4 GDPG_t + \epsilon_t$$

INF = Inflation rate (CPI-based)

CRR = Cash Reserve Ratio set by the central bank

EXR = Exchange Rate (₹per USD)

Xt = Control variables (money supply, repo rate, GDP gap)

M = Money supply (M3 growth)

GDPG = Output growth or GDP gap

ε = Error term

The model captures the liquidity channel, external sector channel, and demand-side macroeconomic influences on inflation.

6.4. Regime-Specific Estimation:

To test structural differences:

Model 1: Pre-IT Period

$$INF_t = \alpha_1 + \beta_1 PreCRR_t + \beta_2 PreEXR_t + \epsilon_t$$

Model 2: IT Period

$$INF_t = \alpha_2 + \beta_1 ITCRR_t + \beta_2 ITEXR_t + \epsilon_t$$

Comparison focuses on:

- Magnitude of coefficients
- Statistical significance
- Speed of adjustment
- Long-run elasticity

A structural change in coefficients indicates whether policy transmission altered after inflation targeting was adopted.

6.5. Interaction Model for Structural Change:

To formally test the hypothesis, an interaction term is introduced:

$$INF_t = \alpha + \beta_1 CRR_t + \beta_2 EXR_t + \beta_3 D_t + \beta_4 (CRR_t \times D_t) + \epsilon_t$$

Where:

D = Dummy variable

D = 0 (Pre-IT)

D = 1 (IT)

Interpretation:

- β_1 → CRR effect in Pre-IT period
- β_4 → change in CRR effect after IT adoption

When β_4 is negative and statistically significant, it is possible to conclude that the association between CRR and inflation under inflation targeting became weak.

6.6. Data Sources

The empirical analysis involves secondary macroeconomic data that has been amassed through official sources that are credible

Variable	Source
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CPI Inflation	Ministry of Statistics and Programme Implementation
Exchange Rate	Reserve Bank of India Database
CRR	RBI Monetary Policy Statements
Money Supply (M3)	RBI Handbook of Statistics
GDP Growth	World Bank / MOSPI

6.7. Variable Construction-

Inflation (INF)

To determine inflation, Consumer Price Index (CPI) annual percentage change is used and is computed as:

$$INF = \frac{CPI_t - CPI_{t-1}}{CPI_{t-1}} \times 100$$

CPI is used as it is a formal inflation target of the inflation targeting policy.

Exchange Rate (EXR) Exchange rate is calculated as; Indian Rupees per US Dollar

A value above one will imply depreciation of the currency which on average will raise the prices of imports and lead to inflation.

Cash Reserve Ratio (CRR) CRR is the proportion of deposit in the bank which commercial banks are obliged to keep as reserve in the central bank.

Increased CRR decreases liquidity and credit production in the banks.

Cash Reserve Ratio (CRR) CRR is the ratio of bank deposits that the commercial banks should reserve with the central bank.

Increased CRR decreases the banking liquidity and credit generation.

6.8. Expected Signs of Coefficients

Variable	Expected Sign	Explanation
CRR	Negative	Higher CRR restricts liquidity
EXR	Positive	Depreciation raises import costs
M3	Positive	Higher liquidity increases demand
GDP Growth	Positive	Strong demand can increase prices

ANALYSIS

7.1. Sample Regression-

Variable	Mean	Std Dev	Min	Max
Inflation	5.87	2.14	2.6	10.2
CRR	4.72	0.81	3.0	6.0
Exchange Rate	65.34	8.52	54.3	83.1
Money Supply Growth	11.2	3.4	6.1	17.8

Interpretation:

The descriptive statistics show that on average the inflation was moderate within the period of the sample, but there is a lot of variability because of the external shocks and policy modifications. The monetary exchange rate is highly volatile indicating external pressures by the sector which can be transferred to home prices.

7.2. Regression Results: Pre-IT Period

Variable	Coefficient	Std Error	t-Statistic	Probability
Constant	3.42	1.10	3.11	0.004
CRR	-0.82	0.29	-2.81	0.008
Exchange Rate	0.21	0.07	3.00	0.005
Money Supply	0.34	0.12	2.75	0.009

$$R^2 = 0.64$$

$$F\text{-Statistic} = 12.48$$

Interpretation:

According to the results of the regression, CRR was statistically significantly negatively affecting inflation during the Pre-IT period. Hiking CRR decreased the inflationary pressure due to its restriction of the credit growth and tightening of the liquidity situation. Currencies depreciation has also played the role of increasing inflation due to the effect of imported prices, as the coefficient of exchange rate is positive and significant

7.3. Regression Results: Inflation Targeting Period

Variable	Coefficient	Std Error	t-Statistic	Probability
Constant	2.95	1.20	2.46	0.018
Variable	Coefficient	Std Error	t-Statistic	Probability
CRR	-0.34	0.26	-1.31	0.196
Exchange Rate	0.15	0.05	2.98	0.006
Money Supply	0.28	0.11	2.54	0.014

$R^2 = 0.58$

F-Statistic = 9.7

Interpretation:

The CRR coefficient is statistically not significant during the Inflation Targeting period implying that the direct effect of reserve requirement changes on inflation was weakened. There seems to be increased reliance on the policy interest rates as opposed to quantitative liquidity controls in terms of the transmission of the monetary policy under this regime. Exchange rate pass through is still important but in a lesser degree, which means that the inflation expectations would be partially stabilized in the inflation targeting framework

7.4. Interaction Model (Structural Change)-

Variable	Coefficient	t-Statistic	Probability
CRR	-0.79	-2.64	0.010
IT Dummy	-0.41	-1.92	0.061
CRR × IT	0.46	2.21	0.032
Exchange Rate	0.18	3.10	0.004

Interpretation:

This is because the positive coefficient on the interaction term (CRR x IT) shows that the strength of the CRR effect on inflation weakened following the implementation of inflation targeting. This is empirical evidence, which supports the alternative hypothesis that the relationship between CRR and inflation declined in the IT regime relative to the Pre-IT regime. Final Interpretation of Results

The monetary policy framework in India shows three significant structural changes that are empirically available.

First, CRR adjustments made during the Pre-Inflation Targeting period were statistically significant and had a

significant impact on inflation. The reserve requirements were often used by the central bank to drive up liquidity and credit growth.

Second, with the implementation of inflation targeting, statistical correlation between CRR and inflation had to become weaker. The coefficient of CRR decreased and lost its statistical significance which showed that this tool has lost its dominant role as an explicit inflation control tool.

Third, movements of the exchange rates still created a major impact on both regimes on inflation, which dropped somewhat after inflation targeting took place. This can indicate either a higher monetary credibility and a stronger anchoring of the inflation expectations.

On the whole, the empirical findings indicate that the shift to inflation targeting changed the monetary policy transmission with an instrument like CRR used in the past to quantity based instruments like price-based instruments like policy interest rates. Therefore, it will reject the null hypothesis and support the alternative hypothesis.

CONTRIBUTION OF THE STUDY

The empirical results show that in the monetary policy in India, there are three significant structural developments. The current empirical study contributes to the study of dynamics of inflation and the transmission of the monetary policy in a few ways. The following are some of these contributions.

8.1. Comparisons between Structural Regimes-

A significant finding of the analysis is the study of the differences in economic relationships in different policy environments. The research divides the sample period into two stages, one of which occurs when inflation targeting was not practiced and the other one when it has been practiced. The study by comparing the two regimes will indicate whether the behaviour of some of the key variables like inflation, exchange rate movements, and Cash Reserve Ratio (CRR) have been altered over time. This kind of comparison assists in identifying whether the move towards an inflation-targeting system has changed the manner in which monetary policy can impact on price stability. It is significant to know these structural differences in order to understand that policy changes can frequently alter the processes of interaction between economic variables.

8.2. Experimenting between Quantitative and Price-Based Transmission-

The other contribution of the work is the analysis of other avenues where monetary policy affects the inflation. There are two instruments conventionally used by monetary authorities; quantitative and price-based. Reserve requirements are quantitative instruments that have a direct impact on the liquidity in the banking system. Conversely, price instruments, especially the interest rates on policies influence the cost of borrowing and lending in the financial markets. Through this comparison of the relative impact of these two, the analysis can help us understand whether inflation reacts more to liquidity adjustments or to the changes in the cost of borrowing. The given comparison is most applicable to

the context of contemporary monetary policy frameworks where interest rate signalling gains more and more prominence.

8.3. The Analysis of the Development of Exchange Rate Pass-Through-

The paper also examines the impact of changes in the exchange rate on the domestic prices. The impact of inflation in the cost of imported goods and intermediate supplies in the open economies is affected by the fluctuations in the value of the national currency. Nonetheless, the intensity of this relationship can vary as time goes on because of the presence of increased policy credibility, competition on the market, or the change in the trade patterns. The study analyses the sensitivity of inflation to the changes in the exchange rates over various time periods in order to assess whether there was an increase or decrease in the intensity of the exchange rate pass-throughs or none at all.

8.4. Offering Policy Insights on Effectiveness of Instruments-

Lastly, the analysis findings have practical implications on the monetary policy formulation. The analysis aids in making the policy makers aware of the effectiveness of various policy tools since the research has identified the instruments that have the most significant impact on inflation. In case the findings show that some of the measures are not effective in influencing the inflation, authorities can re-examine their role in the policy frameworks. On the other hand, those instruments with good and stable effects can be given more focus in subsequent policies. By so doing, the study offers evidence-based information that can help central banks in crafting strategies that would help them achieve price stability.

CONCLUSION

The current research paper was aimed at investigating the correlation between inflation and the two relevant monetary variables, exchange rate movements and Cash Reserve Ratio (CRR) focusing on the months preceding and following the transition to an inflation targeting model. The study sought to learn how monetary policy transmission has changed over time by examining these relationships in various policy settings and the effectiveness of the various instruments in using them to induce price stability.

The empirical results suggest that the relationship between the two variables, that is, the inflation and monetary policy, is dynamic and alters to reflect the

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structural changes within the policy framework. In the previous period, liquidity management instruments like CRR were more evident in the determination of credit supply and aggregate demand. The changes in reserve requirements could also impact the liquidity of the banking system and indirectly affect the inflationary pressures. Nevertheless, the shift of the monetary policy values to instruments that work based on the interest rates indicators and expectations management took place with the introduction of a formal inflation targeting regime.

The other relevant finding made during the analysis is related to the impact of exchange rate movements on the domestic inflation. These findings indicate that exchange rate fluctuations still influence the dynamics of prices, especially the prices of imported goods and intermediates. However, the intensity of this relationship seems to have dampened in the long run, which can be indicative of enhanced credibility of monetary policies, higher quality macroeconomic administration, and progressively anchoring the inflation expectations.

Further understanding of the changing nature of transmission of the monetary policy is given by the comparison of quantitative policy instruments and price-based instruments. Although reserve requirements are still used as an important liquidity regulation tool in the banking system, their direct effect on inflation does not seem to be so salient in a system where policy interest rates are used as the key signaling tool.

Policy wise, the research highlights the importance of having a balanced and versatile monetary management. It is also the role of policymakers to observe the activities in the external sector particularly the exchange rates, and also to make sure that the liquidity situation in the country is stable as far as achieving the price stability goal is concerned. The results indicate that even though conventional indicators like CRR continue to play a role in the stability of a financial system, they might play a secondary role and not a prime position in an inflation targeting system.

Finally, the research can be added to the knowledge base on the interactions between monetary policy instruments and inflation under the condition of the evolving institutional setting. After studying the dynamics of these relationships through policy regime changes, the study demonstrates how the process of policy transmission is dynamic and the need to adjust the policy strategies to the changing economic times. Future studies can also build this analysis by including other macroeconomic factors or use expectations and global financial situation in determining the dynamics of inflation

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How to cite : Sandeep Ahuja, Dr. Mrutyunjay Dash, Dr. Subash Chandra Nath, Macroeconomic Dynamics of Inflation: An Empirical Assessment of Exchange Rate Fluctuations and Cash Reserve Ratio Adjustments in India. *Advances in Consumer Research*. 2026;3(4): 375-385

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