Monetary policy analysis in an inflation targeting framework in emerging economies: The case of India

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Outline

- Motivation
- Literature
- Contribution
- Model, data and calibration
- Results
- Policy implications
- Summary
Part I

Motivation
Inflation persistently above target zone

WPI, YoY (%)
Inflation persistently above target zone

CPI, YoY (%)
Motivation

Transition from fixed to flexible exchange rate regime

Volatility in rupee-dollar exchange rate increased significantly after 2008
Transition from fixed to flexible exchange rate regime

RBI’s intervention in foreign exchange market declined significantly after 2008

![Graph showing RBI trading percent to M0 from 2002 to 2014 with significant interventions in 2003 and 2007.](image-url)
Despite monetary tightening, inflation pressures have persisted.
Rising inflationary expectations

In absence of an alternative nominal anchor, inflationary expectations started rising and have persisted above 10% since 2010.
Questions

- What are the factors that have contributed to post-crisis business cycle fluctuations and inflation dynamics in India?
- Is aggregate demand a contributor to inflation pressure in India? Does monetary policy have a role to play?
- What would have been the post-crisis monetary policy stance in a counter-factual scenario of inflation-targeting (IT) central bank in India?
- Would monetary policy be successful in anchoring inflationary pressure in recent times under a hypothetical scenario of IT central bank?
Part II

Literature review
Micro-founded DSGE models with New-Keynesian features (Smets and Wouters, 2003; Gali, 2007; Gali and Gartler, 2009; Gali and Monacelli, 2008), which help in identifying:

- Factors contributing to **business cycle fluctuations**
- **Welfare-based optimal** monetary and fiscal policy rules under alternative policy regimes

Recently developed FPAS models (Berg and Laxton, 2006; Laxton, Rose and Scott, 2009) apply **reduced form semi-structural New-Keynesian** model coherently with data and help in:

- Providing a practical guide to **IT central banks to assess macroeconomic functioning** of the country in a single framework
- **Predicting future monetary policy path** to contain inflation rate in the country at a desired level in medium to long term
Variants of FPAS models have been applied in countries with an existent, as well as those transitioning to, an IT framework.

**Application by existing IT central banks:** ECB, Australia, New Zealand

**Limited application to EMs:** Kenya (Andrle, Berg, Morales, Portillo, and Vlcek, 2013), Sri Lanka (Anand, Ding, and Peiris, 2011)

**Implemented by Czech National Bank** (Andrle, Hledik, Kamnik, Vlcek, 2009)

**Limited literature on India:** Estimated new Keynesian closed economy model for India (Patra, Kapur, 2010)
Part III

Contribution
First semi-structural New-Keynesian open economy model for India, capturing main macroeconomic mechanisms, useful for:

**Identification** Of factors contributing to Indian business cycle fluctuations and inflation dynamics

**Prediction** Of inflation, and corresponding policy rate, in the medium to long run

**Promoting** Discussion on rules-based policy making in India
Contribution

Comparison of FPAS with other models

- **DSGE:**
  - FPAS allows abstraction away from micro-foundations and deep-parameters, estimation of which is unreliable for EMs

- **Structural time series models (SVAR, SVECM):**
  - They take policy parameters as given, and are unable to incorporate forward looking features. However, each equation in FPAS carries an economic interpretation.
  - Ad-hoc ordering of variables in SVAR leads to identification problems. The FPAS framework is free of such mis-specification errors.
  - Additionally, our model allows analysis of policy intervention under alternative policy parameters.
Part IV

Model, data and calibration
Model

Domestic block

- Aggregate demand (IS curve)
- Aggregate supply (Philips curve)
Model

Domestic block

- **Aggregate demand (IS curve)**

\[ \hat{y}_t = \alpha_1 y_{t-1} - [\alpha_2 \hat{r}_{t-1} - \alpha_3 z_{t-1}] + \alpha_4 E_t \hat{y}_{t+1} + \alpha_5 y^*_t + \epsilon_t \]

Components:

- Lagged aggregate demand
- Real monetary conditions
  - Real interest rate gap
  - Real exchange rate gap
- Expected output gap
- Foreign output gap
- Exogenous shock

- **Aggregate supply (Philips curve)**
Model
Domestic block

- Aggregate demand (IS curve)
- Aggregate supply (Philips curve)

\[ \pi_t = (1 - \theta_1)\pi_{t-1} + \theta_1 E_t \pi_{t+1} + \theta_2 rmc_t + \epsilon_t \pi \]

Components:
- Lagged inflation
- Expected inflation \((E_t \pi_{t+1})\)
- Real marginal costs
  - Real exchange rate gap
  - Output gap
- Exogenous shock
Model

Domestic & foreign block

- Monetary policy (Taylor rule)
- Exchange rate (UIP condition)
- Foreign block
Model

Domestic & foreign block

- **Monetary policy (Taylor rule)**

\[ i_t = \rho_2 i_{t-1} + (1 - \rho_2)(i^n_t + \rho_3(E_t\pi_{t+4} - \pi^T_{t+4}) + \rho_4 \hat{y}_t) + \epsilon_t \]

Components:
- Deviation of expected inflation from target/objective
- Deviation of output from potential
- Exogenous shock

- **Exchange rate (UIP condition)**

- **Foreign block**
Model

Domestic & foreign block

- **Monetary policy (Taylor rule)**
- **Exchange rate (UIP condition)**

\[
\begin{align*}
    s_t &= 0.7E_t s_{t+1} + 0.31 s_{t-1}^e + (-i_t + i_t^* + prem_t)/4 + \epsilon^s_t \\
    s_t^e &= s_{t-1} + 0.5(\Delta \bar{Z} + \pi^T - \pi^*_{ss}) \\
    \Delta \bar{s}_t &= \pi^T - \pi^*_{ss} + \Delta \bar{Z}_t
\end{align*}
\]

Components:
- Domestic interest rate
- Foreign interest rate
- Premium
- Purchasing power parity condition
- Exogenous shock

- **Foreign block**
Model

Domestic & foreign block

- Monetary policy (Taylor rule)
- Exchange rate (UIP condition)

Foreign block

- Modelled exogenously as an AR process, with constant drift representing the steady state of foreign variables
Calibration and Steady-state values

Calculated based on historical data, literature surveys and judgement about the Indian economy.

<table>
<thead>
<tr>
<th>Description</th>
<th>Variable</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inflation target</td>
<td>$\pi_{ss}$</td>
<td>5%</td>
</tr>
<tr>
<td>Real interest rate trend</td>
<td>$\bar{r}_{ss}$</td>
<td>2%</td>
</tr>
<tr>
<td>Real exchange rate trend</td>
<td>$\bar{z}_{ss}$</td>
<td>2</td>
</tr>
<tr>
<td>Output trend</td>
<td>$y_{ss}$</td>
<td>6.5%</td>
</tr>
<tr>
<td>Foreign real interest rate</td>
<td>$\bar{r}^{*}_{ss}$</td>
<td>0.5%</td>
</tr>
<tr>
<td>Foreign inflation target</td>
<td>$\pi^{*}_{ss}$</td>
<td>2%</td>
</tr>
</tbody>
</table>
## Data description

<table>
<thead>
<tr>
<th>Series</th>
<th>Variable</th>
<th>Data used</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output</td>
<td>$y$</td>
<td>GDP, factor cost (Base: 2004-05)</td>
</tr>
<tr>
<td>Prices</td>
<td>$p$</td>
<td>Wholesale Price Index</td>
</tr>
<tr>
<td>Nominal exchange rate</td>
<td>$s$</td>
<td>INR/USD</td>
</tr>
<tr>
<td>Nominal interest rate</td>
<td>$i$</td>
<td>91-day Treasury Bill rate</td>
</tr>
<tr>
<td>Foreign demand</td>
<td>$y^*$</td>
<td>US GDP, market prices (Base: 2009)</td>
</tr>
<tr>
<td>Foreign prices</td>
<td>$p^*$</td>
<td>US Consumer Price Index</td>
</tr>
<tr>
<td>Foreign nominal interest rate</td>
<td>$i^*$</td>
<td>US 13-week Treasury Bill rate</td>
</tr>
</tbody>
</table>

**Range:** 1996 Q1 - 2013 Q4

**Source:** Datastream
Part V

Results
Model performance
Fitted and actual WPI inflation, YoY (%)
Monetary policy transmission in India: AD channel
IRFs from MP shock
Monetary policy transmission in India: AD channel
IRFs from MP shock (Patra & Kapur 2010)
Patterns in post-crisis Indian business cycle

Output gap, per cent deviation from trend
Patterns in post-crisis Indian business cycle

Real interest rate gap, per cent deviation from trend
Patterns in post-crisis Indian business cycle
Real exchange rate gap, per cent deviation from trend
Factors affecting post-crisis business cycle

Output gap

![Decomposition of Output Gap](image-url)

- Persistence
- Real interest rate gap
- Real exchange rate gap
- Expected output gap
- Foreign output gap
- Demand shock

[Year:Quarter]

[Deviation from Equilibrium]
Factors affecting post-crisis inflation dynamics
Factors affecting post-crisis monetary policy

Monetary policy

Decomposition of MP rate

- Lagged
- Policy Neutral
- Inflation Dev.
- Output Gap
- Shock

[ in percent ]

[ Year:Quarter ]

Factors affecting post-crisis monetary policy

Monetary policy

![Graph showing actual and Taylor-implied monetary policy trends from 2000 to 2012](image-url)
Part VI

Policy implications
Post-crisis monetary policy stance

- Imagine an inflation targeting RBI in a post-crisis world
- They respond to deviations of inflation from target, and output gap from trend
- Could they have contained inflation and anchored expectations?
Policy implications

Post-crisis monetary policy stance: Inflation
Comparison of actual and counterfactual inflation

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Policy implications

Post-crisis monetary policy stance: Expected inflation
In-sample forecasting, 2010 Q1 - 2013 Q4

![Chart showing expected inflation, inflation, and target over time from 2005 to 2013.](image)

In-sample forecast period

Part VII

Conclusion
Summary

- Semi-structural New-Keynesian open economy model for India
- Demand plays a significant role in driving post-crisis inflationary pressure in India
- Monetary policy transmission via aggregate demand channel
- The model predicts tighter monetary policy during 2009 to beginning of 2011 implied by the Taylor rule
- Provides evidence for usefulness of inflation targeting in India
Thank you.