Monetary policy transmission: Channels, method of estimation & real world issues

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Outline

- Definition and role of Monetary Policy
- Transmission mechanism of monetary policy (MPT)
- Estimation of monetary policy transmission
- Effectiveness of monetary policy
  - Degree of transmission: Developed vs. developing economies
  - Financial development and MPT
  - Performance of monetary policy under discretion vs. rules
  - Evolution of rule based monetary policy: Way to Inflation Targeting (IT)
- Performance of monetary policy under IT
- Monetary policy and stabilisation of food inflation

Part I

What is Monetary Policy Transmission (MPT)?

What is monetary policy ?

- Macroeconomic policy laid down by the central bank
- Involves management of money supply and interest rate
- Works through demand side of the economy
- Purpose is to achieve macroeconomic objectives like price stability, growth, liquidity, stability of exchange rate

Instruments of monetary policy

- Reserve requirement
- Open market operations
- Lending by central bank
- Interest rate
- Direct credit control
- Intervention in foreign exchange market

What is monetary policy transmission?

- **MPT the process through which monetary policy decisions affect real economic activities in general and the price level in particular**
- Theoretical background: Neo-classical versus New-Keynesian paradigms
  - New-classical paradigm (King and Plosser, 1984; Kydland and Prescott, 1990): Economic fluctuations are driven by technological shocks, monetary policy can only change the price level
  - New-Keynesian paradigm (Clarida, Gali and Gertler, 1999; Blanchard and Gali, 2007): Under nominal and real rigidities in the economy, monetary policy has real effects in the medium run
- Numerous empirical evidence of real effects of monetary policy innovation (ex. Sims 1992, Cochrane, 1998)

Part II

Monetary policy transmission (MPT)

Channels of monetary policy transmission

- Short- and long-term interest rate channels
- Exchange rate channel
- Asset price channel
- Credit channel
  - Bank lending channel
  - Firms' balance-sheet channel

Channels of monetary policy transmission

Interest rate channel

- Affects investment demand

$$i \uparrow \Rightarrow \text{Cost of capital} \uparrow \Rightarrow \text{I} \downarrow \Rightarrow \text{Y} \downarrow \Rightarrow \pi \downarrow$$

- Wealth effect

$$i \uparrow \Rightarrow \text{Demand for common stocks}$$

$$\text{and housing} \downarrow \Rightarrow \text{Consumption} \downarrow \Rightarrow \text{Y} \downarrow \Rightarrow \pi \downarrow$$

Channels of monetary policy transmission

Exchange rate channel

$$i \uparrow \Rightarrow \text{Return on domestic assets relative to foreign}$$

$$\text{assets} \uparrow \Rightarrow \text{domestic currency appreciates} \Rightarrow$$

$$\text{Net exports} \downarrow Y \downarrow \& \text{Price of importables} \downarrow \Rightarrow \pi \downarrow$$

Channels of monetary policy transmission

Asset price channel

- Affects investment demand

$$i \uparrow \Rightarrow P_e \downarrow \Rightarrow \mathrm{q} \downarrow \Rightarrow \mathrm{I} \downarrow \& \mathrm{Y} \downarrow \Rightarrow \pi \downarrow$$

- Affects consumption

$$i \uparrow \Rightarrow P_e \downarrow \Rightarrow \mathrm{W} \downarrow \Rightarrow \mathrm{C} \downarrow \& \mathrm{Y} \downarrow \Rightarrow \pi \downarrow$$

Channels of monetary policy transmission

Credit channel

- Bank lending channel

$$i \uparrow \Rightarrow \text{Bank loans} \downarrow \Rightarrow \text{C} \downarrow \& \text{Y} \downarrow \Rightarrow \pi \downarrow$$

- Firms' balance sheet channel

$$i \uparrow \Rightarrow P_e/\text{cashflow} \downarrow \Rightarrow \text{Networth of firm} \downarrow \Rightarrow \text{I} \downarrow \& \text{Y} \downarrow \Rightarrow \pi \downarrow$$

Part III

Estimation of MPT

Basic New-Keynesian reduced form model

- Dynamic IS curve: Aggregate demand

$$\tilde{y}_t = \delta \tilde{y}_{t-1} + E_t \tilde{y}_{t+1} - \frac{1}{\sigma}(i_t - E_t \pi_{t+1} - r_t^n) \tag{1}$$

- Dynamic LM curve: Aggregate Supply

$$\pi_t = \beta E_t \pi_{t+1} + \kappa \tilde{y}_t \tag{2}$$

- Monetary policy response of central bank

$$i_t = r_t^n + \phi_\pi \pi_t + \phi_y \tilde{y}_t + \nu_t \tag{3}$$

- $\tilde{y}_t$: Output gap; π_t : Inflation rate; i_t : Nominal interest rate; r_t^n : Natural rate of interest

Estimation

- Vector Auto Regression (VAR)
- Structural Vector Auto Regression (SVAR)
- Bayesian estimation

Basic 3-variables reduced form VAR

Output gap, inflation rate and nominal interest rate

- Simple reduced form VAR

$$
\begin{aligned}
y_t &= a_{yy} y_{t-1} + a_{y\pi} \pi_{t-1} + a_{yi} i_{t-1} + u_{yt} && (4)\\
\pi_t &= a_{\pi y} y_{t-1} + a_{\pi\pi} \pi_{t-1} + a_{\pi i} i_{t-1} + u_{\pi t} && (5)\\
i_t &= a_{iy} y_{t-1} + a_{i\pi} \pi_{t-1} + a_{ii} i_{t-1} + u_{it} && (6)
\end{aligned}
$$

- In matrix format

$$
\begin{bmatrix} y_t \\ \pi_t \\ i_t \end{bmatrix} = \begin{bmatrix} a_{yy} & a_{y\pi} & a_{yi} \\ a_{\pi y} & a_{\pi\pi} & a_{\pi i} \\ a_{iy} & a_{i\pi} & a_{ii} \end{bmatrix} \begin{bmatrix} y_{t-1} \\ \pi_{t-1} \\ i_{t-1} \end{bmatrix} + \begin{bmatrix} u_{yt} \\ u_{\pi t} \\ u_{it} \end{bmatrix} \quad (7)
$$

- Estimate by OLS

Impulse response analysis

- Let the model be

$$Y_t = AY_{t-1} + u_t \tag{8}$$

where

$$Y_t = \begin{bmatrix} y_{1t} \\ y_{2t} \\ y_{3t} \end{bmatrix} = \begin{bmatrix} y_t \\ \pi_t \\ i_t \end{bmatrix}$$

- Impulse response: The response of $y_{i,t+n}$ to a one-time impulse in $y_{j,t}$ with all other variables dated t or earlier held constant is $\frac{\partial y_{i,t+n}}{\partial u_{j,t}}$

Orthogonal impulse response

- The assumption behind ordinary impulse response analysis is that a shock occurs only in one variable at a time. Such an assumption may be reasonable if the shocks in different variables are independent
- If they are not independent, correlation of the error terms may indicate that a shock in one variable is likely to be accompanied by a shock in another variable
- Cholesky orthogonalisation: A recursive shock structure imposed where reduced form errors are a lower-triangular combination of original shocks:

$$\begin{bmatrix} v_{yt} \\ v_{\pi t} \\ v_{it} \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 \\ b_{\pi y} & 1 & 0 \\ b_{iy} & b_{i\pi} & 1 \end{bmatrix} \begin{bmatrix} u_{yt} \\ u_{\pi t} \\ u_{it} \end{bmatrix}$$

- Limitations: Recursive structure may not have economic interpretations

SVAR model

- Impose restrictions on error terms based on economic interpretations
- SVAR restrictions allow to get back the structural parameters from reduced form estimation
- Example:
  - Output gap and inflation has contemporaneous effects on each other
  - Monetary policy works on output gap with a lag but inflation responds to it immediately
  - Monetary policy responds to economic conditions and inflation situation with a lag

SVAR model

- SVAR model of monetary policy transmission

$$A^* Y_t = PY_{t-1} + Bu_t \quad (9)$$
$$Y_t = A^{*-1} PY_{t-1} + A^{*-1} Bu_t \quad (10)$$
$$Y_t = AY_{t-1} + v_t \quad (11)$$
$$(12)$$

where

$$A* = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

and $A = A^{*-1}P$, $v_t = A^{*-1}Bu_t$ where u_t is structural error and v_t is reduced form error

- SVAR shock structure:

$$\begin{bmatrix} v_{yt} \\ v_{\pi t} \\ v_{it} \end{bmatrix} = \begin{bmatrix} 1 & b_{y\pi} & 0 \\ b_{\pi y} & 1 & b_{\pi i} \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} u_{yt} \\ u_{\pi t} \\ u_{it} \end{bmatrix}$$

A quick glance at Bayesian estimation

- **Bayesian estimation**: Status-co of the day for structural model estimation
- So far frequency approach to statistical inference
- Inference about a parameter θ interpreted in terms of repeated sampling
- Bayesian approach treats θ as a random variable taking values from an information set Θ
- The investigator's information and beliefs about the possible values for θ, before any observation of data, are summarised by a prior distribution $\pi(\theta)$
- When data $X = x$ are observed, the extra information about θ is combined with the prior to obtain the posterior distribution $\pi(\theta|x)$ for θ given $X = x$

Advantages of Bayesian estimation

- Number of parameters in a VAR increases as a function of the number of endogenous variables and included lags leading to small observation-to-parameter ratios
- In VAR, dimensionality is controlled by setting many of the coefficients to zero, which may not be always realistic
- In Bayesian analysis, one can set prior distributions for these coefficients centered at zero but have a small, yet non-zero variance
- Copes with miss-specification issue by allowing to estimate a densely parameterised model as opposed to a tightly parameterised structural model

Part IV

Effectiveness of monetary policy across countries

Degree of MPT: Developed vs. developing Economies

1% monetary policy shock

Study	Advanced		Emerging		India	
	Output(%)	Inflation(%)	Output(%)	Inflation(%)	Output(%)	Inflation(%)
Gerlach & Smets (EJPE, 1995), Qtrly						
G-7: UK [CPIindex]	**-0.7**	**-0.9**				
	(1-17, 8)	**(4-17, 17)**				
France [CPIindex]	-0.2	-0.4				
	(1-15, 5)	(4-17, 17)				
Italy [CPIindex]	-0.31	-0.6				
	(2-15, 5)	(4-17, 17)				
Smets & Wouters (JEEA, 2003), Qtrly						
Euro Area [real GDP]	**-0.49**	**-0.9**				
	(1-20, 5)	**(1-20, 20)**				
Catao et.al. (IMF, 2008), Qtrly						
Brazil [GDP gap]			-.09	-0.39		
			(1-6, 3)	(1-6, 3)		
Mallick & Sousa (MD, 2012), Qtrly						
Brazil [GDP Defl.]			-0.2	Insignificant, Price		
			(1-8, 4)	puzzle in 1st Q		
Russia [GDP Defl.]			-0.42	-0.2		
			(1-9, 3)	(1-4, 2)		
India [GDP Defl.]			-0.15	Very small, Price		
			(1-8, 2)	puzzle in 1st Q		
China [GDP Defl.]			Small but	Small but		
			persistent decline	persistent decline		
Yuan & Chen (CER, 2015), Qtrly						
BRICS [CPIindex]			Small, Transitory	Insignificant, Price		
				puzzle in 1st Q		

Degree of MPT: Developed vs. developing Economies

1% monetary policy shock

Study	Advanced		Emerging		India	
	Output(%)	Inflation(%)	Output(%)	Inflation(%)	Output(%)	Inflation(%)
Bhattacharya (JAE, 2015), Qtrly						
Emerging Asia [CPIindex]				Insignificant, Price		
Vietnam						
China						
Thailand						
Malaysia						
Indonesia						
Philippines						
Sri Lanka						
India						
			0.5 (1-6, 5)	Insignificant, Price puzzle in 1st Q		
Aleem (JAE, 2010), Qtrly						
India [log of real GDP and Price]					**-0.14 (2-12, 3)**	**-0.1 (2-12, 3)**
Bhattacharya (IMF, 2011), Monthly.						
India [log of IIP and WPI]					**Insignificant**	**-0.2, Persistent (> 5, 8)**

Prerequisites for efficient MPT

- Well-functioning and highly liquid interbank market for reserves
- Highly liquid secondary market for government securities with broad range of maturities
- Well-functioning and highly liquid markets for equities and real estate
- High degree of international capital mobility and floating exchange rate
- Independent central bank with credible monetary policy rule

Institutional structure behind weak MPT in developing economies

- Most developing countries have poor development of domestic securities markets $\Rightarrow$ make interest rate channel weak
- Small and illiquid markets for assets $\Rightarrow$ weaken asset channel
- Imperfectly integrated with international financial markets, maintain relatively fixed exchange rates $\Rightarrow$ weak exchange rate channel
- Low financial depth weakens interest rate and bank lending channel

Part V

Where does India stand in terms of MPT?

Evidence of weak monetary transmission in India

- So far there is no empirical consensus on the precise working and relative importance of various channels
- Existing literature shows that banks are the conduit of monetary policy and play major role in monetary policy transmission
- Interest rate channel is also found to play a role in MPT in India
- Limited evidence of exchange rate channel found

Channels of MPT in India

Author	Channel
Mohanty (2012)	interest rate channel important
Khundrakpam and Jain(2012)	call money rate; interest rate channel important, ER channel weak
Pandit and Vashisht (2011)	hybrid of interest rate and credit channel works
Patra and Kapur (2010)	ER pass-through low, weak credit market channel, inflation inertial character
Aleem (2010)	bank lending channel important, ER channel weak
Pandit et.al.(2006)	bank rate and CRR; existence of bank lending channel
Prasad and Ghosh (2005)	interest rate channel strengthened after 1998

Channels of MPT in India

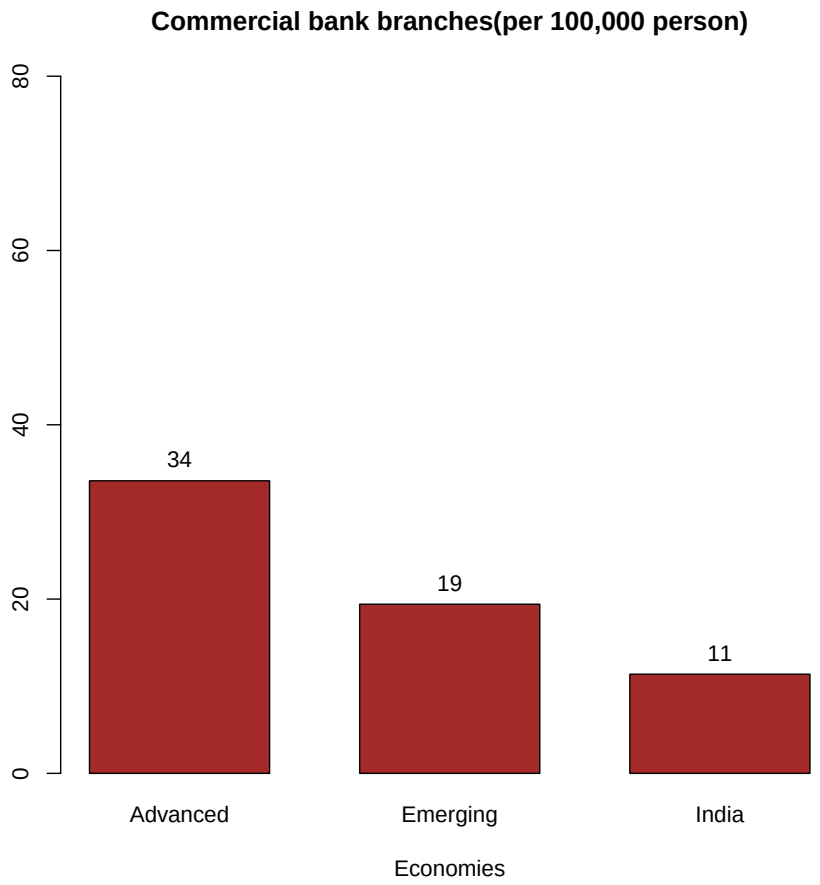
Author	Channel
Bhattacharya et.al. (2011)	ER channel strong; weak MPT due to informal borrowing
Singh and Kalirajan (2007)	[post-reform] interest rates channel important
RBI (2004)	broad money, call money rate; response quicker in post-1994 period, narrow credit channel, interest rate channel weak
Al-Mashat (2003)	bank lending channel insignificant, ER channel important, short-lived effect of interest rate
Rangarajan and Arif (1990)	money supply; price effect stronger

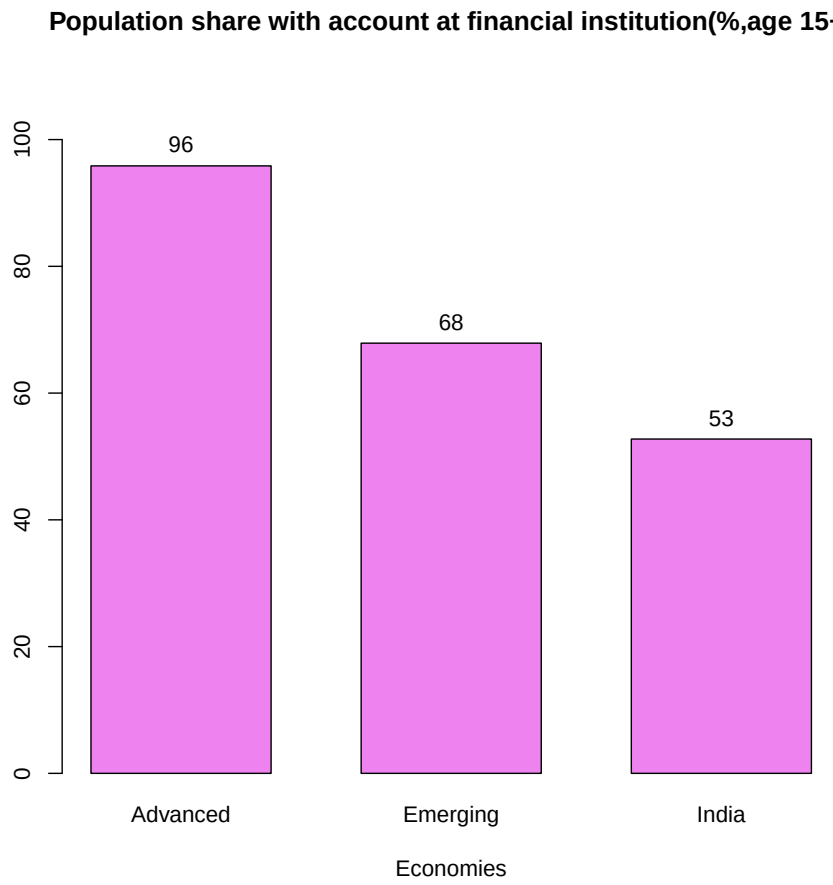
Part VI

Financial structure: Developed vs. developing economies

Financial depth: Developed vs. developing economies

Lack of access to financial services in developing economies

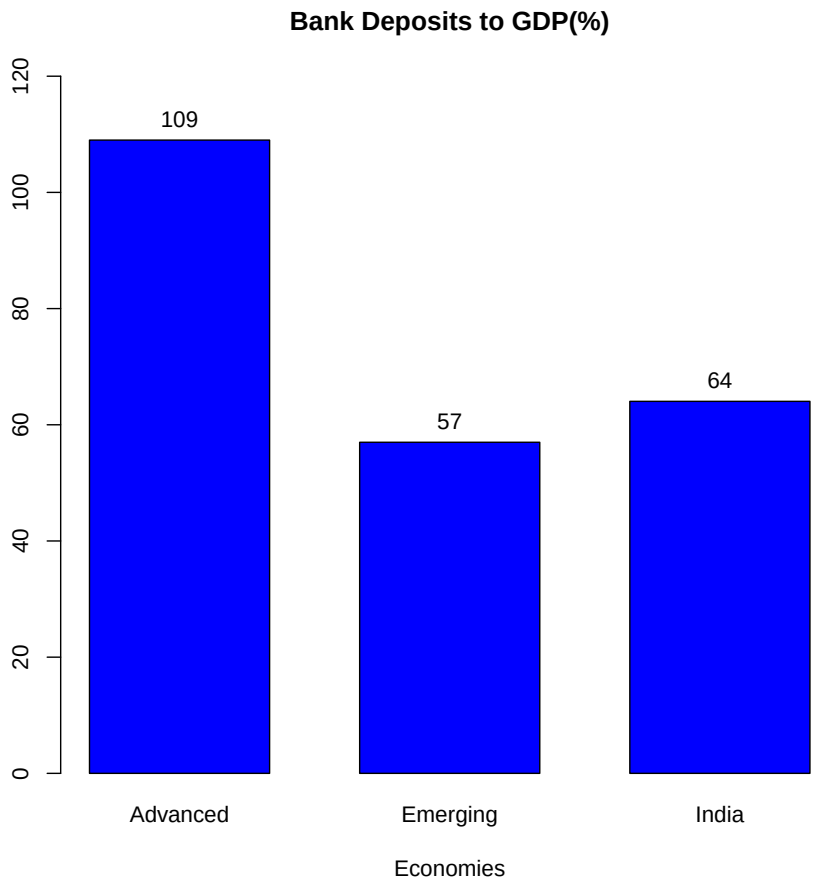


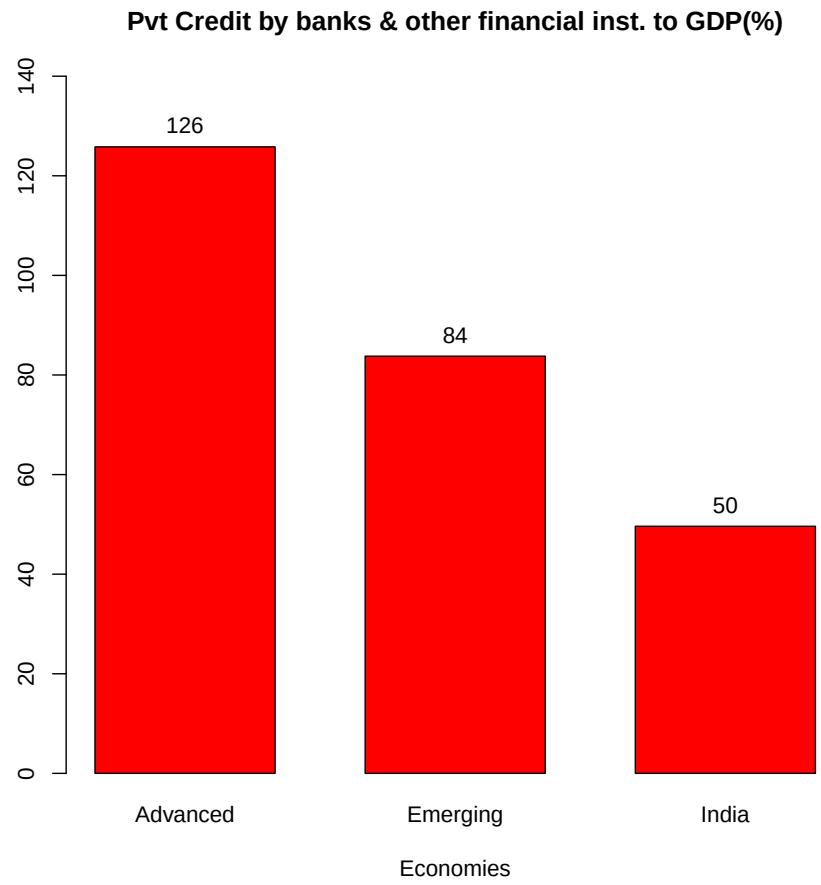


source: World Bank, as on 2014

Financial depth: Developed vs. developing economies

Lack of access to financial services in developing economies

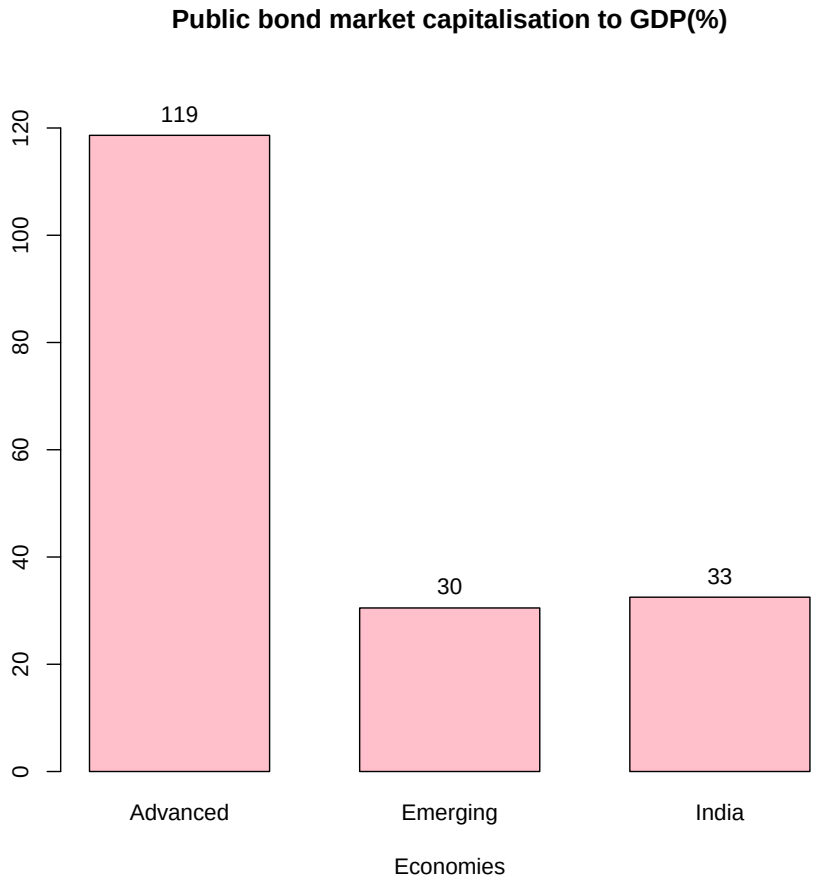


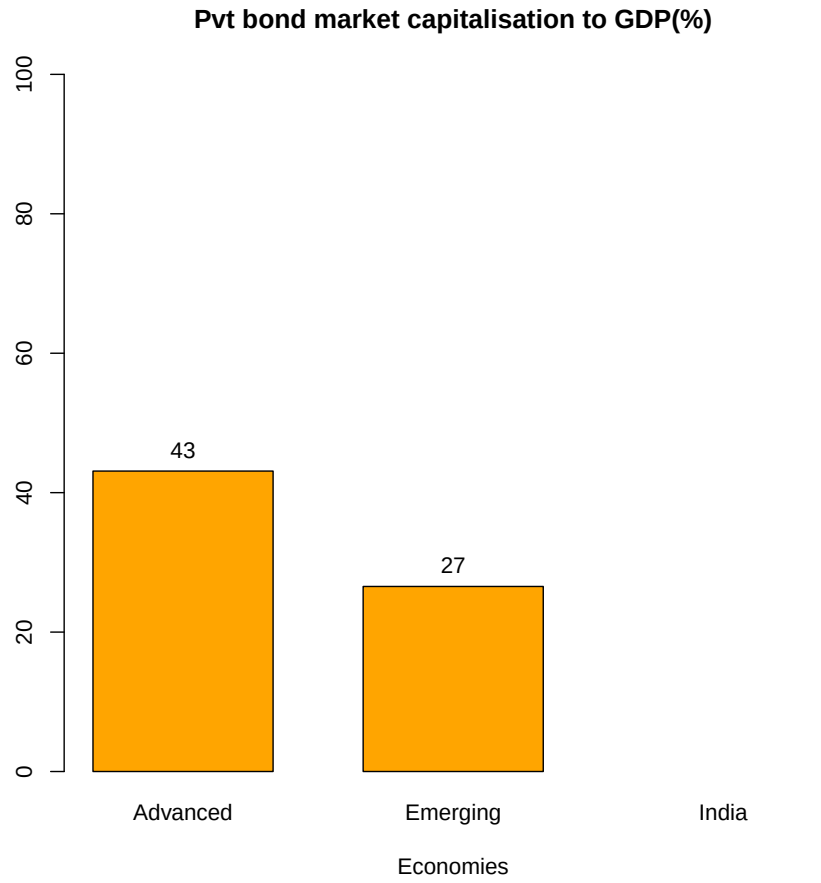


source: World Bank, as on 2014

Financial structure: Developed vs. developing economies

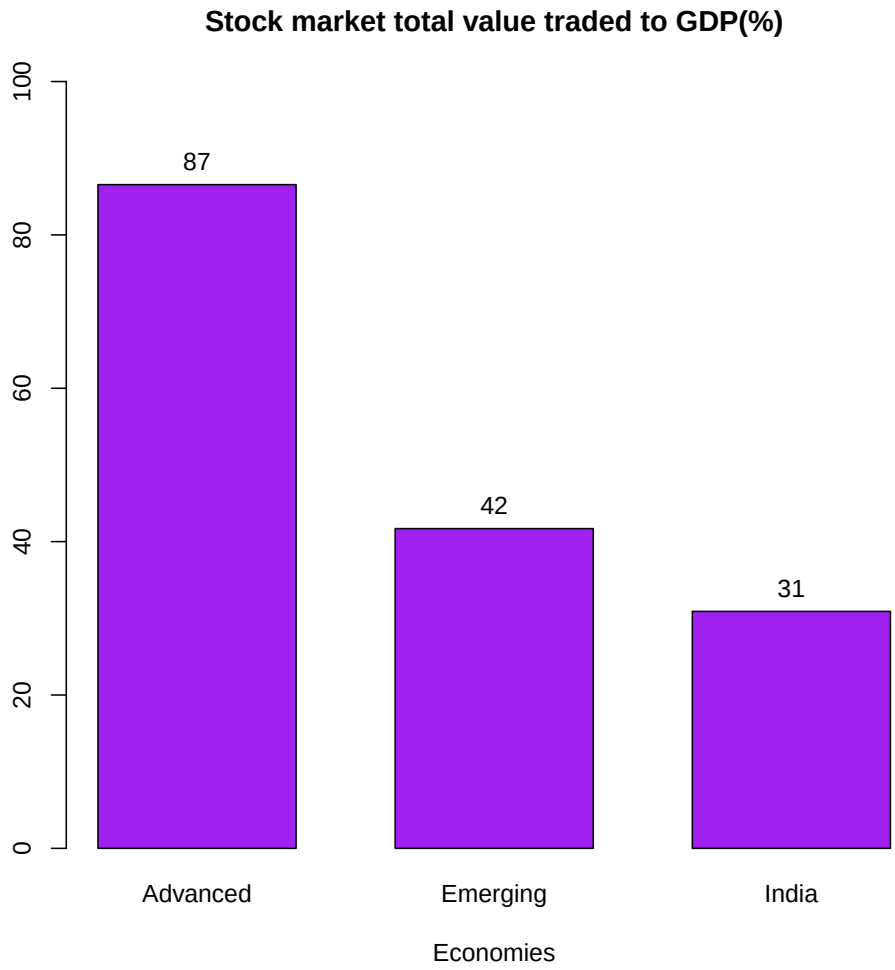
Weak private bond market in developing economies





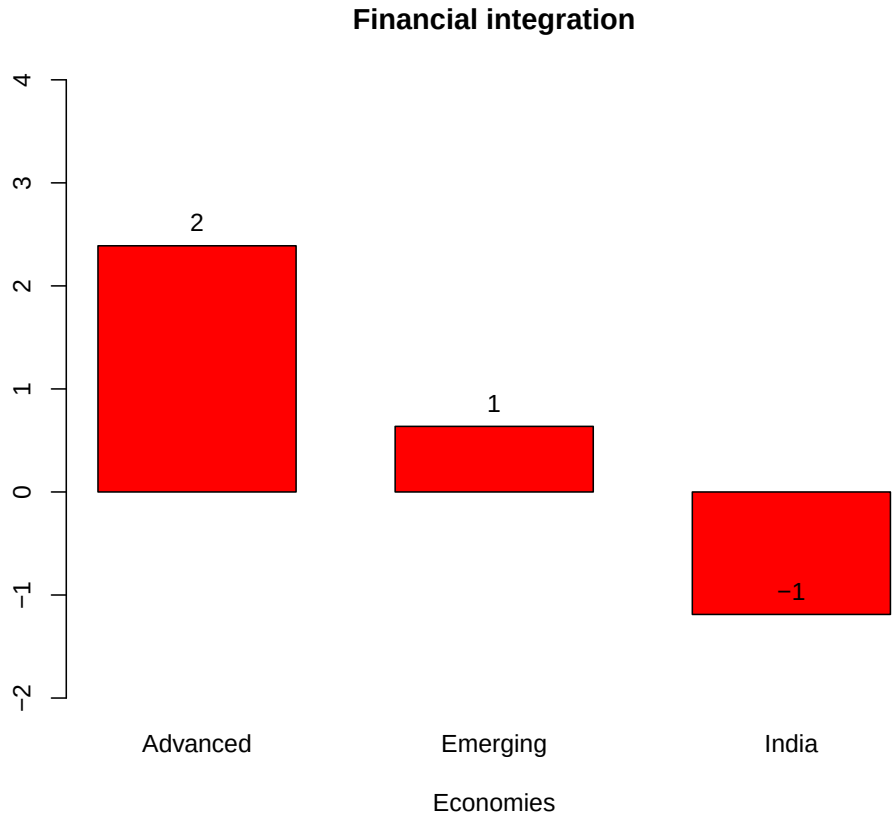
Financial structure: Developed vs. developing economies

Poorly developed domestic security market in developing economies



Financial structure: Developed vs. developing economies

Low level of integration with international financial market



source: Chinn-Ito index as on 2014

Part VII

Credibility of central bank: Evolution of MP from discretion to Rule

Evolution of Monetary Policy: from 'Discretion' to 'Rule'

Historical perspective behind issue of credibility, MP under discretion vs. rule

- Fixed exchange rate system under Bretton Woods providing nominal anchor
- US dollar pegged to gold, all currencies pegged to dollar
- Bretton Woods system collapsed due to unsustainable arrangements during 1968-1973
- Period of global inflation, commodity boom, oil price shock (1970s):
  - Stagflation in U.S.
  - Unanchored inflation expectations imposing further threat of inflation
- Internal stability of prices emerged as a priority

Evolution of Monetary Policy: from 'Discretion' to 'Rule'

Historical perspective behind issue of credibility, MP under discretion vs. rule

- Inflation surge in 1970s: A global phenomenon except in Germany
- Experience of Germany
  - History of hyperinflation motivated for price stability
  - Law on the Bundesbank (1957) made central bank independent from political interference and instituted to 'safeguard currency' interpreted as maintaining price stability
- Theory of dynamic inconsistency of Kydland and Prescott (1977) advocates rule-based policy over discretion
- Foundation of modern rule based central banking leading to Inflation Targeting (IT) central banks

Credibility of central bank

Theory of dynamic inconsistency (Kydland and Prescott, 1977)

- If monetary policy action by central bank not credible, agents will not alter expectations $\Rightarrow$ Weak MPT
- Current decisions of agents depend in part on their expectations of future policy actions
- In context of monetary policy: Central bank announces monetary tightening to achieve low inflation $\rightarrow$ Agents reduce inflation expectation leading to small wage rise $\rightarrow$ Central bank tempted to actually conduct monetary easing to reduce unemployment $\rightarrow$ Since agents know central bank will never credibly commit to reduce inflation, they will not reduce inflation expectation $\rightarrow$ Economy trapped in high inflation equilibrium

Path of Monetary Policy: from Bretton Woods to IT

Search for an alternative nominal anchor

- Target of money stock growth introduced
  - Germany in 1974
  - US, Switzerland, Canada and Italy in 1975
  - UK, France and Australia in 1976

Path of Monetary Policy: from Bretton Woods to IT

Search for an alternative nominal anchor

- Arguments in favour of money growth targets
  - Difficulty in manipulation of real interest rate under high and variable inflation
  - Pre-announced targets may stabilise economic environment and so contribute to growth
  - May affect inflation expectations
  - Targets would improve the credibility of official policies
  - Provide an alternative nominal anchor to the dollar peg

Path of Monetary Policy: Way to IT

- Mixed experiences with money growth target
- Issues with money growth target
  - Unstable demand for money – precise control on money stock not feasible
  - Lack of effective instruments to control money supply

Inflation Targeting Monetary Policy

Concept

- Need for a nominal anchor and the failure of other anchors (monetary or exchange rate targets)
- Need for a framework for the accountability of the central bank
- Inflation target provides a clear benchmark and operates as a precommitment in the time-inconsistency sense

Inflation Targeting Monetary Policy

Definition (IMF)

In an Inflation Targeting (IT) Monetary Policy Regime

- The central bank estimates and makes public a projected, or "target," inflation rate (set by the Law of the country or some memorandum)
- Attempts to steer actual inflation toward that target in medium to long run horizon, using such tools as interest rate changes
- The central bank is accountable to give explanation if actual inflation rate varies substantially from the target beyond the horizon specified

Inflation Targeting Monetary Policy

Institutional structure

- Independence of central bank from political interference
- With sole motivation of price stability facilitating stability of economic performance
- A clear mandate
- Prohibition of monetary financing of public finances

Inflation Targeting Monetary Policy

Experiences

In majority view, inflation targeting successful in terms of

- Stabilising inflation without high output/unemployment variability
- Improved accountability and transparency
- Inflation targeters coped better with the commodity price rises and financial crisis of 2009 than non-IT countries

List of ITs: Advanced economies

Country	Adoption Year	Inflation Measure
New Zealand	1990	CPI excluding interest cost component, indirect taxes, govt. charges and significant chnages in terms of trade
Canada	1991	Headline CPI
UK	1992	Retail price index excluding mortgage interest payments, replaced by Headline CPI from 2003 onwards
Sweden	1993	Headline CPI
Finland	1993	CPI excluding mortgage interest payments, indirect taxes, govt. subsidies and house prices
Australia	1993	CPI excluding mortgage interest payments, indirect taxes and volatile items
ECB	1998	Harmonised index of consumer prices (HICP)

List of ITs: Emerging economies

Country	Adoption Year	Inflation Measure
Brazil	1999	Headline CPI
Chile	2000	Headline CPI
Colombia	2000	CPI excluding agri.food, public services and transport
Hungary	2001	Headline CPI
Indonesia	2005	Headline CPI
Israel	1997	Headline CPI
Mexico	2001	Headline CPI
Peru	2002	CPI excluding food,fruits, vegetables,urban transport

List of ITs: Emerging economies

Country	Adoption Year	Inflation Measure
Phillipness	2002	Headline CPI
Poland	1999	Headline CPI
Romania	2005	Headline CPI
South Africa	2000	Headline CPI
South Korea	1998	Headline CPI
Thailand	2000	CPI excluding food and energy prices
Turkey	2006	Headline CPI
India	2015	Headline CPI

Relating monetary policy to targets

- Seminal paper of Taylor, (1993)
- Rule: policy rate a function of inflation deviation from target and output deviation from long-run potential
- Example for US

$$r = w_\pi(\pi - 2) + w_y \frac{(Y - Y^*)100}{Y^*} + 2$$

  - r is policy rate of central bank in real terms
  - π is inflation rate over previous 4 quarters
  - Inflation target of 2%
  - Y is real GDP
  - Y^* is trend real GDP (equals 2.2% per year from 1984.1 through 1992.3)
  - policy-neutral real interest rate of 2%
  - Central bank chooses w_π and w_y based on medium to long term macroeconomic scenario

Today's framework for rule-based monetary policy practice

Forecasting and Policy Analysis System (FPAS) Models

- Semi-structural New Keynesian Models developed by IMF
- Underlying framework is micro-founded Dynamic Stochastic General Equilibrium (DSGE) Model with
  - Rational expectations
  - Nominal and real rigidities
  - Aggregate demand having a role in output determination and inflation dynamics
- Estimated with Bayesian estimation technique

Today's framework for rule-based monetary policy practice

Forecasting and Policy Analysis System (FPAS) Models

- Provides central banks a practical guide to assess macroeconomic functioning of the country in a single framework
  - Behaviour of output: growth and status of business cycle
  - Behaviour of inflation and exchange rate
  - Impact of demand and supply specific shocks
  - Impact of monetary and exchange rate shocks
  - Impact of foreign shocks
- Allows predicting future monetary policy path to contain inflation rate in the country at a desired level in medium to long term

Application of FPAS models

- Variants of this model have been applied in countries with a full-fledged inflation targeting (IT) framework, as well as those transitioning to an IT regime
- Broadly applied by IT central banks: ECB, Australia, New Zealand
- Limited application to emerging economies: Keneya (Andrle, Berg, Morales, Portillo, and Vlcek, 2013), Sri Lanka (Anand, Ding, and Peiris, 2011)

Application of FPAS models

- Implemented by Czech National Bank (Andrle, Hledik, Kamnik, Vlcek, 2009)
- Literature on India
  - Estimated new Keynesian closed economy model for India (Patra, Kapur, 2010)
  - FPAS models (Bhattacharya, Patnaik, 2014), Reserve Bank of India (in collaboration with IMF)

Performance of IT in emerging economies

Hove, Tchana and Mama (RIBF, 2017)

- 15 IT emerging economies from 1991 to 2008
- Deviation from IT: Sample average

	Frequency	Magnitude	Duration
Below target	15.96	-1	2.01
Within target	41.85		
Above target	42.75	3.43	4.94

- Probability of inflation being
  - Below the target
  - Within the band
  - Above the target

  on various institutional factors: monetary, fiscal and financial

Performance of IT in emerging economies

Hove, Tchana and Mama (RIBF, 2017)

- Monetary institution–Measures of Central Banks Independence
- Fiscal institutions–Budget deficit to GDP ratio and domestic debt to GDP ratio
- Financial sector development—Private sector credit to GDP ratio
- Other controls such as Output gap, inflation persistence, exchange rate gap, terms of trade
- Findings:
  - Higher central bank independence reduces probability of inflation being above target and increases probability of being within band
  - Higher fiscal deficit to GDP ratio increases probability of inflation to go above target
  - Higher credit to GDP ratio increases probability to go below target and to remain within band
  - Central bank independence, strong fiscal and financial institutions matter for IT monetary policy to be successful

Part VIII

Monetary policy in India

Monetary policy in India: Pre-IT

Monetary policy in India has been motivated by the multiple objectives

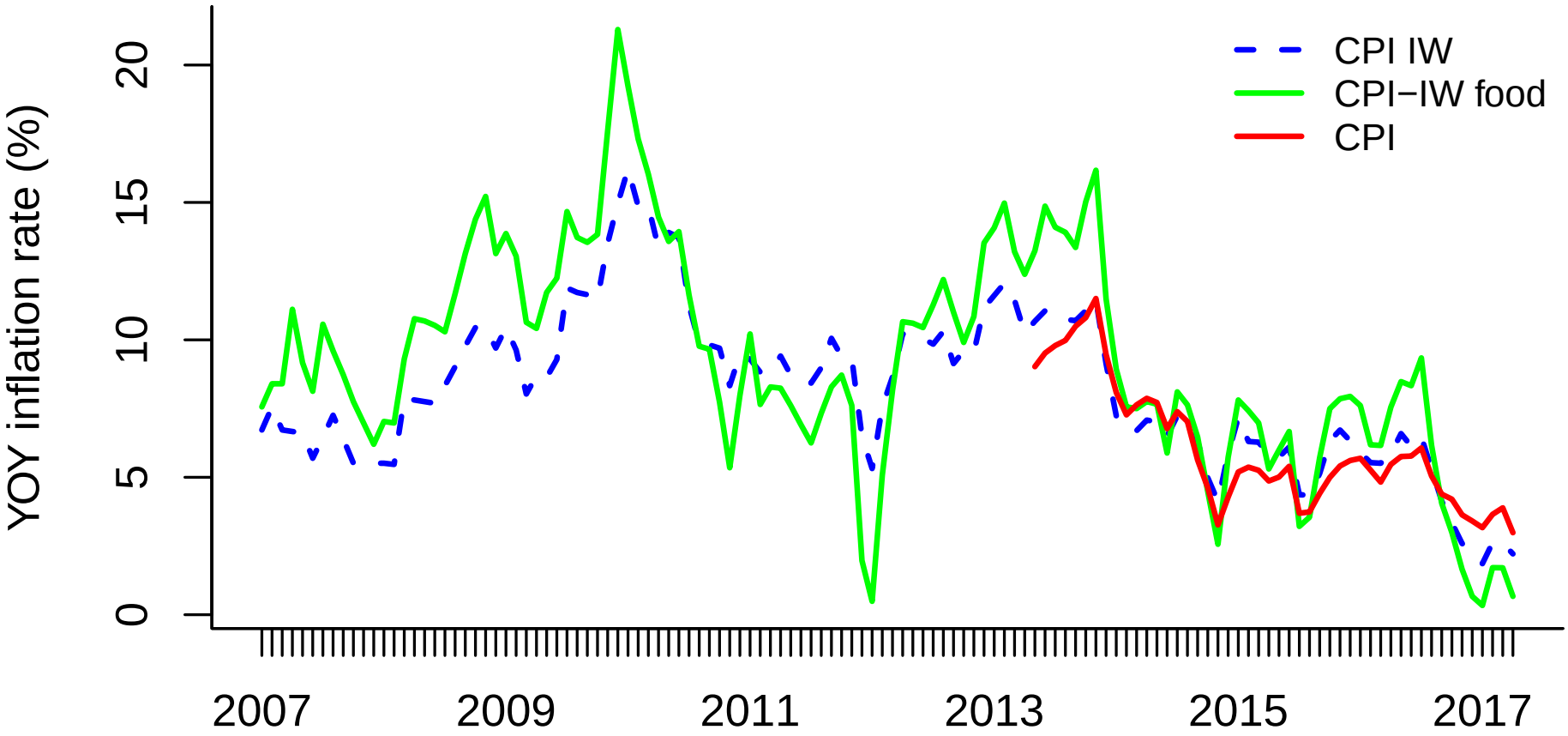
- Fostering economic growth
- Controlling inflation
- Stabilising exchange rate volatility

Monetary policy instruments in India

- Direct instruments
  - Cash Reserve Ratio (CRR)
  - Statutory Liquidity Ratio (SLR)
- Indirect instrument
  - Repo Rate/Reverse Repo Rate
  - Open Market Operations (OMO)
  - Liquidity Adjustment Facility (LAF)
  - Marginal Standing Facility (MSF)
  - Bank Rate

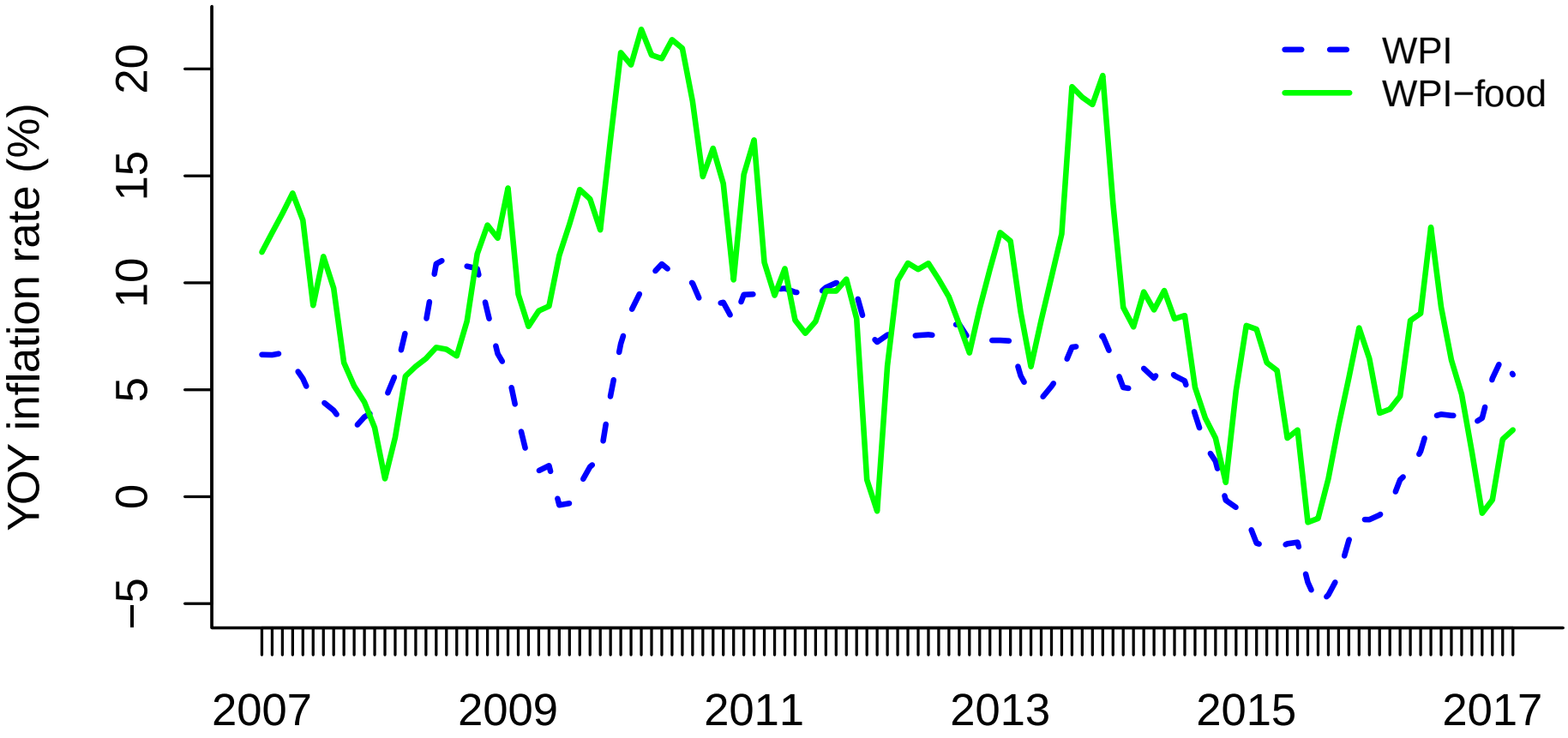
Macroeconomic scenario in recent past

In last decade, consumer price index (CPI) inflation crossed the level of 10% several times and was over 15% in January, 2010



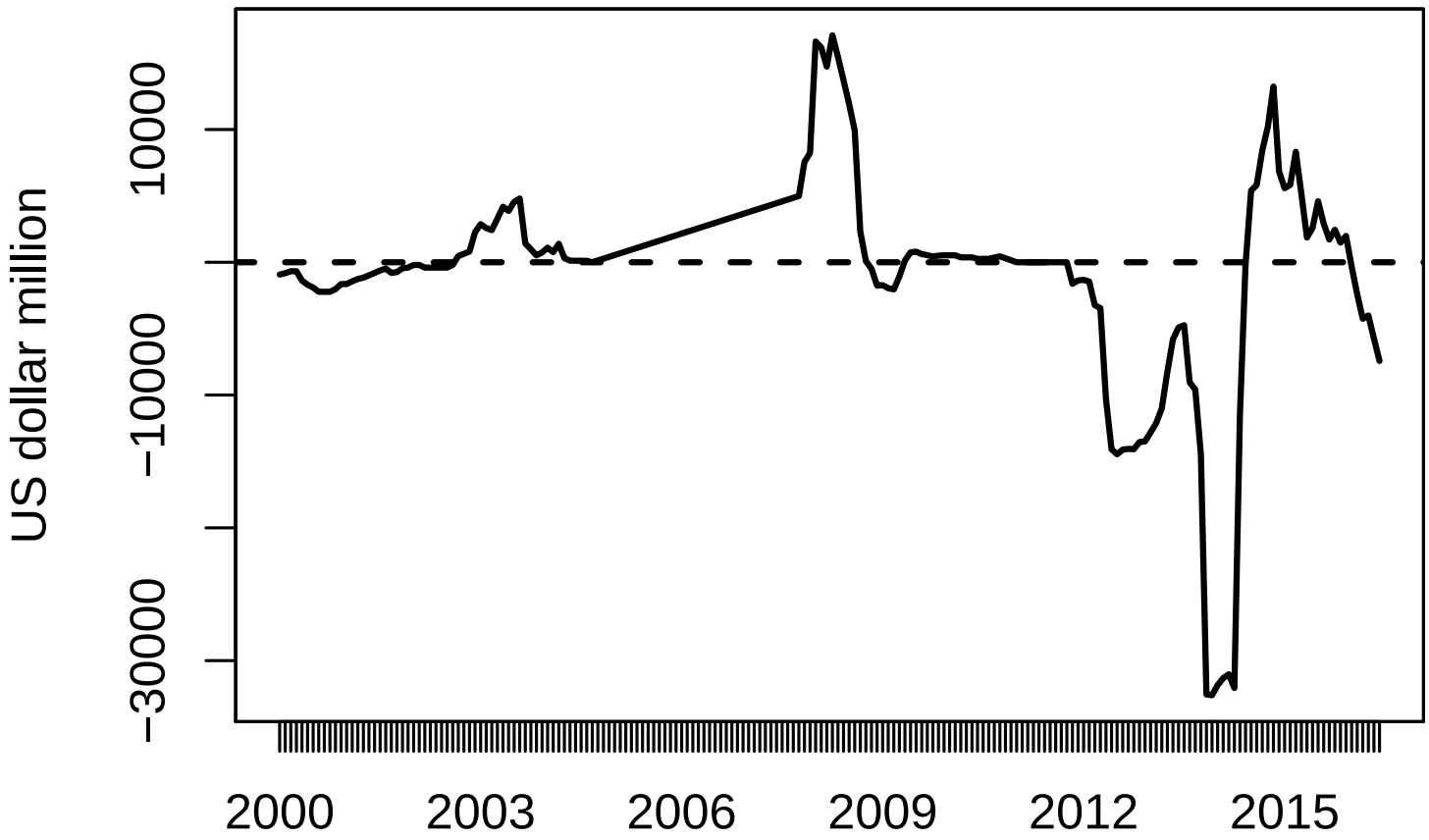
Macroeconomic scenario in recent past

High and persistent WPI inflation driven by food inflation

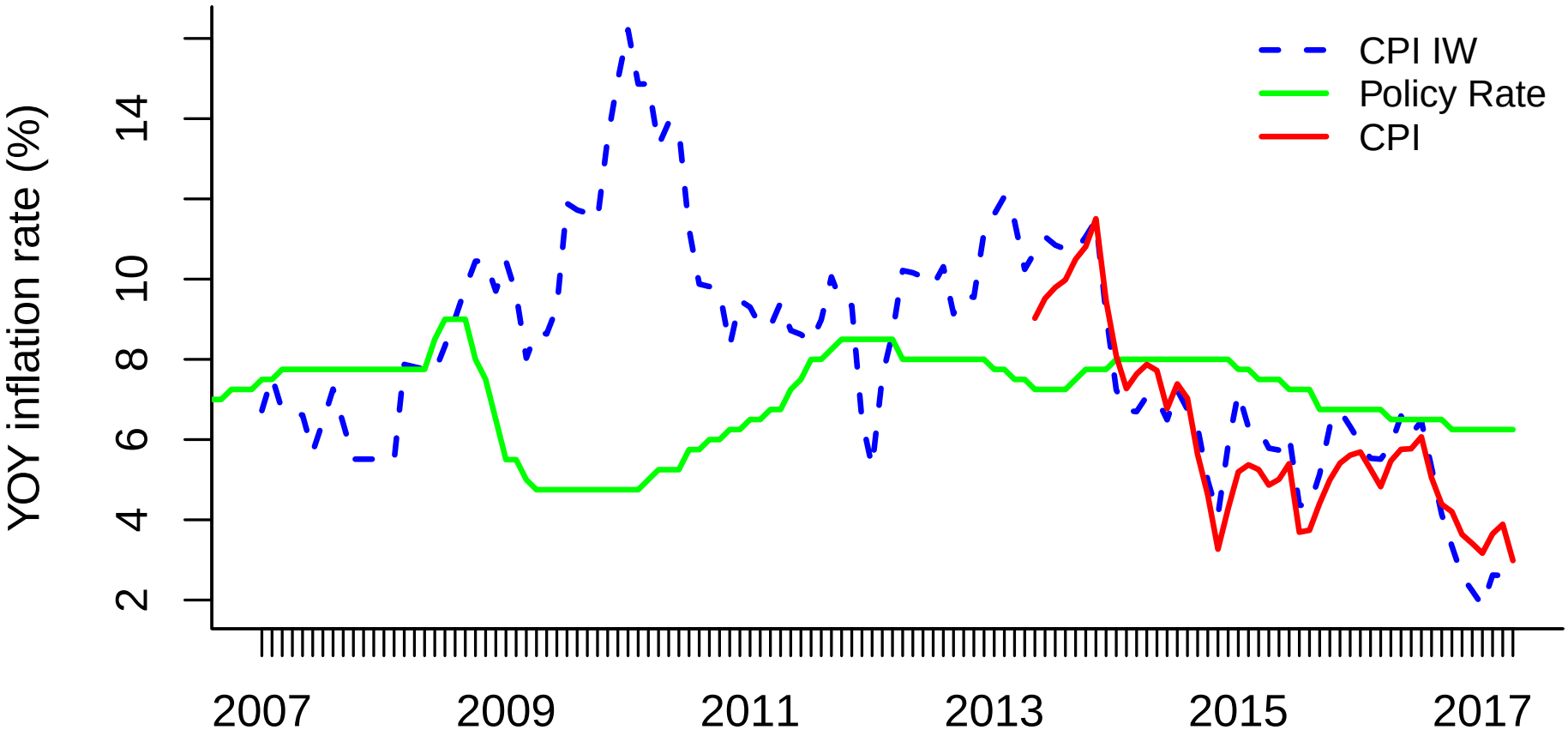


Transition from fixed to flexible exchange rate regime

2009-11 was a period of RBI's neutral position in terms of foreign exchange market intervention. Absence of nominal anchoring added to unanchored inflation expectation



Despite monetary tightening, inflation pressures have persisted



Monetary policy developments

- Urjit Patel Committee Report in January, 2014
- RBI's monetary policy statement—follow the glide path suggested by the Patel committee to bring down retail inflation to 8% by January 2015 and 6% by January 2016

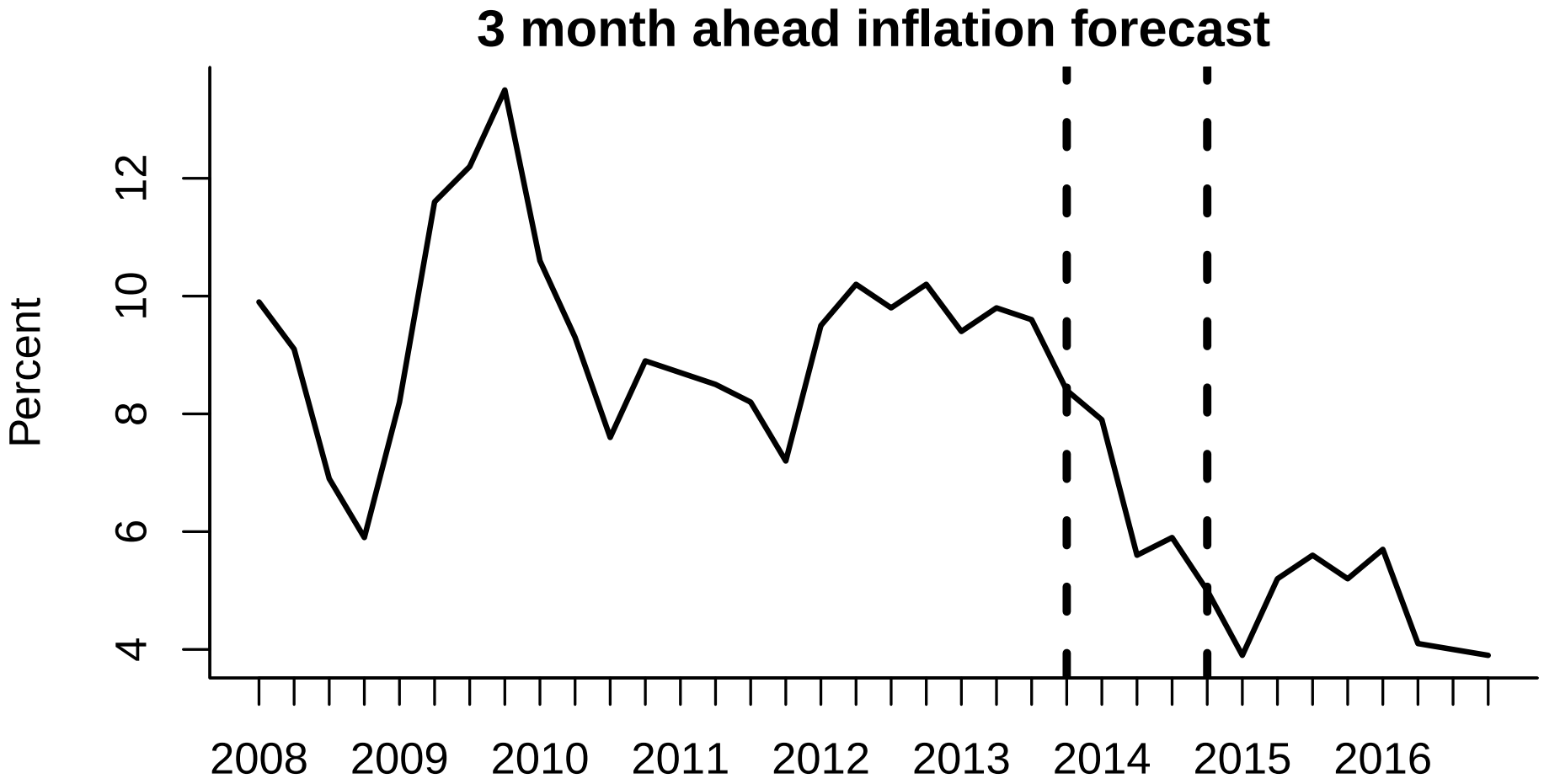
India's transition to formal IT

India's current monetary policy regime

- India entered into formal Inflation Targeting (IT) regime on the 20th February, 2015 through an agreement between MOF and RBI
- The inflation in headline CPI published by the Ministry of Statistics and Programme Implementation chosen as the indicator for target
- Currently, the target is to achieve CPI inflation of 4% with a band of +/- 2% in medium term

Inflation expectations pre and post IT in India

In absence of an alternative nominal anchor, inflationary expectations started rising and have persisted above 6% since 2009



Part IX

Food inflation and monetary policy

Why does central bank bother about food inflation?

- High food inflation has transmission effect to core and headline inflation
- High food inflation transmits to core inflation via
  - Rise in labour cost due to wage-price spiral
  - Substitution effect
  - Rise in real income of producers in food sector
- Headline inflation increases directly if food constitutes a large share of consumption basket and indirectly via rise in core inflation

Role of monetary policy to stabilise food inflation

Theory

- Targeting core inflation, after taking into account the pass-through of food inflation to non-food inflation, is optimal under the assumption of complete financial market (Aoki, 2001)
- Targeting broad CPI is welfare superior
  - When financial market is incomplete so that farmers do not have access to financial services for saving or borrowing (Anand and Prasad, 2010; Anand, Prasad, and Zhang, 2015)
  - When food constitutes a large share of the consumption basket, be it a non-traded good (Soto, 2003; Pourroy et al., 2016) or an imported one (Catao and Chang, 2015)
- By stabilising headline inflation, central bank stabilises fluctuations in consumption
  - By stabilising real exchange rate
  - By stabilising real income of food producers
  - By stabilising relative price of food with respect to non-food when food is a non-traded sector and hit by a negative productivity shock

Practice

World Economic Outlook, IMF, 2011

"Because shocks to commodity price inflation are typically beyond the control of policymakers, hard to predict, and often not sustained, central banks seeking to establish credibility are generally better off setting and communicating their monetary policy in terms of underlying inflation rather than headline inflation. A headline framework may be preferred, however, if economic agents place a much higher value on the stability of headline inflation than on the stability of output"

Practice

Country	Food share	Target	Range
Brazil	22.54	Headline CPI (YOY)	4.5% (+/-2%)
Chile	16.50	Headline CPI (YOY)	3% (+/-1%)
Colombia	28	CPI excluding agri. food, public services, transport (YOY)	2-4%
Hungary	17.60	Headline CPI (YOY)	3% (+/-1%)
Israel	-	Headline CPI (YOY)	3-5%
Mexico	16.90	Headline CPI (YOY)	3% (+/- 1%)
Peru	21.20	CPI excluding food, fruits vegetables,urban transport (YOY)	1-3%
Poland	22.00	Headline CPI (YOY)	2.5% (+/- 1%)
South Korea	13.60	Headline CPI (YOY)	3% (+/-1%)
South Africa	16.90	Headline CPI (YOY)	3-6%
Thailand	23	CPI excl. food & energy prices (YOY)	0-3.5%
Turkey	22.30	Headline CPI (YOY)	5%
India	**39%**	**Headline CPI (YOY)**	**4% (+/-2%)**

Source: OECD, Central Banks, BIS

Can monetary policy stabilise food inflation?

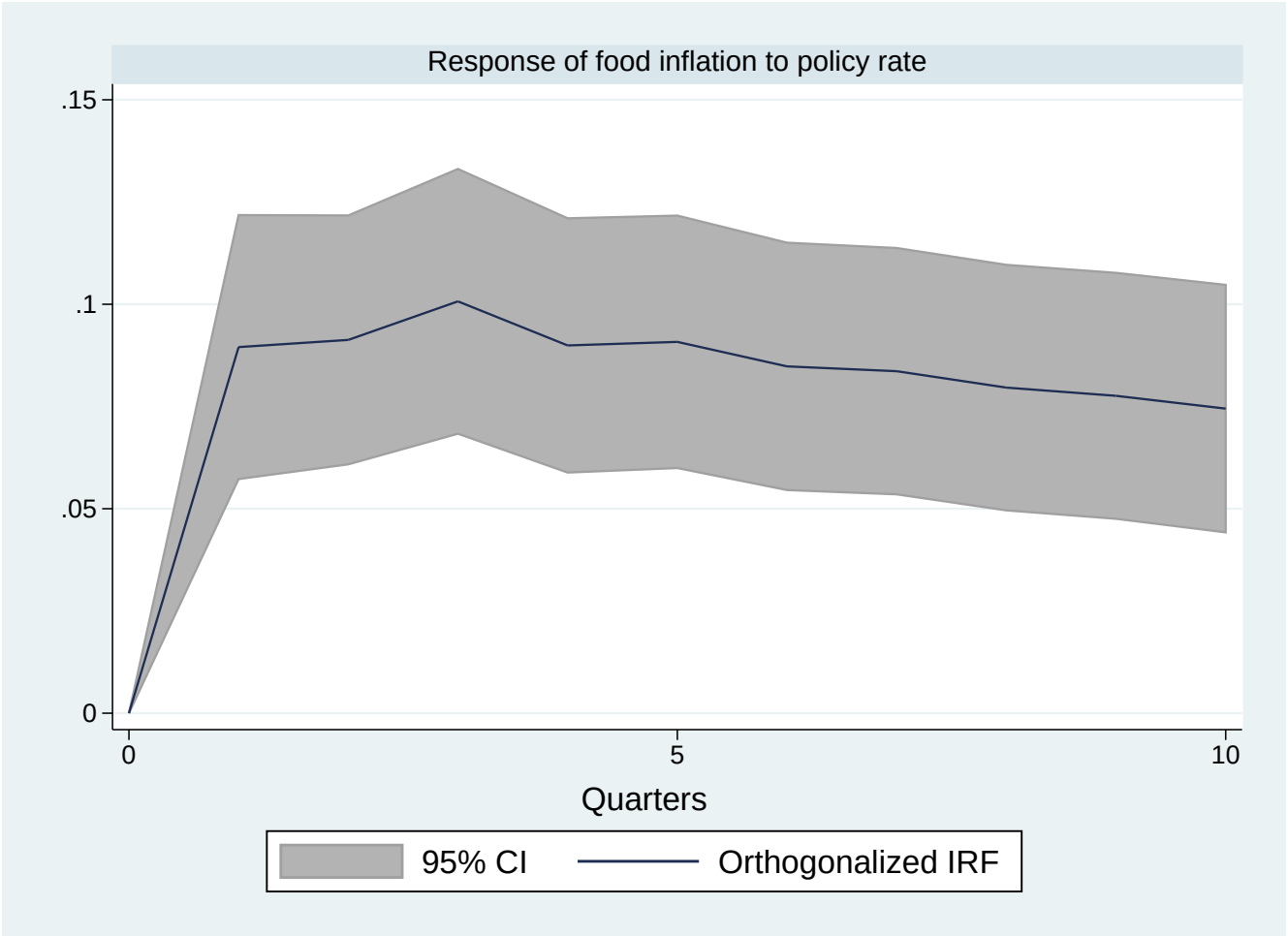
Empirical evidence

- Recent strand of literature developing on response of commodity prices to monetary policy shock
- No empirical consensus found
- Stabilising role of monetary policy for real commodity prices, including agricultural commodities in US (Frankel, 2008; Akram, 2009; Scrimgeour, 2014)
- Channels: Higher (lower) interest rate
  - Increases (decreases) storing cost and hence encourages suppliers to deplete (accumulate) stocks, thereby enhancing (reducing) the supply
  - Encourages speculators to re-arrange portfolio by shifting from (to) commodity contracts to (from) treasury bill
  - Aggregate demand channel

Can monetary policy stabilise food inflation?

- Unexpected monetary policy innovation can be destabilising for food inflation (Hammoudeh, Nguyen and Sousa, 2015)
- Initial price puzzle observed following a monetary contraction in all classes of commodities in US, with a persistent rise in food prices.

Empirical evidence from a panel of developed and emerging economies



Empirical evidence from a panel of developed and emerging economies

- An unanticipated monetary policy tightening causes food inflation to rise persistently
- Monetary tightening increases the price of capital intensive non-food products via cost channel of monetary policy transmission (Barth and Ramey, 2001; Chowdhury, Hoffmann and Schabert, 2006; Gaotti and Secchi, 2006; Henzel, Hlsewig, Mayer, Wollmershuser, 2009)
- Durable goods, which can be bought against loan also becomes expensive following an interest rate hike.
- Households substitute consumption of non-food items by food, causing an upward pressure on food prices
- For emerging economies having large share of food in the consumption basket and a large share of population consuming food at far below the satiation point, this effect is large compared to advanced economies

Summary

- Developing economies found to have low monetary policy transmission into economic activities and prices
- Effectiveness of monetary policy depends on financial and institutional structure of an economy
- Strengthening financial system of an economy improves monetary policy transmission
- An independent central bank with rule based price stabilisation policy enhances credibility and helps in anchoring inflation expectations
- When food constitutes a large share in consumption basket, as in developing economies, stabilising headline inflation including food component enhances welfare in the economy
- But, in the backdrop of inflationary pressure stemming from food sector, a monetary tightening may turn out to be destabilising for food as well as overall inflation

Thank you