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ABSTRACT

An increase in policy rates, in order to control inflation, may lead to a credit crunch, slowdown in economic growth and spurt in non-performing loans. In this chapter, we explore the impact of policy rate shocks on the volume and cost of bank credit, in an imperfect competition framework. We examine the conditions under which credit growth may occur, despite a rise in policy rates. This phenomenon is consistent with recent Indian experience. The paper also analyzes central bank monetary policy announcements, in an extensive form game-theoretic structure, which take into account future decisions by banks and borrowers, on the quantum and cost of credit. We discuss how the central bank fixes its optimal policy rates, given its dual objectives to manage price stability and financial stability in an economy. We highlight the dilemma that it faces when it tries to manage both inflation and systemic risk, through its policy rate announcements.

Keywords: Bank Credit, Price Stability, Systemic Risk, Extensive-Form Games

JEL Classification: C72, D43, E44, E52, G21, G28.

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Financial Instability, Credit Growth and Optimal Monetary Policy Design

Section 1: Introduction[1]

The recent growth in retail credit, by Indian banks, has aroused widespread curiosity among academics and policymakers alike (Kumar and Senapati 2023). The spike in credit offtake has occurred in the wake of a sharp and sustained rise in policy rates, by the RBI, in 2022-23. However, policy rate hikes during the same period have led to bond market collapse, premature withdrawal of wholesale deposits and a string of bank failure across US and Europe (IMF 2023). Hence, the obvious research agenda is to investigate the conditions under which (i) bank credit can flourish or (ii) financial instability may occur, in a tight money regime.

In this paper, we employ a game-theoretic approach to address a related problem: should financial stability be an objective of monetary policy? In our simple model, the central bank acts as a Stackelberg leader, to set optimal repo rates. In response, the monopoly bank (or, a group of oligopolistic banks) sets the equilibrium loan rate. Hence, aggregate loan volume is also determined. We show that, if the central bank tries to balance price stability and financial stability[2], it will not raise or lower policy rates to the same degree as the change in GDP growth and inflation gaps. The fear of financial instability restrains it from a sharp spike or cut in policy rates. As a result, under certain conditions, bank credit may register a healthy rate of growth.

In this article, we make the following contributions. First, we present a parsimonious theoretical framework, to understand the sharp rise in bank credit (both retail and corporate), during the tight money regime in India, from May 2022 onwards. While the policy repo rate has risen by 250 basis points, between May 2022 and February 2023, credit disbursement has also shot up, especially in the personal loan segment. We state the conditions under which such a counterintuitive result may occur. Hence, we add to the large literature on the credit channel of monetary policy transmission (e.g. Bernanke and Blinder 1988).

Secondly, much of the literature treats individual agents as the first mover, while the central bank is the follower. For instance, in the seminal Barro-Gordon (1983) model, wages and prices are higher than they should be, because agents anticipate surprise inflation by the central bank, in future (Gibbons 1992). However, in our story, the central bank decides policy rates, at the outset, while banks respond with the equilibrium loan rate. This role reversal gives the central bank some degree of control over the credit channel of monetary policy transmission. This result chimes in well with a world in which

[1] This paper has benefited from helpful comments and suggestions by Jiji Mathew, Partha Ray and Saibal Ghosh. The usual disclaimer applies.

[2] We thank Saibal Ghosh for suggesting that management of financial stability, rather than output stability, should be a more appropriate goal of monetary policy, at present

the bargaining power and information processing ability of agents is limited, relative to the central bank.

Thirdly, we contribute to the recent literature on the changing contours of monetary policy, after the global financial crisis (GFC) of 2008. Before the meltdown, traditional discourses on Macroeconomics would treat a bank as a passive conduit of credit from the central bank to the real sector (Dornbusch et. al. 1998). However, after the collapse, the role of banks became the focal point of policy debates in Macroeconomics (Blanchard 2018). It was felt that their asset allocation strategies (i.e. the manner in which funds were deployed in loans, bonds and structured products) had aggravated systemic risk. It was also argued that such errant behaviour was triggered by sustained easy money policies of central banks in advanced countries for more than a decade. The allegation was that monetary policy, focussed only on stabilization of price and output, was oblivious to the perils of financial instability. The important question, now, is whether monetary policy should be used to reduce the likelihood of financial crises (in addition to its traditional goals), or whether the management of financial instability should be best left to macroprudential tools like the Countercyclical Capital Buffer (Blanchard 2018). Our model suggests that recognition of the threat of financial instability instils more caution with rate fixation – neither a sharp rise nor a steep cut in policy rates. As we discuss later, a sharp and prolonged decline in policy rates followed by a sudden spike is a strong early warning indicator of financial crises.

Finally, we provide the microfoundations of the Taylor rule, for nominal policy rate determination. The Taylor rule is a famous heuristic, which uses arbitrary coefficients for inflation and output gaps. In our model, the coefficients are derived through an optimization process. They are based on parameters related to financial instability. The most important difference between the original Taylor rule (Taylor 1993) and the one we derive lies in the coefficient of the inflation gap. In the original model, the coefficient is expected to be greater than one, so that the central bank changes the nominal policy rate more than the change in inflation. The real rate increases and spending is reduced. In our framework, the response is less than proportionate, given the fear of financial instability.

The rest of the paper is structured as follows. Section 2 presents some stylized facts on policy rate change, credit growth and economic growth in India. In Section 3, we review the existing literature, to contextualize our work. Section 4 develops a dynamic game framework, in which the central bank sets the policy rate first and the bank reacts with equilibrium loan rates and volumes. In section 5, we discuss the recent US macro-financial trends and monetary policy response, in light of our model. Section 6 concludes, with some suggestions for future research.

Section 2: Stylised Facts - India

The Indian economy went through a phase of price surge, after the Covid pandemic, which was aggravated by supply shocks created by the Ukraine-Russia war. Retail inflation had breached the target of 4% ± 2% set by the Reserve Bank of India (RBI) and remained elevated after March 2022. In line with other central banks, the RBI started raising the policy pepo rate, from 4.00% in May 2022, to 6.5% by February 2023 (Figure 1).

There is a potential short-run trade-off between economic growth and inflation. High inflation, i.e. beyond a threshold, can be inimical to growth. Inflation targeting monetary policy authorities have to consider this dilemma when they choose policy rates and liquidity measures. As can be seen from Figure 2a, this trade-off was valid for the Indian economy in the past. Bouts of high inflation slowed down output growth and benign prices accompanied faster economic growth. However, after the pandemic, this relationship broke down as the economy registered a sharp recovery, in a low interest rate environment, despite price conflagration. Furthermore, the growth momentum has continued even during the latest tight money regime (Figure 2b).

One of the transmission mechanisms of tightening monetary policy is through the credit channel. Lending rates of banks and financial institutions adjust to higher policy rates. Figure 3 shows the correlated changes to lending rates (weighted average lending rates on outstanding and fresh loans and the MCLR) as RBI has changed the repo rate. In the latest tightening phase (May 2022 to March 2023), banks have passed on 181 bps of the 250 bps rate hike to fresh loans and the average lending rate on outstanding credit has increased by 100 bps.

Increase in policy rates reduces supply of bank loans, which in turn reduces spending by borrowers (Bernanke and Blinder, 1988). Furthermore, higher interest costs weaken corporate balance sheets, reducing their ability to borrow from all sources and creating a potential risk of default. Retail credit driven consumption can also be expected to fall with rising interest rates. Figure 4 demonstrates this relationship, in the long-run, but also highlights that in the period after Covid, loan volumes continued to spike despite consecutive rate hikes.

During this tight money phase, such paradoxical credit growth has been driven by the spurt in retail loans (Figure 5). However, credit to industry has slowed down (Figure 6).

There is a strong interdependence between credit expansion and economic growth. (Figure 7). The significance of such positive correlation is clear – if credit continues to rise, despite the increase in rates, economic growth will be boosted. Higher GDP growth, in turn, will accelerate credit growth. A virtuous cycle – between the financial and real sectors – will ensue.

The non-performing loans (NPLs) of the Indian banking sector have also shrunk over the last 4 years (Figure 8). For banks, this implies a declining probability of default (PD) for their credit portfolios and a corresponding improvement in profitability and capital adequacy.

The main research questions which emerge from these stylized facts are as follows:

1. Under what conditions will credit continue to grow, during a tight money regime?

2. How should a rational central bank set policy rates, over time, to ensure adequate credit growth?

We seek the answers to these questions in Section 4. The next section provides the backdrop, against which we develop our theoretical model on commercial and central bank interactions.

Section 3: Literature Review

Our work aims to tie up two strands of literature. The first is on the Credit Channel of Monetary Policy transmission. One of the seminal papers, in this domain, is Bernanke and Blinder (1988). Through the addition of a CC (i.e. Commodities and Credit) curve, to the IS-LM framework, the authors investigate the effects of factors like an increase in bank risk aversion, tight money policy and GNP shocks on credit supply and loan rates. Another important contribution is by Bernanke and Blinder (1992). It provides evidence on the presence of the credit channel based on US data. It establishes that a monetary contraction is followed by a decline in aggregate bank lending. It does not explain further whether the reduced credit volumes are due to demand or supply factors in the credit markets. Kashyap and Stein (2000) analyze a large dataset of US banks over 20 years, to conclude that the impact of monetary policy on lending is stronger for smaller banks and those with less liquid balance sheets.

Altunbas et.al. (2010) examine the impact of monetary policy regimes on bank risk profiles. They find that, in an environment of sustained low short-term interest rates, bank risk increases. This may happen due to the manner in which banks measure risks related to valuations, incomes and cash flows during periods of low interest rates. It may also happen through their search for higher yields. They imply that central banks need to be aware of the financial stability implications of monetary policy actions and the fall-out on longer term macroeconomic growth. Aikman et. al. (2020) infer that the relationship between the credit gap and the monetary policy transmission channel is non-linear. When the credit gap is low, monetary tightening leads to increase in unemployment, contraction of GDP and decline in credit. However, when the credit gap is high, financial constraints do not bind during a tight money regime, and this works against the contractionary effect.

These papers establish that there is a strong linkage between monetary policy actions and the price and quantum of bank credit, which in turn has implications for financial stability. We will examine the nature of such a relationship, within a theoretical construct, in the next section. However, the more important branch of literature relates to the objectives of monetary policy. The goal will shape monetary policy strategies, which will be transmitted to banks as fluctuations in quantum and cost of credit.

The traditional goal of the monetary policy authority is to minimize a discounted loss function, which consists of squared deviations of output and inflation from their target levels (Clarida et.al. 1999). The weight (i.e. relative importance) of each component need not be the same. This principle - known as Flexible Inflation Targeting - served the discipline well till the GFC. However, in the wake of the collapse, central banks came under increased scrutiny due to their persistence with cheap money policies before the crisis. It was alleged that the single–minded pursuit of recovery from a recession, after the Dotcom bubble and 9/11, made them neglect the dangers of sustained easy money policy. It was proposed that monetary policy should be mindful of financial instability concerns as well.

However, an influential body of macroeconomists invoked the separation principle – macroprudential policy for financial booms and busts while monetary policy is appropriate for inflation and output fluctuations (Caruana 2015). Svensson (2010) observes that (i) higher policy rates might not have prevented the crisis, given the global saving glut and free capital mobility. Further, empirical models do not link monetary policy regimes with asset price bubbles. Adrian et. al. (2018) point out that the impact of higher rates on credit growth not only occurs with a lag but is also small. Moreover, there may not exist any trade-off between output stability and financial stability – similar monetary policy actions may be recommended in both cases. Finally, the costs of a spike in policy rates, beyond that warranted by inflation levels, may outweigh the benefits. Hence, the appropriate division of labour should be the use of monetary policy for price and output stability and deployment of macroprudential policy for financial stability.

Caruana (2015) feels that these two policies should operate together, to be most effective. Monetary policy affects all interest rates while macroprudential policy targets only bank borrowers. As a result, booms in the capital market (outside banks) may be managed better by monetary, rather than macroprudential, policy. Moreover, monetary and macroprudential policies are interactive. Hence, the separation argument is not cogent enough and management of financial stability may be a goal of monetary policy design.

Even if financial instability is considered to be a monetary policy objective, how should it be incorporated? Adrian and Duarte (2022) consider a Value-at-Risk (VaR) constraint, as a limit on tail risk assumed by banks. Due to macro-financial linkages, GDP and monetary policy are affected. Akinci et. al.(2022) determine a real interest rate r^{**}, above which financial instability will occur. Sustained cheap money policy is found to lower the threshold.

The debate on price versus financial stability has been reignited in the recent past, after the failure of Silicon Valley Bank in the US and Credit Suisse in Europe. Despite deficiencies in internal risk management practice and loopholes in bank supervision and regulation (Fed Reserve 2023), such failure has also been blamed on a sharp rise in rates, after a prolonged easy money regime (Rajan 2023). Jimenez et.al. (2023) show that a U-shaped Monetary Policy curve (sharp, sustained decline in policy rates, followed by a steep hike) increases banking sector risk, across 17 countries, over 150 years. The implication is that central banks should be careful about the trajectory of policy rates, lest financial instability pressures arise.

In light of the preceding discussion, the following questions arise:

1. What is the relationship between bank loan rates and policy rates? This is the credit channel for transmission of monetary policy.

2. What are the implications for monetary policy if management of financial instability is an explicit goal for the central bank?

We shall answer both the questions, in the next section.

Section 4: The Model

We begin with a list of symbols used for subsequent analysis:

Sl. No.	Symbol	Interpretation
1.	Π_B	Profit function of monopoly bank
2.	p	Probability of default (PD) of loans
3.	r_L	Lending interest rate
4.	L	Volume of loans
5.	r	Policy interest rate (Repo rate)
6.	M	Investments in market instruments linked to policy rate (government bonds/ money market instrument)
7.	r_D	Deposit interest rate
8.	D	Volume of deposits
9.	C(D,L)	Operating costs for loans and deposits
10.	c_D	Marginal operating cost of deposits
10.	c_L	Marginal operating cost of screening/monitoring a loan
11.	ξ	Elasticity of loan demand
12.	b	Constant elasticity of loan demand
13.	A(=PY)	Nominal economic output (say nominal gross domestic product) or market size
14.	P	General price level
15.	Y	Real economic output
16.	NPL_1	Level of non-performing loans in Period 1
17.	NPL_e	Target non-performing loans
18.	θ_0/θ_1	Inflation level in period 0/1
19.	θ_e	Target inflation level
20.	a	(Regression) Coefficient of lending interest rate
21.	c	(Regression) Coefficient of market size
22.	$\hat{Y}_0/\hat{Y}_1$	Real output growth in period 0/1
23.	$\hat{Y}_e$	Target Real output growth

In the following subsections, we develop a simple theoretical model, to illustrate how the banking sector may set the optimal loan rate in response to the equilibrium repo rate announced by the central bank. The extensive-form game has to be solved backwards – we determine the optimal loan rate first (Stage 2), then proceed to fix the equilibrium repo rate for the central bank (Stage 1).

Section 4.1: The Banker's Problem (Stage 2)

We assume a monopoly bank (or a group of oligopolistic banks) in a Monti-Klein framework (Freixas and Rochet 2008, Ch. 3). The profit function of this bank is given by:

$$\pi_B = (1-p)r_L L + rM - r_D D - C(L,D) \qquad \text{..........(1)}$$

Where,

p= probability of loan default

r = Policy repo rate

D=Deposit Volumes

M=Investments in market instruments (opportunity cost of loans)

We also assume, for simplicity, that the recovery rate is zero. In other words, the bank does not recover any principal after loan defaults. Introduction of a positive recovery rate will complicate the analysis, without any substantive contribution to results.

If a Bank's reserve ratio with the central bank is α, then, investments in market instruments by the bank will be to the extent of net deposit funds less the loan volumes. That is,

$$M = (1-\alpha)D - L$$

Furthermore, if cost of processing deposits and loans is additive and each segment of credit is independent of others, then the bank becomes a multiproduct monopolist. That is,

$$C(L,D) = c_L L + c_D D$$

Based on the above two conditions, the profit function of the Bank can be rewritten as:

$$\pi_B(L) = (1-p)r_L L - rL - c_L L + r(1-\alpha)D - r_D D - c_D D \qquad \text{..........(2)}$$

Optimizing the Bank's profit function with respect to loan volumes, we get

$$\frac{\partial \pi_B(L)}{\partial L} = 0 \rightarrow r_L^* = \frac{1}{(1-p)}\left[\frac{1}{\left(1-\frac{1}{\xi}\right)}\right](r + c_L) \qquad \text{..........(3)}$$

Where,

ξ is the elasticity of loan demand.

While traditional theories of monetary policy transmission focus primarily on money or bank deposits, i.e. treat bank liability as a driver of aggregate demand, the emphasis of our model is on bank assets, that is credit, a la Bernanke and Blinder (1988). The implicit assumption is that bank deposits are substitutable with bonds and other market instruments. We are agnostic on the source of finance. That is why we do not include equity as well. This approach allows us to develop a direct linkage between lending rates and external benchmarks (such as the policy repo rate).

It follows from (3) that the lending rate is computed as a mark-up over policy rate *r* (risk free) and the processing cost c_L. The markup consists of the credit spread $\frac{1}{(1-p)}$ and the strategy premium $\frac{1}{(1-\frac{1}{\xi})}$, which depends on the elasticity of loan demand. The Janak Raj Committee Report (RBI 2017), which recommended migration to an external benchmark for bank loans, observed that both the credit spread and strategy premiums were manipulated by some banks to keep lending rates unchanged, even as market rates declined during the MCLR regime.

Comparative Statics:

$$\frac{\partial r_L^*}{\partial p} = \frac{1}{(1-p)^2}\left[\frac{1}{1-\frac{1}{\xi}}\right](r + c_L) > 0$$

Higher the credit risk (p), higher the equilibrium loan rate, to offset the losses from future loan defaults. As long as loans continue to perform, the bank earns more than the risk-free rate *r*.

$$\frac{\partial r_L^*}{\partial \xi} = -\frac{1}{(1-p)}\left[\frac{1}{(\xi-1)^2}\right](r + c_L) < 0$$

Higher the elasticity of loan demand, lower the equilibrium loan rate. This is the familiar inverse elasticity pricing rule.

$$\frac{\partial r_L^*}{\partial r} = \frac{1}{(1-p)}\left[\frac{1}{1-\frac{1}{\xi}}\right] > 0$$

As the risk-free rate rises, the equilibrium loan rate increases more, given the margin. Therefore, those loans which are linked to the external benchmark (e.g. personal loans in India) become more profitable (cet. par.) as the risk-free rate increases. However, those loans which are not priced off the market benchmark (e.g. corporate loans) may not be as profitable after the policy rate is hiked. This may be one reason why personal loan growth has been more robust than corporate credit, in India, during the rate hike phase since May 2022.

Proposition 1: The equilibrium loan rate includes the credit spread and strategy premiums. Loans linked to the external benchmark become more profitable after policy rates are hiked.

Section 4.2: Loan Demand

For simplicity, we assume an isoelastic loan demand curve, i.e. $\xi = b \forall$ (r_L, L)

$$L = A r_L^{-b}$$

Where A is the market size (nominal GDP) and b *(>1)* is the constant elasticity of demand. Thus, optimal loan volume can be represented as:

$$L^* = \frac{A}{(r_L^*)^b} \quad \text{...........(4)}$$

From which it follows (after substitution for r_L^*), from (3)

$$\widehat{L^*} = \hat{A} + b(\widehat{1-p}) - b(\widehat{r + c_L}) \quad \text{.............(5)}$$

Since b is constant

The "hat" symbol denotes proportional change or growth. The use of a proportional change operator was pioneered by Jones (1965).

Equation (5) captures a standard debt sustainability condition. Even with a rise in policy rates, loan growth may persist if (i) the market continues to expand and (ii) expected risk of loan defaults reduces, at a faster rate.

A recent paper on retail credit trends in India (Kumar and Senapati 2023) provides empirical support to equation (5). The authors show, using a Generalized Method of Moments (GMM) Model, that bank credit in general (and, in particular, retail credit) is influenced by three factors: a positive relationship with nominal GDP growth and an inverse one with (i) lending rates and (ii) NPA ratios (which is a proxy for PD).

Proposition 2: Loan volumes may increase, after policy rate hike, with increase in market size and reduction in credit risk.

It follows, from Proposition 2 that robust credit growth may be possible even after policy repo rates increase. If margins rise, market expands and credit risk declines, loan volumes may continue to grow. The intertemporal implications of such a proposition are significant. In Section 2, we saw that if credit increases at present, future GDP growth may be higher. As a result, market size will expand and encourage sharper increase in loan volumes. The process will be accelerated if credit risk also declines. The rise in interest rates, during this cycle, may be a boon in disguise. It may prevent excessive credit growth or a lending boom which triggers future financial crises. In short, equation (5) presents a condition under which an initial expansion in credit may be self-sustainable.

Section 4.3: The Central Bank's Problem (Stage 1)

In this section, the central bank acts as a Stackelberg leader. It anticipates the equilibrium loan rates chosen by banks and fixes the policy rate, at the outset, to optimize its objective function.

We assume that the central bank tries to strike a balance between financial stability and price stability. It minimizes a quadratic loss function, which features the squared deviation of future NPL and inflation from their target levels. The perils of high system-wide NPL, for the central bank, are well-documented. Too low NPL levels (relative to the target) may also be dangerous. Such episodes could imply that banks take inadequate risk and earn low returns. A stream of low returns may erode capital adequacy and increase systemic risk.

At this point, it is important to clarify that NPLs may not constitute the only source of financial instability, for an economy. The recent spate of bank failures in US and Europe (IMF 2023) was triggered by a collapse in bond and deposit markets. However, we have chosen NPLs because we want to focus on the role of lending rates, which in turn are affected by policy repo rates.

The current period loss function for the central bank is as follows:

$$Loss_0 = (NPL_1 - NPL_e)^2 + (\theta_1 - \theta_e)^2 \qquad \text{........(6)}$$

$$NPL_1 = ar_{L0} - c\widehat{A_0} \qquad \text{........(7)}$$

$$NPL_e = ar_{Le} - c\hat{A}_e \qquad \text{........(8)}$$

Assumption 1: $a > c$

For simplicity, the weights on financial stability and price stability are the same, in equation 6.

In other words, we assume that future NPL is positively related to the current lending rate and declines with faster growth in current market size or nominal GDP. The reason for the adverse impact of higher loan interest rates on NPL is straightforward. Higher loan interest rates, adversely impact the financial positions of borrowers and increase the prospect of default. However, the rationale for the reduction in NPLs, with growth in nominal GDP, needs some elaboration. First, the increase in real output or GDP will raise national income and reduce future NPLs. Secondly, a rise in price will cet.par. improve business profitability and reduce NPLs. We also assume that the marginal impact of a rate hike on NPLs is stronger that the effect of nominal GDP growth (that is, $a > c$).

We know that since $A_0 = P_0Y_0$

$$\widehat{A_0} = \hat{P}_0 + \hat{Y}_0 \qquad \text{...... (9)}$$

Or,

$$\widehat{A_0} = \theta_0 + \hat{Y}_0$$
.......(10)

Where θ_0 is the current inflation, in period 0. A similar derivation follows for $\widehat{A_e}$

Substituting equations (9) and (10) in equation (6), we have

$$Loss_0 = \left[a(r_{L0} - r_{Le}) - c\left(\hat{Y}_0 - \hat{Y}_e\right) - c(\theta_0 - \theta_e)\right]^2 + [\theta_1 - \theta_e]^2 \qquad \text{......(11)}$$

Substituting equilibrium loan rates, from equation 3, we have

$$Loss_0 = \left[a\left(\frac{1}{(1-p)}\right)\left(\frac{1}{\left(1-\frac{1}{b}\right)}\right)(r_0 - r_e) - c\left(\hat{Y}_0 - \hat{Y}_e\right) - c(\theta_0 - \theta_e)\right]^2 + [\theta_1 - \theta_e]^2 \quad \text{..(12)}$$

After optimization of the loss function w.r.t r_0 and simplification we get

$$\frac{\partial Loss_0}{\partial r_0} = \left[a\left(\frac{1}{(1-p)}\right)\left(\frac{1}{\left(1-\frac{1}{b}\right)}\right)(r_0 - r_e) - c(\hat{Y}_0 - \hat{Y}_e) - c(\theta_0 - \theta_e)\right] = 0 \quad ....(13)$$

i.e.

$$.r_0 = r_e + \left(\frac{c}{a}\right)(1-p)\left(1-\frac{1}{b}\right)(\hat{Y}_0 - \hat{Y}_e) + \left(\frac{c}{a}\right)(1-p)\left(1-\frac{1}{b}\right)(\theta_0 - \theta_e)$$

$$r_0 = r_e + w_1(\hat{Y}_0 - \hat{Y}_e) + w_2(\theta_0 - \theta_e) \quad .....(14)$$

Where $w_1 = w_2 = \left\lfloor\frac{c}{a}\right\rfloor(1-p)\left(1-\frac{1}{b}\right) < 1$, by Assumption 1

Equation (14) represents a modified Taylor Rule, with equal weights on current output growth and inflation gaps. It is noteworthy that Taylor himself had chosen equal weights, in his seminal paper (Taylor 1993), to illustrate the eponymous monetary policy rule. The first implication of equation (14) is that, if both inflation and GDP growth exceed their target levels, the central bank should increase the policy repo rate above its target, but by less than the change in growth and inflation gaps. The reason is that, unlike the original Taylor proposal, a policy rate hike in our model will increase future NPLs as well. In particular, if *(c/a)* is low and *p* is high, the weights on inflation and growth gaps (in equation 14) will be low. Large deviations from target growth and inflation levels will elicit smaller policy rate responses. Therefore, some degree of price stability may have to be sacrificed at present, to ensure financial stability in future.

The second point is that, the coefficients of the growth and inflation gaps are no longer arbitrary. The original Taylor rule is a heuristic, with the coefficients chosen by the central bank. In a world where the central bank is as concerned with financial stability as inflation control, equation (14) shows how it could construct optimal weights from macro-financial data. The weights depend on the following factors: (i) relative impact of nominal GDP growth and lending rate on future NPL (ii) probability of default and (iii) elasticity of loan demand. In this paper, we derive the Taylor rule and its coefficients from first principles.

Comparative Statics:

1. $$\frac{\partial r_0}{\partial\left(\frac{c}{a}\right)} = \left[(1-p)\left(1-\frac{1}{b}\right)\right]\{(\hat{Y}_0 - \hat{Y}_e) + (\theta_0 - \theta_e)\} > 0 \quad ....(15)$$

With stronger impact of output growth and weaker transmission from lending rate changes to NPL (i.e. higher *(c/a)*), the policy rate should increase, when growth and inflation are above their target levels. The central bank can focus on inflation control, rather than the repercussions on financial stability.

2. $$\frac{\partial r_0}{\partial p} = -\left[(c/a)\left(1-\frac{1}{b}\right)\right]\{(\hat{Y}_0 - \hat{Y}_e) + (\theta_0 - \theta_e)\} < 0 \quad ......(16)$$

As the PD increases, the policy rate should decline, even when growth and inflation are above their target levels. This is another instance of a compromise of the price stability objective, given the threat of financial instability.

3. $$\frac{\partial r_0}{\partial b} = \left[\left(\frac{c}{a}\right)(1-p)\left(\frac{1}{b^2}\right)\right]\{(\hat{Y}_0 - \hat{Y}_e) + (\theta_0 - \theta_e)\} > 0 \qquad \text{.......(17)}$$

As loan demand elasticity (b) increases, the policy rate should also rise. With more elastic loan demand, the impact of a rate increase on positive output and inflation gaps will be stronger.

The moral of the story is summarized as:

Proposition 3: The threat of financial instability will constrain the management of price stability.

The linkage between Stage 1 and Stage 2, of the model, is straightforward. The spectre of financial instability does not allow the central bank to recommend a steep hike in the policy rate, vide equation (14). The consequent rise in loan rates, vide equation (3), is also moderate. As a result, the growth in loan volume, vide equation (4), is not dampened. It continues to support economic activity. As already discussed, if external conditions are favourable (i.e. market size registers healthy growth and credit risk is on the decline), a virtuous cycle of credit and GDP growth may follow.

What happens when growth and inflation are below their target levels? The simple answer is that the rate cut is less than the size of the negative gaps. The same principle applies here as well – the fear of financial crisis that often follows an extreme easy money policy will prevent the central bank from a large rate cut.

Section 5: Recent US Experience

In this section, we analyse recent US macro-financial data, to evaluate the impact of its monetary policy response to inflationary pressure. We illustrate the trends below.

Even before real GDP growth in the United States had recovered from the slowdown after the pandemic, inflationary headwinds were visible, which were exacerbated with geo-political tensions in Europe. The US Fed took delayed but sharp action in consecutive monetary policies starting from March 2022. Within one year, it had administered a 475 bps increase in the Fed Funds rate (Figure 9). However, the credit markets in the US had not yet stabilised. In fact, credit growth rates began to decline, after the rebound from the pandemic, when the monetary tightening started (Figure 10). Furthermore, the credit risk (delinquency rates) of different loan segments had also not fallen enough (Figure 11). In terms of our model (Equation (5)), the conditions were not ideal for large rate hikes targeted at price stability. On an almost one-to-one basis, the rate shocks were passed onto credit (Figure 12). Such transmission may trigger potential financial instability, as seen by the escalating delinquencies in consumer loans (Figure 11). The policy rate spikes have not only shaken bond and deposit markets since 2022, but may also have sown the seeds of the next credit crisis in the US.

In short, the US experience offers a stark contrast to the Indian case, discussed in Section 2. It shows that, if initial conditions are not favourable, sharp rate hikes aimed at price stability may rather engender financial instability. This is what our theoretical framework also suggests.

Section 6: Conclusion

In this paper, we try to understand why robust credit growth may occur, even after sustained rate hikes. We find that such a phenomenon is possible if (i) loans are linked to an external benchmark (ii) size of the credit market expands and (iii) loan quality improves over time. We also investigate the challenges faced by a central bank that aims to manage both price and financial stability, with the policy rate. We observe that such an institution should follow a modified Taylor rule, with equal emphasis on current growth and inflation gaps. It has to monitor the elasticity of loan demand in the economy, the default risk of different loan categories and the impact of GDP growth and lending rates on NPLs. Such macro-financial information will help the central bank improve its monetary policy rule.

There are a few directions in which this work can be extended. First of all, in order to focus on financial stability, the central bank may lose sight of price stability in future. Many central banks have paused rate hikes while others have slowed down, in the wake of the recent bank collapse in US and Europe. This aspect appears in our work as well. Though the future inflation gap (θ_1- θ_e) is a central bank target in equation (12), it drops out of the subsequent optimization programme altogether. However, this happens due to the design of our problem. In subsequent analysis, we may examine how financial stability considerations may make the central bank myopic and less attentive to future price stability

Secondly, we have used only one instrument - policy rate change - to address both price and financial stability issues. Further ahead, macro-prudential tools like Countercyclical Capital Buffer, for management of financial stability can also be considered. This will allow the central bank more freedom to use policy rates for price stability. In this chapter, we have employed a simple model in which banks are funded only by debt. Inclusion of equity capital (or networth), in future, will enrich the analysis further. It will enable us to study the combined impact of two devices on multiple targets.

Finally, our model should incorporate the oft-documented nonlinear relationship between market rates and bank assets. Financial instability may occur – in loan and bond markets – only when rates are high enough. Preliminary analysis suggests that the task is not simple. We need to assess the objective function of the central bank at low and intermediate market rates as well. We need to identify the location of a possible kink or break in the function and investigate its implications.

The history of financial crises has shown that a meltdown is often preceded by prolonged decline in policy rates, followed by a sudden rise which acts as the trigger. Such a behaviour needs to be changed. If Unconventional Monetary Policy can be used after the global financial crisis and the failure of Silicon Valley Bank (i.e. ex-post), why can’t conventional monetary policy be employed before crises occur (i.e. ex-ante)? Our analysis shows that consideration of financial instability makes traditional monetary policy more conservative. The resultant policy decisions should bode well for the financial sector.

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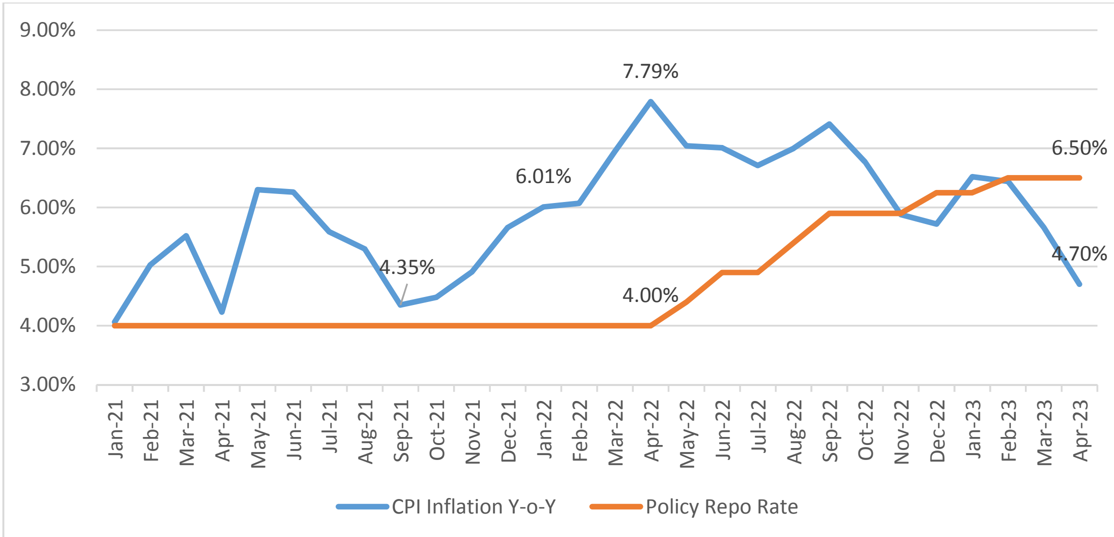
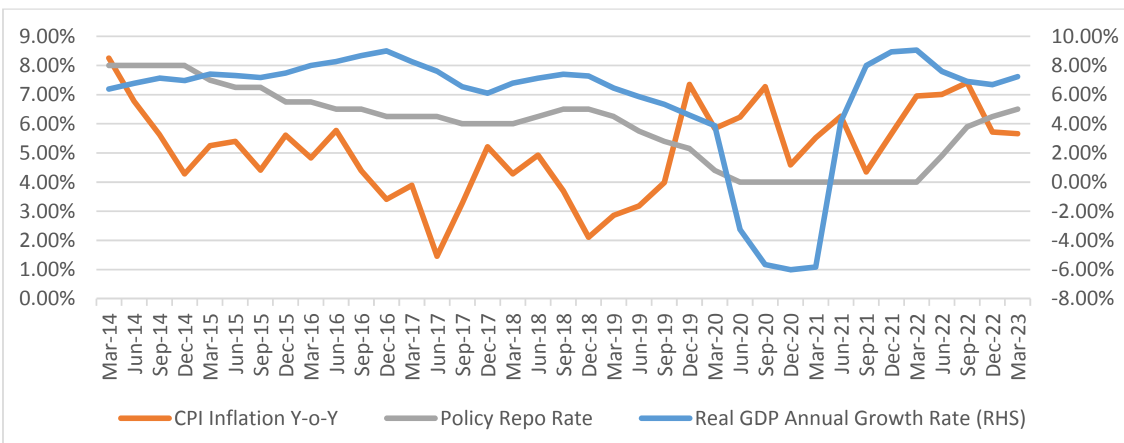
Figure 1: Annual CPI Inflation and Policy Repo Rate



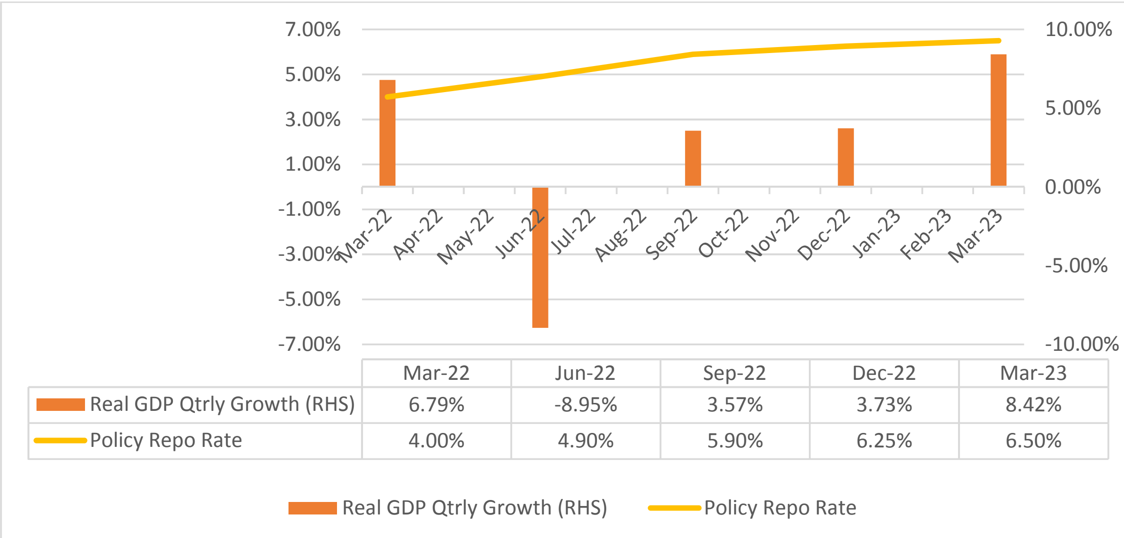
Source: The Reserve Bank of India Database on Indian Economy

Figure 2a: Trends in Real GDP Growth, CPI Inflation and Policy Repo Rate



Source: RBI Database on Indian Economy and MoSPI

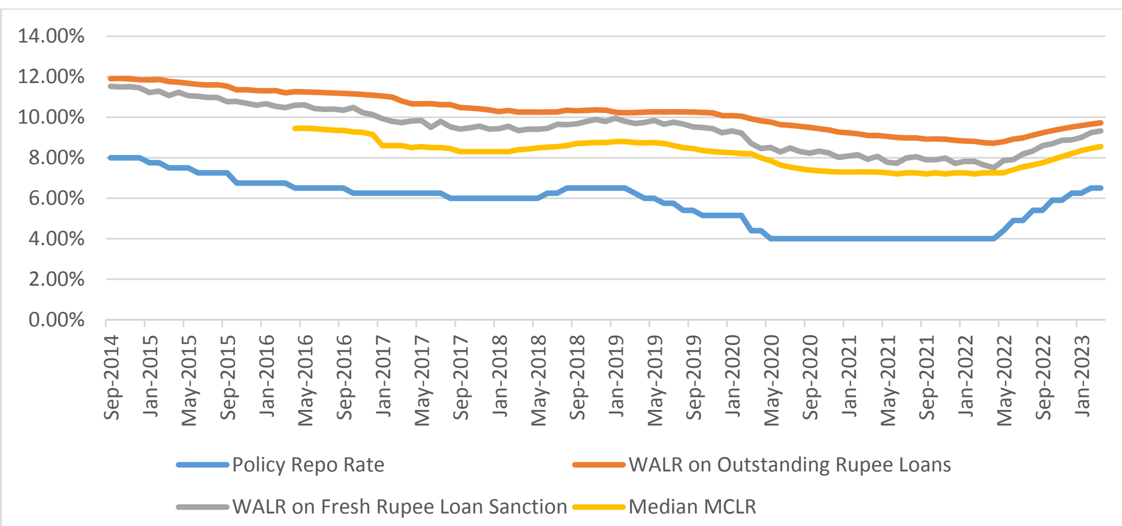
Figure 2b: Q-o-Q GDP Growth Rate and Repo Rates during the Latest Tightening Phase



	Mar-22	Jun-22	Sep-22	Dec-22	Mar-23
Real GDP Qtrly Growth (RHS)	6.79%	-8.95%	3.57%	3.73%	8.42%
Policy Repo Rate	4.00%	4.90%	5.90%	6.25%	6.50%

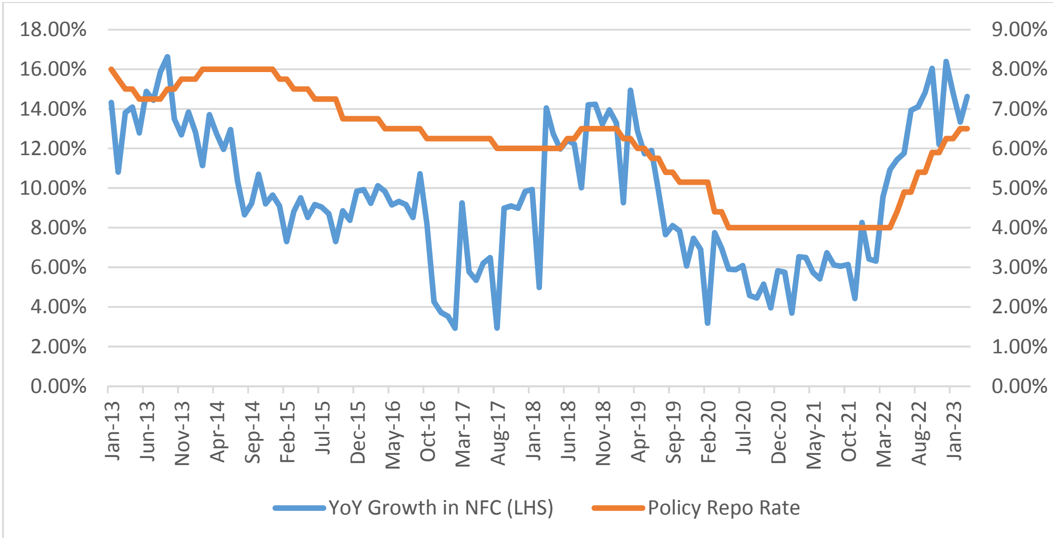
Source: RBI Database on Indian Economy

Figure 3: Movement of Lending Rates with Policy Repo Rate



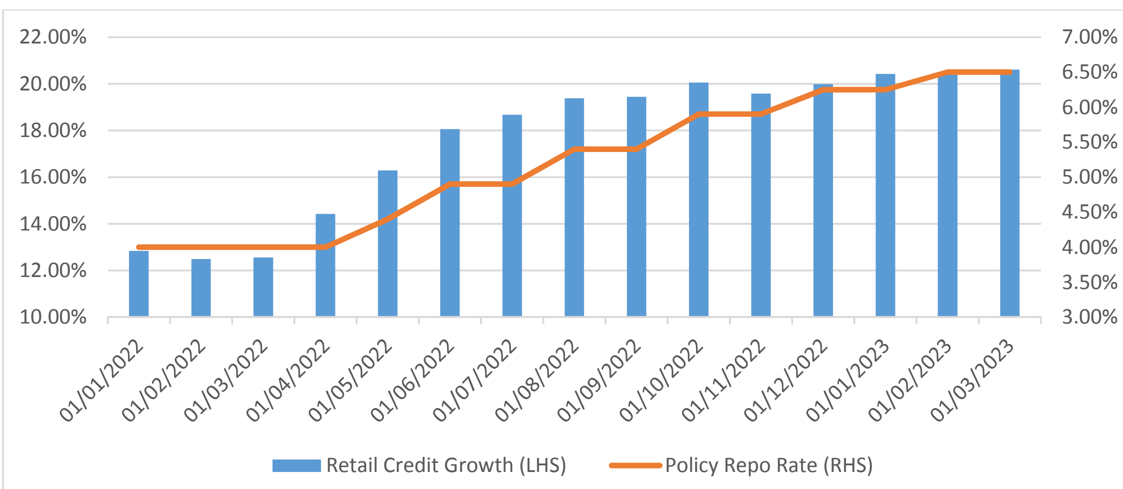
Source: RBI Database on Indian Economy

Figure 4: Y-o-Y Non-Food Credit Growth and Policy Repo Rate



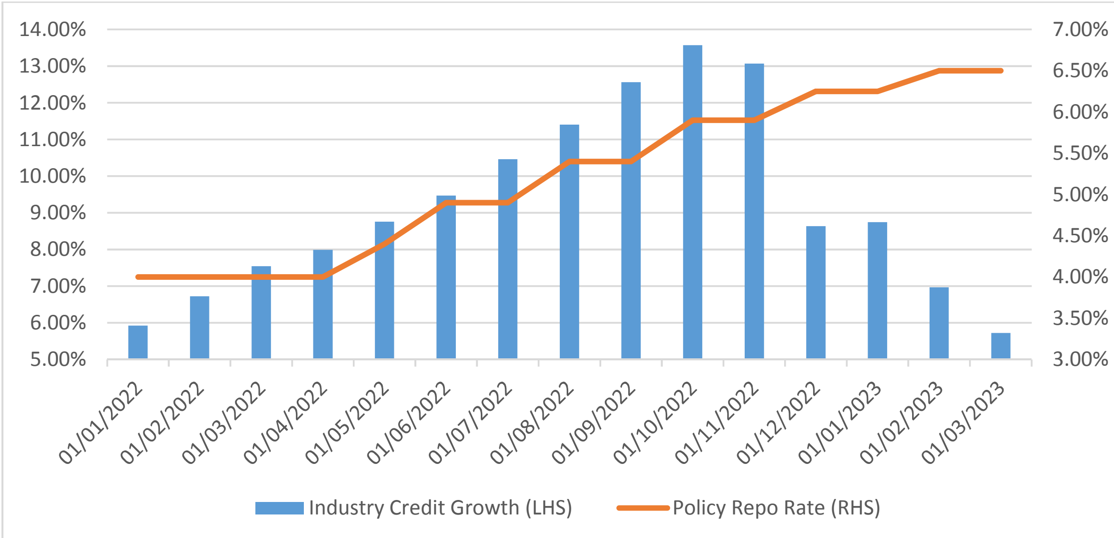
Source: RBI Database on Indian Economy

Figure 5: Y-o-Y Retail Credit Growth vis-à-vis Policy Rate Hikes during the Rate Hike Period



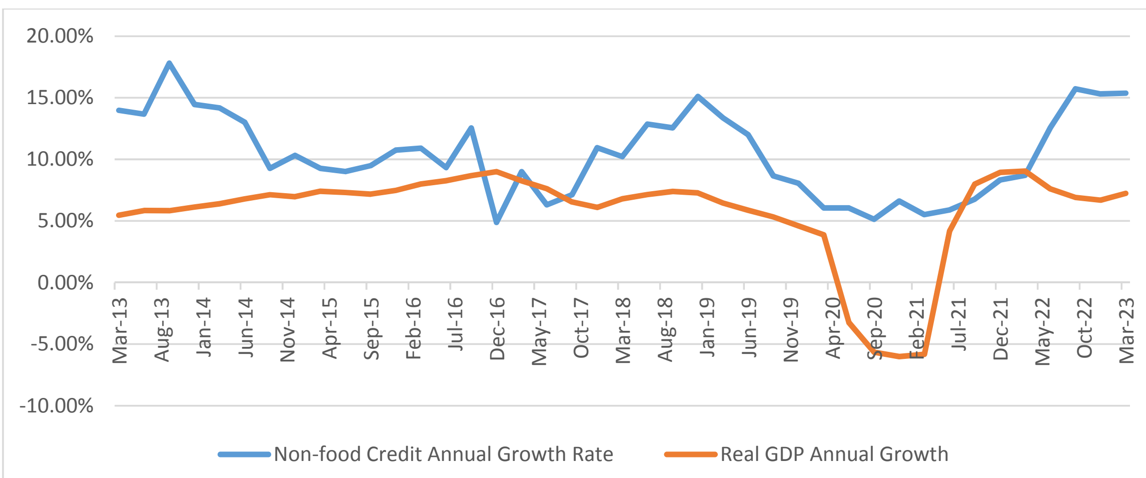
Source: RBI Database on Indian Economy

Figure 6: Y-o-Y Credit Growth to Industry vis-a-vis Policy Rate Hikes during the Rate Hike Period



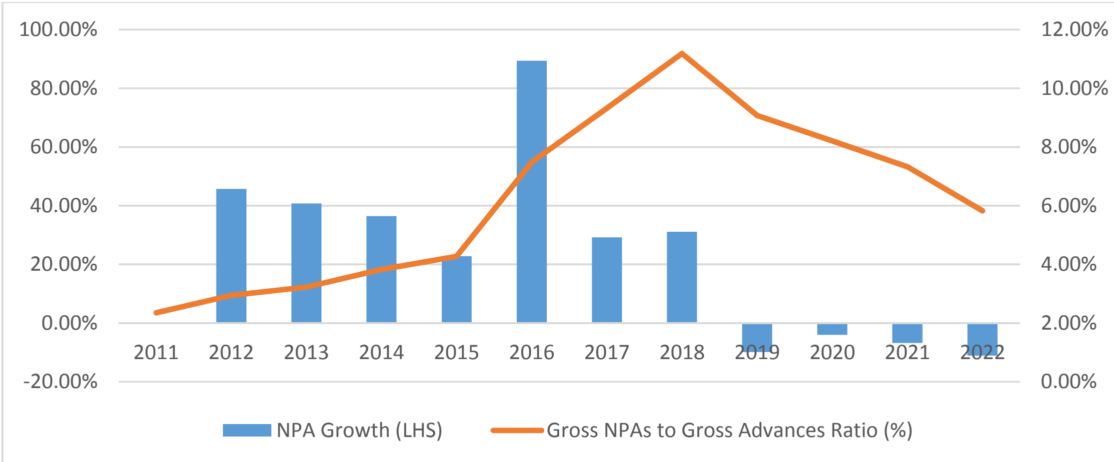
Source: RBI Database on Indian Economy

Figure 7: Trends in Real GDP Growth and Non-Food Credit Growth



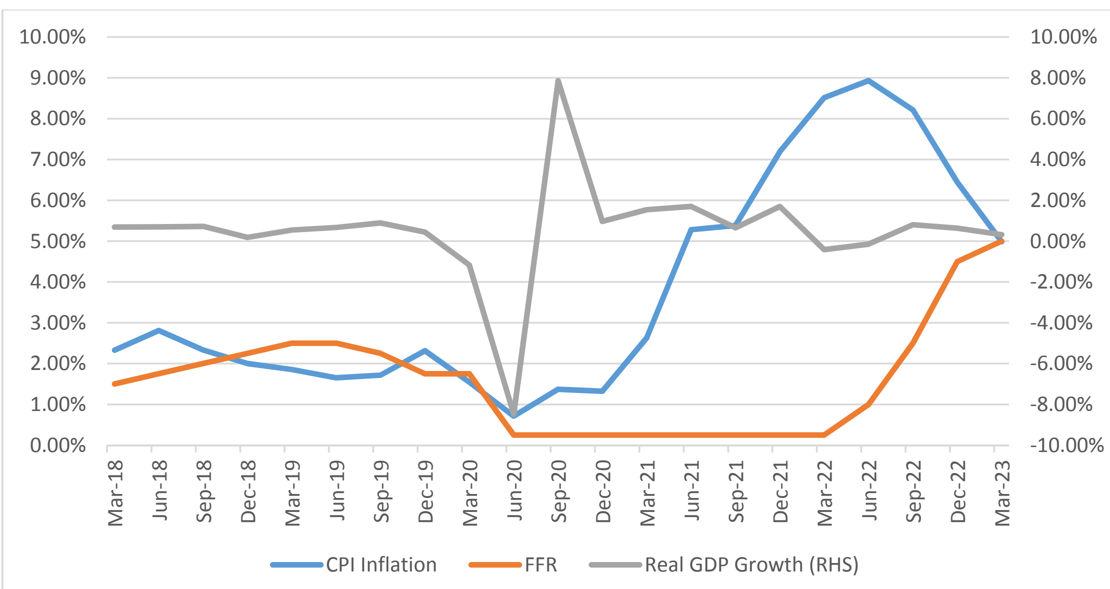
Source: RBI Database on Indian Economy

Figure 8: Trend in Non-Performing Loans of Indian Banks



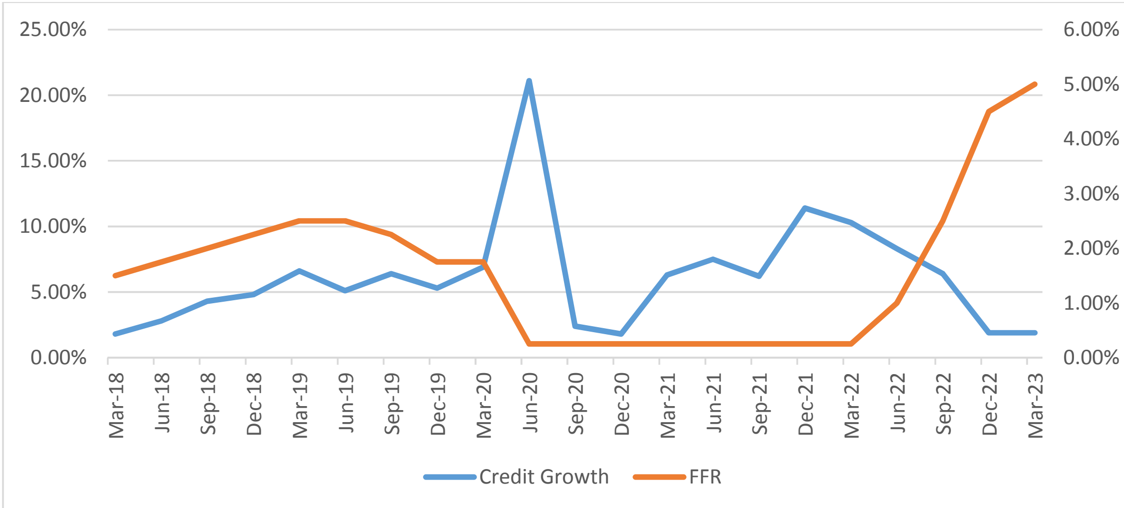
Source: RBI Database on Indian Economy

Figure 9: Trends in Real GDP Growth, CPI Inflation and Policy Rate in US



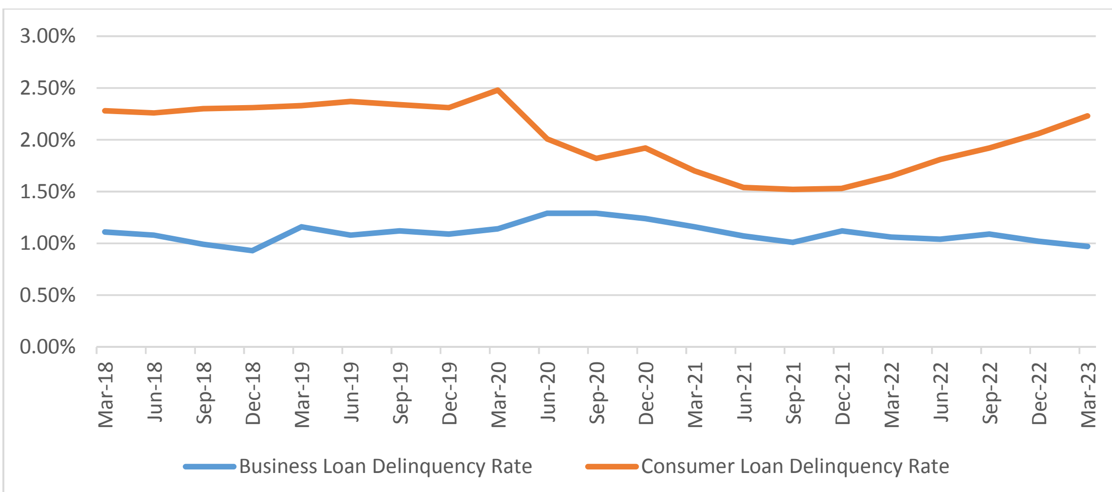
Source: Federal Reserve Board, US and NY Fed Reserve

Figure 10: Credit Growth and Policy Rate Movements in the US



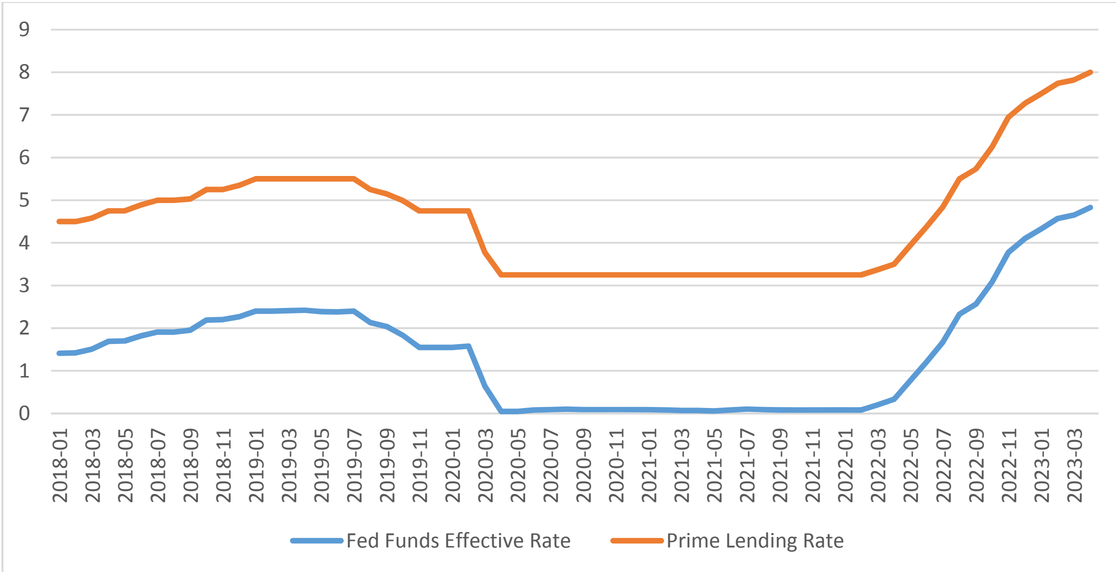
Source: Federal Reserve Board, US and NY Fed Reserve

Figure 11: Delinquency Rates in US Loan Segments



Source: Federal Reserve Board, US and NY Fed Reserve

Figure 12: Co-movement of Fed Funds Effective Rate and Prime Lending Rate



Source: Federal Reserve Board, US and NY Fed Reserve