

W P S (DEPR) : 13 / 2012

RBI WORKING PAPER SERIES

Fiscal Stance, Credibility and Inflation Persistence in India

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JULY 2012

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Fiscal Stance, Credibility and Inflation Persistence in India*

Pankaj Kumar and Pratik Mitra[†]

Abstract

In the recent past India has experienced high and persistent inflation. In response the Reserve Bank of India cumulatively raised the cash reserve ratio by 100 basis points and the policy rate (repo rate) by 375 basis points between January 2010 and October 2011. Despite these policy actions, the inflation rate however continues to remain stubbornly high. What explains our current inflation predicament? This paper finds that large contemporary government deficits unaccompanied by concrete prospects for future government surpluses promote realistic doubts about whether monetary restraint must be abandoned sooner or later to help finance the deficit. The result will be a rise in inflationary expectations in spite of current money-supply restraint- a bout of unpleasant monetarist arithmetic. In sum, it is insufficient to announce and maintain restrictive monetary policies unless accompanied by a coordinated reduction in the budget deficits. Prudent anti-inflation policy includes containment of the deficit.

JEL classifications: E31; E44; E52

Keywords: Inflation Persistence; Credibility; Fiscal policy; Kalman Filter

* Disclaimer: Any opinions, findings and conclusions or recommendations expressed in this paper are those of the authors and do not necessarily reflect the views of the institutions they represent.

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1. Introduction

Since the global financial turmoil of 2008 the Indian economy has grappled with high and persistent inflation. The headline inflation measured by wholesale price index (WPI) hovered in the range of 9-10 per cent in every month between February 2010 and November 2011, way above the RBI's comfort zone.¹ There is growing apprehension that the recent inflationary experience might well be the 'new normal' for an economy like ours. The concern is not just the level of inflation, but also its persistence. To deal with the inflationary pressure, the Reserve Bank cumulatively raised the cash reserve ratio (CRR) by 100 basis points and the policy rate (the repo rate) by 375 basis points between January 2010 and October 2011. Despite these policy actions, the inflation rate however continues to remain persistently high.

What explains our current inflation predicament? It is often claimed that stubbornly high inflation is because of "temporary factors or cost shocks" such as an increase in oil or commodity prices. According to this widely held view inflation is largely a non-monetary phenomenon: it is driven by "cost-push" factors, and these factors dominate the behaviour of inflation regardless of what course monetary or fiscal policy takes.² It has also become fashionable in certain circles to assert that the way to deal with the problem is by microeconomic policy- the panoply of controls and subsidies associated with a different era.³

Economic theory teaches us that inflation persistence is a product of the forcing processes (shocks) interacting with the policy regime. It is perfectly reasonable to find that these shocks are themselves auto-correlated. These processes will propagate themselves through all the endogenous variables and be a natural source of persistence. Monetary authorities (in the absence of fiscal constraints) could choose to close this persistence down if they wish by credibly committing to price stability. So what explains rise and fall in inflation persistence? There is a growing body of research which links persistence to policy regime credibility (see Brainard and Perry (2000), Taylor (2000) and Kim et al. (2001), Ravenna (2000), Benati

¹ Although RBI does not have target band for inflation, the conduct of monetary policy continues to condition and contain perception of inflation in the range of 4.0-4.5 per cent. This is in line with the medium-term objective of 3.0 per cent inflation consistent with India's broader integration into the global economy.

² For example Balakrishnan (1991) concluded that inflation in India was driven mainly by supply shocks. Structuralists argue that inflation occurs because of structural bottlenecks in the agricultural sector. Sectoral imbalances (caused by rapid growth of the industrial sector) lead to an excess demand for agricultural goods and, consequently, a rise in agricultural commodity prices. The increase in raw material prices and the indexation of money wages to the consumer price index results in the transmission of the rise in agricultural prices to industrial prices as firms simply pass on the increase in costs to the consumers.

³ Milton Friedman, writing in 1978, observed that in diagnosing the inflation problem, there were many factors other than money that politicians, economists and journalists write about...*[They] attribut[e] the acceleration of inflation to special events - bad weather, food shortages, labor-union intransigence, corporate greed, the OPEC cartel...*(cited in Nelson, 2005). Recalling this period a quarter-century later, Friedman argued: Central banks performed badly prior to the 80s... because they [had] a wrong theory.... Inflation, according to this vision, was produced primarily by pressures on cost that could best be restrained by direct controls on prices and wages.

(2004) and Levin et al. (2004)). For example, inflation was approximately a white noise process in both the U.S. and the U.K. during the gold standard regime and exhibited considerable persistence in the post war era.

In fact, major inflation episodes around the world have ultimately resulted from fiscal problems and it is hard to think of a fiscally sound country that has ever experienced high and persistent inflation. So long as the government's fiscal house is in order, people will naturally assume that the central bank should be able to stop a small uptick in inflation. Conversely, when the government's finances are in disarray, inflation expectations can become "unanchored" very quickly. But this link between fiscal and monetary expectations is too often ignored by both policymakers and the popular press.⁴

The basic point is that fiscal deficits today must be paid for by taxes, money expansions or lower expenditure tomorrow (the government's inter-temporal budget constraint). If one assumes any reasonable termination of the rising debt/GDP ratio, whether because of a limit on incentive damaging taxes, then money financing is eventually required in the absence of quite implausibly severe cuts in public expenditure. This means a rise in future inflation is worse than the moderation in current inflation from current money-supply restraint. This analysis was spread widely by Sargent and Wallace (1981) in their well known paper 'Some unpleasant monetarist arithmetic'. From the government's inter-temporal budget constraint, if the fiscal house is not in order in the present and the future, then this implies monetary restraint will be abandoned sooner or later to ensure solvency. This would undermine credibility of the monetary regime as inflationary expectations would remain elevated. Hence the 'unpleasant' policy lesson that the budget deficit must also be cut back to make a monetarist inflation-control programme work. By implication contractionary monetary policy signalling the authorities' wish to halt inflation may not be credible unless accompanied by a coordinated reduction in the budget deficits. Therefore, in order to establish counter-inflationary credibility it is not

⁴ There are exceptions of course. In fact, in its Third Quarter Review of Monetary Policy 2011-12, the Reserve Bank of India notes that "the anticipated fiscal slippage, which is caused largely by high levels of consumption spending by the government, poses a significant threat to both inflation management and, more broadly, to macroeconomic stability." It further states that "strong signs of fiscal consolidation, which will shift the balance of aggregate demand from public to private and from consumption to capital formation, are critical to create the space for lowering the policy rate without the imminent risk of resurgent inflation."

In an interview to the Wall Street Journal on February 13, 2012, Governor Subbarao said "If you see our monetary policy statement over the past two years, we've consistently drawn attention to the fiscal deficit concerns having recognised that some stimulus was of course necessary as part of crisis management. However, we thought that this was an appropriate time this time around to call a more pointed attention to this, because this year, the current fiscal year, the fiscal deficit has breached the initial budget estimate and there are a lot of expenditure demands piling up as we see from the newspapers. So we thought it important to call attention to the inflationary dimensions of the fiscal deficit, inasmuch as we have combating inflation over the past two years. To summarize, we did call attention to our concerns to fiscal deficit but did so more pointedly this time around because it was a more appropriate and more opportune time to do that."

sufficient just for the monetary authority to be responsible. We need fiscal stance to be responsible too.

In the literature, there exist different approaches to explain lag dynamics in inflation. One such approach relies on imperfect credibility and learning (see Erceg and Levin (2003) and Westelius (2005)). The idea is that, if the announced inflation target lacks credibility (say because of fiscal constraints), then inflation expectations will not be significantly affected. Facing imperfect credibility the policy maker perceives a quick disinflation to be extremely costly and consequently finds it optimal to gradually reduce inflation – higher persistence. Thus, these models predict that a monetary regime that lacks credibility, learning by private agents can generate a significant amount of inflation persistence. In contrast, a policy regime that enjoys credibility, agents learn quickly, resulting in a drop in inflation persistence.⁵ From an empirical standpoint the credibility literature predicts that the degree of inflation persistence should negatively covary with policy regime credibility. This paper attempts to empirically evaluate this hypothesis using Indian data.

The rest of the paper is organized as follows. Section 2 provides a brief description of the inflationary trend since the 1950s. Section 3 traces the historical evolution of monetary-fiscal interface. Section 4 presents the theoretical model of imperfect credibility, learning and inflation persistence. In Section 5, we empirically evaluate the link between policy regime credibility and inflation persistence. Our empirical methodology, data used in the analysis and our empirical results are also discussed. Section 6 concludes.

2. Inflationary trend in India: A long-term view

Price stability has been an important objective of monetary policy in India. In fact, India's inflation performance compares favourably against other emerging market economies. The 1950s witnessed average inflation of less than 2 per cent, but with considerable variation in yearly inflation. During the 1960s, the average decadal inflation edged up to 6.3 per cent, on account of wars and unsatisfactory agricultural supply position. Like most other developed and developing countries the decade of 1970s was the most turbulent period when it comes to India's inflation history. The average inflation was 9 per cent in that decade.

Figure 1 shows all commodities WPI inflation since the early 1980s (summary statistics in Table 1). We have split our sample 1983:4 to 2011:1 into different

⁵ Erceg and Levin (2003) formulate a DSGE model in which households and firms use optimal filtering to disentangle persistent and transitory shifts in the central bank's inflation target. Their calibrated model for the U.S. exhibits moderate persistence of inflation when monetary regime is transparent and credible and much higher persistence when agents use signal extraction to make inferences about the central bank's inflation target.

segments with each segment corresponding to a statistically distinct mean of overall inflation compared with the adjoining segment. This periodisation of the data is based on the Bai and Perron (2003) test of multiple structural breaks at unknown dates where the optimal breakpoints are estimated from the data itself. For the period beginning April 1983 up to January 2012, average headline inflation measured in terms of year-on-year increase in all commodities wholesale price index (WPI) has been 6.9 per cent. While the primary (7.9 per cent) and fuel groups (9.0 per cent) have been the high and volatile components, the manufactured group (6.1 per cent) component has been low and stable.

There was a palpable decline in both the level and volatility of headline inflation during the first half of the 1980s from those seen in the 1970s. Inflation picked up during the latter part of the 1980s fuelled mainly by the manufactured group. An important factor behind rising inflationary pressures of the 1980s was expansionary fiscal policy.

Figure 1: Multiple structural breaks in inflation

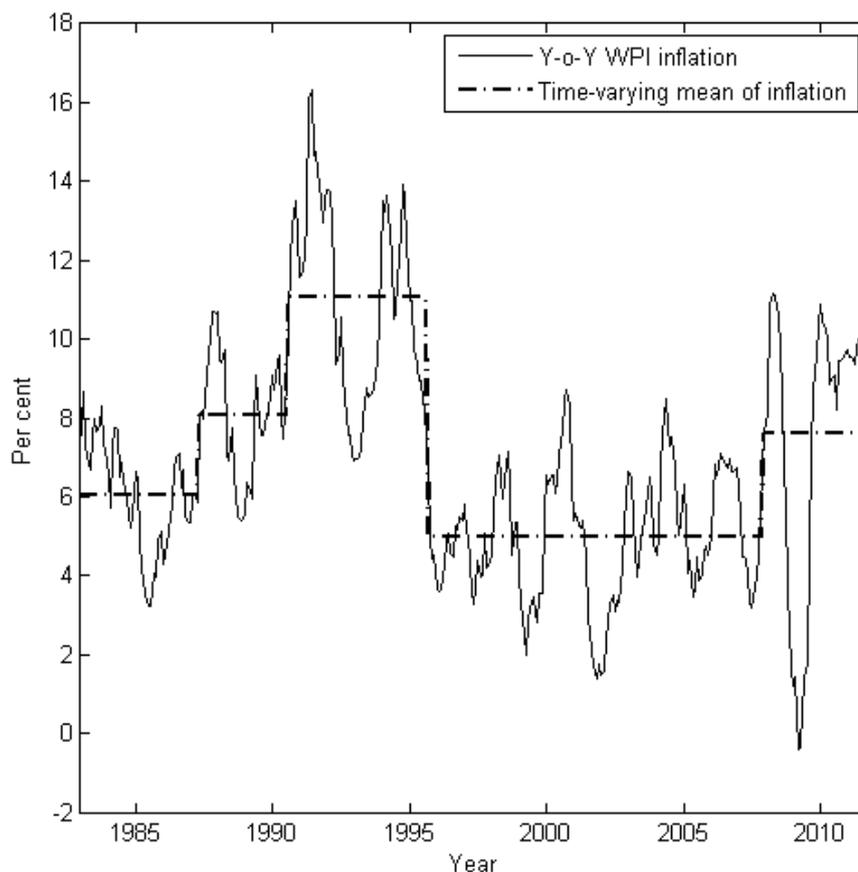


Table 1: Summary statistics, WPI inflation and its components⁶

Period	Average inflation			
	Overall	Primary Group	Fuel Group	Manufactured Group
April 1983 - July 1987	6.0	6.6	6.5	5.7
August 1987 – October 1990	8.1	6.8	5.0	9.4
November 1990 - November 1995	11.1	12.3	12.5	10.4
December 1995 – February 2008	5.0	5.3	9.6	3.8
March 2008 - January 2012	7.6	13.0	8.8	5.4
April 1983 - January 2012	6.9	7.9	9.0	6.1

The fiscal deficit of the central government increased from 3.8 per cent of GDP during the 1970s to 6.8 per cent during the 1980s. Approximately, one-third of this burden was borne by Reserve Bank of India (RBI) through automatic monetization of budget deficit which in turn led to a rapid acceleration in reserve money growth. The experience of this decade highlighted the importance of fiscal-monetary coordination in fighting inflation and paved the way for enhanced monetary autonomy.⁷

Increasingly, expansionist fiscal stance spilled over to the external sector. The Indian economy underwent a severe economic crisis in 1991 mainly triggered by a balance of payment problem and manifestation of underlying imbalances emanating from an adverse impact of high budget and current account deficits of the 1980s. Following the Gulf crisis of 1991, the first half of the decade was characterized by double-digit inflation, with high inflation in the primary and fuel group segment joining hands with the already high inflation in the manufactured group. The high inflation of this period was a result of several factors: devaluation of exchange rate, very low foreign exchange reserves precluding imports to meet the demand gap, hike in procurement prices and supply-demand imbalances in some essential commodities, sustained rise in fuel prices, and monetary expansion resulting from the surge in capital inflows with the advent of opening up of the economy.

For more than a decade starting from the mid-1990s until early 2008, India witnessed the longest period of benign inflation averaging around 5 per cent on account of subdued inflation in both primary as well as manufactured group,

⁶ Primary group (weight: 20.1 per cent) consists of food and non-food articles and minerals. Fuel group (weight: 14.9 per cent) contains coal, mineral oils and electricity. Manufactured group (weight: 65.0 per cent) consists of food products, beverages, tobacco and tobacco products, textiles, wood and wood products, paper and paper products, leather and leather products, rubber and plastic products, chemicals and chemical products, non-metallic mineral products, basic metal, alloys and metal products, machinery and machine tools, and transport, equipments and parts.

⁷ Some studies have empirically confirmed the existence of vicious circle operating from higher monetisation of fiscal deficit leading to higher inflation which in turn gave rise to higher fiscal deficit (Rangarajan and Arif, 1990).

although inflation in the fuel group remained elevated. This was a commendable performance in view of substantial capital inflows and several other adverse developments such as Asian financial crisis, border tensions with Pakistan and high commodity prices. This turnaround in the inflationary trend is partly explained by the improved monetary-fiscal interface and reforms in the government securities market enabling a lower degree of monetisation of fiscal deficits.

A particularly noteworthy step was the historic accord between the government and the RBI for phasing out the issue of automatic monetization of budget deficit. This in turn reinforced monetary policy autonomy and enhanced central bank credibility. Moreover, by the end of the decade of 1990s the reform measures undertaken to liberalize the economy started to bear fruit, as there was a surge in productivity growth. With productivity growth on an uptrend and the trend growth rate of the economy moving on to a higher trajectory, inflationary pressure subsided. In addition, factors such as containment of global inflation, lower order of depreciation of exchange rate and weaker pass-through, comfortable level of buffer stocks of food grains and foreign exchange reserves may also have played their part in keeping inflation under check.

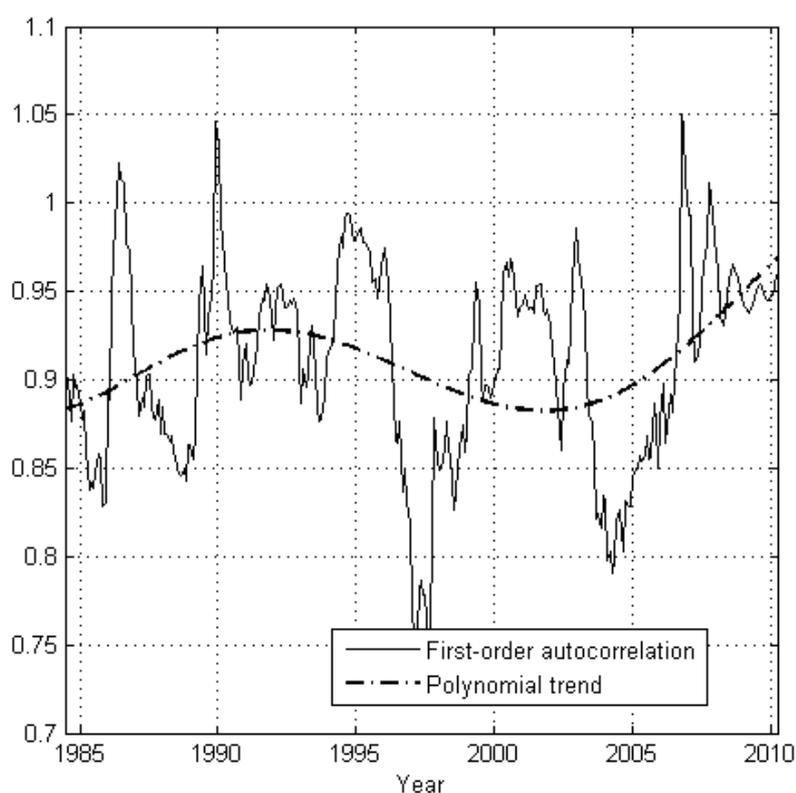
The period from March 2008 to January 2012 represents another phase of high inflation averaging around 7.6 per cent. In various reports and policy documents, the Reserve Bank attributed the stubborn inflation of this phase to: (i) food inflation resulting from long-term change in the dietary pattern, (ii) food inflation permeating into the core/generalised inflation via changes in inflationary expectations and wage-price spiral, (iii) buoyant demand conditions enabling producers to pass on the increase in input cost to the final price, (iv) elevated international commodity prices on account of ultra accommodative monetary policy in major advanced economies, depreciating exchange rate and geo-political uncertainties, and (v) fiscal stimulus largely of the nature of consumption expenditure in response to the 2008 financial crisis stoking inflation and inflationary expectations.

Apart from its level, an important empirical property of an observed inflation measure is its persistence.⁸ The purpose of focusing attention on persistence is to isolate changes in the dynamic response of inflation to shocks around its mean from changes in the mean of inflation itself. Figure 2 plots a 3-year rolling window estimate of first order autocorrelation of the inflation series. The evidence in figure points towards time variation in inflation persistence even after accounting for time

⁸ Persistence captures the idea that inflation remains close to its recent history, absent other economic forces that move it elsewhere. Some researchers define persistence as the extent to which shocks that occurred in the past continue to have an effect on current inflation (see, e.g., Cogley, Primiceri, and Sargent, 2010). One can see from the moving average (MA) representation of the first-order autoregressive process of inflation, $\pi_t = a\pi_{t-1} + \varepsilon_t$ that the larger a is, the larger the influence of past shocks on current inflation – equivalently, shocks have a long lasting effect on inflation.

variation in the mean of the series. We observe that while persistence increased from the late 1980s to early 1990s, it stabilized thereafter. We once again witness an upward drift following the global financial crisis. What explains this turnaround? We explore these issues later in the paper.

Figure 2: 3-year rolling window estimate of first-order autocorrelation in inflation



3. Evolution of Monetary-Fiscal Interface in India

The legal basis of the monetary-fiscal interface in India is enshrined in the RBI Act, 1934, under which the Reserve Bank manages the public debt of the Central and the State Governments and also acts as a banker to them. The monetary-fiscal coordination, however, has been a continuously evolving process reflecting the institutional framework of the time. In the colonial settings of the pre-independence era, the British Government adopted a stance of fiscal neutrality and the Reserve Bank's role was restricted only to the day-to-day management of the financial system. Notwithstanding this, the financing requirements of the World War II necessitated the Government to take recourse to primary accommodation from the Reserve Bank.

Post-independence, India embarked on the path of planned economic development. Fiscal policy was geared to exert a 'big push' to the low level of saving and investment in the economy by setting up public sector companies. According to the

Report of the Working Group on Operating Procedure of Monetary Policy, *“During this period, the conduct of monetary policy was influenced significantly by the need to support plan financing and promote savings for its deployment to sectors in accordance with plan priorities. The large plan financing led to the RBI accommodating deficit financing of the government through the issue of ad hoc Treasury Bills from the beginning of Second Five-Year Plan. This led to the conduct of monetary policy becoming a process of passive accommodation of budget deficits by the early 1960s.”*

In addition to the ad hoc Treasury Bills, monetisation of deficits was also a result of the Reserve Bank’s subscription to primary issuances of Government securities as financial markets were under-developed and were unable to absorb the large government borrowings required for plan financing. As the debt-manager of the Government, the Reserve Bank was forced to control the cost of Government borrowings. To neutralise the impact of monetary accommodation, the Reserve Bank of India (Amendment) Act, 1956 empowered the Reserve Bank to vary cash reserve ratio, which was hitherto fixed. An important amendment of the Banking Regulation Act, 1949 came in 1962 which excluded the balances maintained under Cash Reserve Ratio (CRR) from being reckoned under Statutory Liquidity Ratio (SLR) in order to prevent banks from liquidating their Government securities to meet higher reserve requirements. The gradual increase in minimum SLR requirements along with nationalisation of banks in 1969 provided an increasing captive investor base for Government securities as the fiscal situation deteriorated.

The Government’s efforts to arrest the increasing inflationary pressures of the 1960s and 1970s included mainly selective credit control and a system of administered prices. The public finances of the Central Government started deteriorating in the 1970s and 1980s. With accommodative monetary policy, the rising deficit led to phenomenal growth in reserve money. To neutralise the same and stem inflationary pressures, the Reserve Bank took recourse to progressive increases in CRR, SLR and the Bank Rate during the 1970s and 1980s. With worsening fiscal situation and its attendant monetary impact in the 1980s, there was an increasing recognition for pursuing development strategy consistent with price stability. Against this backdrop, the Committee to Review the Working of the Monetary System (Chairman: Prof. S. Chakravarty, 1985) made comprehensive recommendations for the adoption of a flexible monetary targeting framework with feedback from the real sector, whereby growth of broad money as a nominal anchor was targeted in line with economic growth and an acceptable level of inflation.

The tipping point of persistent fiscal imbalances was reached in 1991 with the unprecedented external payment crisis. Monetization of budget deficits in the 1980s fuelled double digit inflation. The crisis underscored the importance of fiscal

correction. Recognising this, a sharp correction in fiscal deficit was implemented in 1991-92 and fiscal consolidation was continued through expenditure compression measures and by reducing the reliance on monetization during 1990-91 to 1996-97. A landmark event in the monetary-fiscal interface was reached with the agreement between the Government and the Reserve Bank in 1994 through which the ad hoc treasury bills were completely phased out as on end-March 1997.

The easing of fiscal dominance paved the way for reduction in CRR and SLR and restoring the latter's role as a prudential instrument. Alongside, the government market borrowing through auctions since 1992-93 led to development of a secondary market in government securities and the market determination of interest rates. However, the need for growing market borrowings at reasonable cost required the Reserve Bank to adopt a strategy of appropriately combining devolvement/private placements with open market operations. The monetary-fiscal coordination has entered a new phase with the enactment of the FRBM Act, 2003 under which the Reserve Bank has been prohibited from subscribing to government securities in the primary market from April 1, 2006.

4. A model of credibility, learning and inflation persistence

The starting point for the imperfect credibility literature is that following a prolonged period of inflation, an announcement by the central bank that in future the inflation target will be consistent with price stability does not command immediate credibility (Erceg and Levin, 2003). Agents must judge the central bank's credibility of intent, that is, whether the target represents the true goal of the central bank and its credibility of action, that is, whether the central bank has the ability to meet the target even if it wants to (say, in the face of fiscal constraints). Learning takes time. And the longer the period during which inflation was high, the longer it is likely to be before the private sector is persuaded that policy has changed.

Following King (1996) and Bomfim and Rudebusch (2000), we define monetary policy credibility through the relationship between inflation targets and inflation expectations.⁹ Their definition of central bank credibility is straightforward. At period $t-1$, the central bank announces its inflation target for period t , denoted, π^* . The private sector must evaluate the future reliability of this target. Overall credibility is

⁹ Westelius (2005) on the other hand defines credibility of the policy regime through the relationship between the relative weight assigned by the central bank to inflation variability in the loss function and inflation expectations. Since the public cannot observe the true value of this parameter, they are forced to infer this based on actual inflation realisation. This model also gives rise to persistence in inflation and unemployment.

measured by the extent to which the pronouncement of a target is believed by the private sector in the formation of their inflation expectations. Specifically, we assume that period $t-1$ expectations of the inflation target at time t , that is, perceived inflation target denoted, π_t^p , are a weighted average of the announced target (π^*) and the current period's inflation rate:

$$E_{t-1}\pi^* = \pi_t^p = \lambda\pi^* + (1-\lambda)\pi_{t-1}. \quad (4.1)$$

The parameter λ (with $0 \leq \lambda \leq 1$) indexes the target credibility of the central bank. For analytical convenience we assume that this learning parameter is constant in what follows.¹⁰ If $\lambda = 1$, there is perfect credibility, and the private sector's perceived inflation target will be equal to the announced target. If $\lambda = 0$, there is no credibility, and the announced target is ignored in the formation of expectations. Intermediate values of, λ , represent partial credibility for the announced target.

The policymaker's loss function is:

$$L(\pi_t, u_t) = 1/2 \left[b(\pi_t - \pi^*)^2 + (u_t - ku^n)^2 \right], \quad 0 < b < 1 \quad (4.2)$$

where π_t is the inflation rate in period t , u_t is the unemployment rate and ku^n represents the central bank's target level of unemployment. We assume that, $k < 1$, in which case the central bank's target unemployment rate is below the natural rate. The constraint facing the policymaker is given by an expectations augmented short-run Phillips curve:

$$u_t = u^n - \alpha(\pi_t - \pi_t^e) + \varepsilon_t, \quad \alpha > 0 \quad (4.3)$$

where u^n is the natural rate of unemployment assumed to be a constant and ε_t is a random shock to supply assumed to be normally distributed with zero mean and constant variance. The policymaker's optimal choice of inflation at time t , that is, the inflation rate that equates the marginal benefit from inflation surprise to the marginal cost is given by,

$$\pi_t = \left(\frac{b}{b + \alpha^2} \right) \pi^* + \left(\frac{\alpha(1-k)}{b + \alpha^2} \right) u^n + \left(\frac{\alpha^2}{b + \alpha^2} \right) \pi_t^e + \left(\frac{\alpha}{b + \alpha^2} \right) \varepsilon_t, \quad (4.4)$$

¹⁰ Credibility of the announced target as indexed by λ is unlikely to be exogenous. In fact, a major contribution of the learning literature is to show that credibility is established by outcome. That is, the weight that agents place on the announced target reacts to developments in the economy. If past inflation matches the inflation target, then the announced target is given more weight by the private sector in the formation of expectations of future inflation. See Erceg and Levin (2003) and Westelius (2005) for models with endogenous credibility.

where π_t^e represents the private sector's expectations of period t , inflation. The private sector in this framework knows the model including the policymaker's objective function. So the private sector expects inflation to be

$$\pi_t^e = \lambda\pi^* + (1-\lambda)\pi_{t-1} + \frac{\alpha(1-k)}{b}u^n. \quad (4.5)$$

Under discretion the central bank cannot credibly manipulate inflation expectations. So the central bank takes private sector inflation expectations as given when it solves its optimization problem. Substituting (4.5) in (4.4) for π_t^e yields the reduced-form solution for inflation:

$$\pi_t = (a_0\pi^* + a_1u^n) + a_2\pi_{t-1} + a_3\varepsilon_t, \quad (4.6)$$

where $a_0 = \left(\frac{b + \alpha^2\lambda}{b + \alpha^2}\right)$, $a_1 = \left(\frac{\alpha(1-k)}{b}\right)$, $a_2 = \left(\frac{\alpha^2(1-\lambda)}{b + \alpha^2}\right)$ and $a_3 = \left(\frac{\alpha}{b + \alpha^2}\right)$.

The reduced-form solution for inflation in this model has an ARMA(p, q) representation. The source of persistence in this model is imperfect credibility ($0 \leq \lambda < 1$). Time-variation in inflation persistence can arise in this model because of learning on the part of the private sector.

That is, if the announced inflation target lacks credibility, then inflation expectations will not be significantly affected. Facing imperfect credibility the policymaker perceives a quick disinflation to be extremely costly and consequently finds it optimal to gradually reduce inflation. The problem is that since policy is not perfectly transparent, the public assesses the likelihood of a regime change from observing inflation outcomes. If actual inflation realization matches the target, then the announced target is given more weight by the private sector in the formation of expectations of future inflation (low state-dependence). On the other hand a small reduction in inflation provides little new information and inflation expectations will therefore only adjust marginally (high state-dependence). This of course, forces the policymaker to continue to reduce inflation gradually. It is in this manner that discretionary policy gives rise to inflation persistence.

From an empirical standpoint the learning literature predicts that a policy regime that lacks credibility, learning by private agents can generate a significant amount of inflation persistence. In contrast, in a stable and transparent policy regime agents learn quickly, resulting in a drop in inflation persistence.

5. Policy Regime Credibility and Inflation Persistence- The Indian Evidence

Our empirical strategy is to establish the link between policy regime credibility and inflation persistence. To this end we estimate the path of the time-varying persistence parameter in our inflation reduced form (Eq. 4.6 above). We track inflation persistence by estimating the autoregressive process in our inflation reduced-form treating inflation as an observable variable and inflation persistence parameter (and the intercept) as an unobserved time-varying state variable. The model for inflation is couched in annual terms. To preserve this interpretation we estimate the model with twelve-month ended inflation data but at a monthly frequency. We estimate the following model:

$$\pi_t = \alpha_t + \rho_t \pi_{t-1} + u_t + \sum_{j=1}^q \theta_j u_{t-j},$$

$$\alpha_t = \alpha_{t-1} + \xi_t,$$

$$\rho_t = \rho_{t-1} + \gamma C_t + \eta_t,$$

where π is the inflation rate and u is the disturbance term assumed to be normally distributed with zero mean and constant variance. The order- q moving-average (MA) error term is motivated by the use of year ended data. The first equation represents the *measurement* equation and the remaining two equations are *transition* equations. The disturbances ξ_t and η_t are serially uncorrelated disturbances with zero mean and constant variances, and are assumed uncorrelated with each other in all time periods.

The variable C_t is the combined gross primary deficit of the central and state governments as percentage of GDP- our proxy for credibility.¹¹ From an empirical standpoint, the credibility hypothesis predicts that when the government's finances are in disarray (characterised by persistent primary deficits) and is projected to get worse, the central bank's inflation target enjoys very low credibility. In this case we should expect substantial inflation inertia (high state-dependence). Conversely, when the government's fiscal house is in order the basic source of monetary temptation so to speak is bolted down, then control of money supply itself would be easier over the long term and, most importantly market confidence in that control would be assured.

¹¹ To test the Sargent and Wallace (1981) theory of 'Some Unpleasant Monetarist Arithmetic', the appropriate data is primary deficit, which is the indicator of current fiscal stance. The standard proxy for credibility in the literature is data on bond yield. We do not use this as a proxy because during most of the 1980s the debt market in India was dominated by government securities primarily due to large fiscal deficits and banking regulations that forced banks to invest in government securities. The interest rate on government debt was administered and there was hardly any secondary market for these securities. Although a significant degree of deregulation has taken place in the recent past, there is still captive demand for government debt. Nearly 70% of the debt is owned either by the RBI or by the banking system which remains dominated by state-owned lenders. As a result it would be inappropriate to use bond yields as a proxy for credibility.

We would expect inflation persistence to drop significantly (low state-dependence or the inflation to be approximately white noise). Therefore, the resulting estimate of γ in our state-space model should be positive: lower the credibility (higher the primary deficit), higher will be the inertial effect on inflation. These equations represent a state space form, in which the unknown parameters γ, σ_{ξ}^2 , and σ_{η}^2 can be estimated by maximum likelihood techniques. The Kalman filter recursions can then be applied to yield optimal estimates of the state variable sequence.¹²

Data and Estimation Results

The state-space model described above is estimated with monthly observations of year-ended inflation data for India (all commodities wholesale price index (WPI) with base year 1981-82=100) from 1981:4-2011:11. The data is collected from the Office of the Economic Adviser, Ministry of Commerce and Industry, Government of India. The data on combined gross primary deficit is obtained from RBI's Handbook of Statistics on Indian Economy 2010-11. This data is available at annual frequency, which is converted to monthly frequency by using cubic spline interpolation.

Kalman filter recursions were applied to yield optimal estimates of the state variable sequence. Table 2 reports our estimates of $\hat{\gamma}$ (asymptotic standard error in parentheses) based on MA(12) process for the errors. The coefficient γ is positive, as predicted by the model, and highly significant.¹³ Figure 3 plots our estimates of persistence along with our proxy for credibility- primary deficit as percentage of GDP. The estimates of the persistence coefficient indicate significant variation over the sample period. Specifically, the persistence coefficient started to drift up in the 1980s. It rose steadily until the early 1990s, before stabilising thereafter. It starts to drift up during the late 1990s. After the financial crisis of 2008 we once again witness an upward drift. So what explains the time-variation in inflation persistence?

Table 2: Maximum Likelihood Estimates

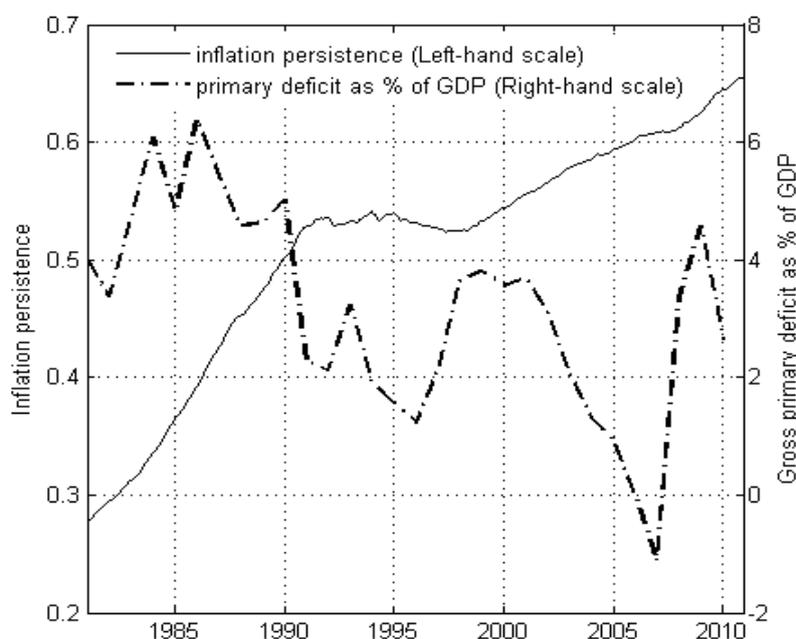
$\hat{\gamma}$	$\hat{\sigma}_{\xi}^2$	$\hat{\sigma}_{\eta}^2$
0.04 (0.02)	4.06×10^{-3}	4.22×10^{-5}

¹² For a detailed discussion on Kalman Filter and the TVP model see Anderson and Moore (1979), Harvey (1989) and Durbin and Koopman (2001).

¹³ When we estimated the model for a longer sample the coefficient was positive but not significant. This is consistent with the view that until the beginning of the 1980s the overall fiscal situation was under control with very low deficits (see Chelliah, 1996). In fact, it is only during the eighties that the fiscal situation steadily deteriorated. This resulted in increasing additions to unproductive debt and the interest burden on the general budget began to grow exponentially.

In the 1980s fiscal controls weakened and deficits mounted. Increasingly expansionist fiscal stance spilled over to the external sector, requiring growing recourse to external borrowing on commercial terms. Against a background of rising trade and current account deficits and a deteriorating external debt profile, the 1990 Gulf War and consequent oil price spike tipped India's balance of payments into crisis in 1990-91. This period is associated with substantial rise in inflation persistence. In 1991 the central government seized the opportunity offered by the crisis to launch an array of long overdue and wide-ranging economic reforms. They encompassed fiscal consolidation and reform of the tax system, which kept a check on government borrowings. The persistence coefficient stabilized during this phase. This was followed by a period of steady deterioration in government finances during the late 1990s. Our persistence estimate starts to drift up during this phase.¹⁴

Figure 3: Persistence estimates and gross primary deficit



Finally, in the aftermath of the global financial crisis of 2008, we see a significant deterioration in government finances (mainly due to large public sector pay increases following the Sixth Pay Commission and Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA)). In response to the financial crisis, monetary and fiscal policies were eased by allowing for a pause in the fiscal consolidation process enjoined by the FRBM Act of 2003. Moreover, there are increasing indications that meeting the targets adopted in the revised road map for fiscal consolidation as recommended by the Thirteenth Finance Commission would

¹⁴ Primary deficits witnessed significant decline during 2002-03 to 2005-06 but averaged around 2 per cent of GDP prior to the two exceptional years of primary surpluses – 2006-07 and 2007-08. Correspondingly, the rise in persistence is much lower during this period as compared to the 1980s when primary deficits averaged around 5 per cent of GDP.

pose a formidable challenge. In sum, government finances are once again in disarray and are not expected to improve over the foreseeable future. This has clearly undermined public confidence in RBI's ability to stabilise inflation going forward. We see a rise in inflation persistence during this phase.

6. Lessons and Conclusions

The policy implications of this paper are quite clear. Prudent anti-inflation policy includes containment of the deficit to an amount that can be comfortably financed at steady interest rates without printing money. Large contemporary government deficits unaccompanied by concrete prospects for future government surpluses promote realistic doubts about whether monetary restraint must be abandoned sooner or later to help finance the deficit. It is insufficient to announce and maintain restrictive monetary policies. Agents will also look at fiscal policy in their attempt to determine whether the 'reform' can be sustained. If fiscal policy is incompatible with the 'reform' in monetary policy, agents will attach positive probability to the event that the reform will be abandoned in the future. The result will be an increase in inflationary expectations. If so, agents will try to get rid of money today- driving up the prices of goods, services, and eventually wages across the entire economy. Our economy will be primed for it as long as our fiscal trajectory is unsustainable. In sum, it is insufficient to announce and maintain restrictive monetary policies unless accompanied by a coordinated reduction in the budget deficits.

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